Psychology of Addictive Behaviors
2005, Vol. 19, No. 3, 326–334

0893-164X/05/$12.00 DOI: 10.1037/0893-164X.19.3.326

An Affective–Motivational Model of Marijuana and Alcohol Problems Among College Students

Jeffrey S. Simons and Raluca M. Gaher
University of South Dakota

Christopher J. Correia
Auburn University

Christopher L. Hansen and Michael S. Christopher
University of South Dakota

The study examined models of marijuana ($n = 309$) and alcohol ($n = 731$) problems. Impulsivity was directly associated with both marijuana- and alcohol-related problems. Negative mood regulation expectancies were indirectly associated with marijuana problems through coping motives. Sensation seeking was indirectly associated with alcohol problems through enhancement motives. Affect lability and negative affect were indirectly associated with alcohol problems though coping motives. In both models, coping motives were directly associated with use-related problems. A multigroup analysis indicated that the association between negative affect and coping motives as well as use and problems was stronger among participants using both alcohol and marijuana relative to alcohol only. Enhancement motives were a stronger predictor of alcohol use among participants using alcohol only.

Keywords: alcohol, marijuana, motives, substance use problems, affect regulation

Marijuana and alcohol are two of the most common drugs used by young adults. Approximately 29.8% of young adults from 18 to 25 years old report past-year marijuana use, and 77.9% report past-year alcohol use (Substance Abuse and Mental Health Services Administration [SAMHSA], 2003). Although many use these drugs without incurring significant use-related problems, a sizable minority do incur problems (Drug Abuse Warning Network, 2003; SAMHSA, 1999, 2003; Wechsler et al., 1998). Most college students are between 18 and 25 years of age, the age group with the highest rates of alcohol or illicit drug abuse or dependence (SAMHSA, 2003). Rates of illicit drug use among college students are approximately the same as among their same-age peers; however, rates of heavy alcohol use are higher among college students than among their same-age peers (18.8 vs. 13.4%, respectively; SAMHSA, 2003). Thus, college students are an at-risk population for substance-related problems. Previous research has indicated that individual differences in regulating affect and behavior are associated with use-related problems (Simons, 2003; Simons & Carey, 2002; Wills, Sandy, & Yaeger, 2002). A better understanding of paths by which such variables pose risk for problems is an important goal.

Jeffrey S. Simons, Raluca M. Gaher, Christopher L. Hansen, and Michael S. Christopher, Department of Psychology, University of South Dakota; Christopher J. Correia, Department of Psychology, Auburn University.

Michael S. Christopher is now at the Department of Psychology, University of Anchorage.

This research was supported in part by National Institute on Drug Abuse Grant DA15066, awarded to Jeffrey S. Simons.

Correspondence concerning this article should be addressed to Jeffrey S. Simons, Department of Psychology, University of South Dakota, 414 East Clark Street, Vermillion, SD 57069. E-mail: jsimons@usd.edu

Motivational models of substance use provide a framework for understanding paths from emotional functioning to use and problems (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988). Research on alcohol motives has been extensive (Carey & Correia, 1997; Cooper, 1994; Cooper, Agocha, & Sheldon, 2000; Cooper et al., 1995; Read, Wood, Kahler, Maddock, & Palfai, 2003). The results of this research indicate that individual characteristics are associated with specific motives for alcohol use and that these in turn exhibit some unique relations with alcohol-related problems. In general, negative affective traits (e.g., negative affect, neuroticism, negative mood regulation expectancies) are most often associated with using alcohol to cope with negative mood, whereas positive affective traits (e.g., sensation seeking, positive affect, extraversion) are associated with using alcohol to enhance positive affect (Cooper et al., 2000; Cooper et al., 1995; Kassel, Jackson, & Unrod, 2000; Read et al., 2003). Alcohol coping motives and enhancement motives exhibit distinct pathways to problems. Enhancement motives are most often indirectly associated with alcohol problems through alcohol use (Cooper et al., 1995; Read et al., 2003). In contrast, coping motives exhibit both an indirect and direct association with alcohol problems (Cooper et al., 1995; Simons, Correia, Carey, & Borsari, 1998).

Research on marijuana motives has received less attention; however, research has indicated that motives for using marijuana, although exhibiting some differences, are similar to motives for alcohol use (Comeau, Stewart, & Loba, 2001; Newcomb, Chou, Bentler, & Huba, 1988; Simons, Correia, & Carey, 2000; Simons et al., 1998). As with alcohol motives, marijuana enhancement and coping motives are associated with marijuana problems indirectly through use (Simons et al., 1998). However, coping motives have not exhibited a direct relation with problems in past research (Simons et al., 1998). In respect to predictors of marijuana use motives, Comeau and colleagues (2001) reported significant biva-

riate positive associations among anxiety sensitivity, trait anxiety, and coping motives, and a significant negative association between anxiety sensitivity and enhancement motives. Sensation seeking was unrelated to marijuana use motives. However, when residual marijuana coping and enhancement motives were regressed onto the affective predictors and demographic covariates, none of these predictors demonstrated a unique relation with motives. Thus, further research is needed to identify predictors of marijuana motives.

Previous research and theory have posited that substance use motives may be a final common pathway by which more distal factors influence use behavior (Cooper et al., 1995; Cox & Klinger, 1988). There is a considerable amount of support for this in respect to affective–cognitive variables (Cooper et al., 1995; Pierce, Frone, Russell, & Cooper, 1994; Read et al., 2003). In contrast, social–environmental variables, such as social contact, offers of alcohol, and perceived peer drinking environment, appear to have direct relations with alcohol use that are not mediated (or are only partially mediated) by motives (Pierce et al., 1994; Read et al., 2003). Thus, previous research has provided mixed support for the role of substance use motives being a final proximal pathway through which more distal factors influence use. Research indicates that although motives are a prominent proximal predictor of use, some variables (e.g., peer drinking environment, offers of alcohol) have direct effects on use.

Similarly, research on predictors of use-related problems indicates that although substance use is a primary predictor of use-related problems, use itself is not a sufficient predictor of problems. For example, research has demonstrated direct associations between affect lability, impulsivity, and other affect-regulation variables and both marijuana and alcohol problems (Simons, 2003; Simons & Carey, 2002; Simons, Carey, & Gaher, 2004; Stice, Barrera, & Chassin, 1998). Similarly, coping motives (but generally not enhancement motives) have evidenced direct (i.e., not mediated by use) relations with alcohol problems in past research (Cooper et al., 1995; Simons et al., 1998). Thus, research on affect-regulation variables and research on coping motives have identified direct paths to use-related problems while controlling for level of use.

Combining the research findings on direct relationships between affect regulation and problems with research findings regarding associations from motives to substance use problems indicates two potential paths that may account for direct associations between affect-regulation variables and use-related problems. That is, variables such as lability or impulsivity that are associated with problems above and beyond use might be associated with coping motives, and thus the direct relation with problems would be explained in part by the direct path from coping motives to problems. Alternatively, affect regulation may have a direct association with problems irrespective of motives for use. Mood instability may encourage use of substances to regulate affect. Thus, affect lability appears to be a good candidate for the former path; that is, labile affect may be associated with increased substance use coping motives, which are in turn directly associated with problems. In contrast, impulsivity may not be associated with specific reasons for substance use. Thus, impulsivity appears to be a likely candidate for the latter path; that is, impulsivity may be associated with use-related problems in a direct fashion rather than through its association with substance use motives. Previous research on alcohol motives has provided some support for a direct relationship between impulsivity and heavy drinking (i.e., not mediated by use motives; Cooper et al., 2000). However, the association between impulsivity and drinking-related problems was indirect (mediated by heavy drinking) in this study (Cooper et al., 2000).

In the present study we examined an affective-motivation model for both marijuana- and alcohol-related problems in a sample of college students. This study extends previous research by examining a latent variable affective-motivation model of marijuana-related problems. Although several studies have tested similar models for alcohol use and problems, to our knowledge this is the first study to test a comparable model of marijuana use and problems. By testing parallel marijuana and alcohol models, we were able to examine similarities and differences between these two common drugs of abuse. Furthermore, we used an exploratory multigroup analysis to compare the hypothesized alcohol motives model across a group of individuals who reported use of both alcohol and marijuana and a group composed of individuals reporting use of alcohol only.[1]

We included two predictors of enhancement motives (sensation seeking and positive affect) and three predictors of coping motives (negative affect, negative mood regulation expectancies, and affect lability). Consistent with the majority of previous research on alcohol motives, we hypothesized that these affective variables would be indirectly associated with substance use through motives. We hypothesized that negative affect and lability would be positively associated with coping motives and that negative mood regulation expectancies would be negatively associated with coping motives. Positive affect and sensation seeking were expected to be positively associated with enhancement motives. Coping and enhancement motives were expected to be directly associated with use and indirectly associated with problems through use. In addition, coping motives were expected to be directly associated with problems. Thus, negative affect dysregulation variables were expected to be indirectly associated with use and problems via coping motives. Positive affect and sensation seeking were expected to be indirectly associated with use and problems via enhancement motives. Impulsivity, in contrast, was expected to have a direct relationship with problems.

Method

Participants

The sample consisted of 831 college students at two state universities participating in research for partial fulfillment of course requirements. Approximately 70% of the participants were women. The mean age was 20.20 ($SD = 2.81$). Eighty-nine percent of the participants were White, 7% were Black, 2% were Asian/Pacific Islander, and 3% were of other races. A subset of these data was used in a previous scale validation study (Simons & Gaher, in press).

Measures

Substance use and problems. Marijuana and alcohol use frequency in the past 12 months was assessed by a 9-point rating scale (0 = *none at all*, 8 = *more than daily*). Marijuana- and alcohol-related problems were assessed with parallel 23-item scales: the Rutgers Alcohol Problem Index

[1] We thank an anonymous reviewer for this suggestion.

(RAPI) and the Marijuana Problem Index (Johnson & White, 1989; Simons & Carey, 2002; White & Labouvie, 1989). Items are rated on 5-point scales (1 = *never*, 5 = *more than 10 times*). In the current sample, alphas were .91 and .88, respectively.

Substance use motives. Enhancement and coping motives for alcohol and marijuana use were assessed by parallel items from the Drinking Motives Measure and Marijuana Motives Measure (Cooper, 1994; Simons et al., 1998). Sample items include the following: "I drink/use marijuana because it helps me when I am depressed or nervous" (coping) and "I drink/use marijuana because it's exciting" (enhancement). Participants were instructed to consider all the times they used the target drug and to indicate how often they used it for each reason. Each item is rated on a 5-point scale that ranges from 1 (*almost never/never*) to 5 (*almost always/always*). The measures have demonstrated sound psychometric properties in samples of adolescents, adults, and college students (Cooper, 1994; Cooper et al., 1995; Simons et al., 1998). Validity of the measures is demonstrated by moderate-to-strong concurrent associations with alcohol and marijuana use and problems (Cooper, 1994; Cooper et al., 1995; Simons et al., 1998). Previous research has demonstrated some evidence of differentiation between marijuana and alcohol motives among experienced users (Simons et al., 2000). The coping motives latent variable was defined by four indicators (αs = .86 for alcohol and .89 for marijuana in the current sample). Enhancement motives were defined by five indicators (αs = .89 for alcohol and .93 for marijuana in the current sample).

Positive and negative affect. Trait affect was assessed by single indicators from the Positive and Negative Affect Schedule (Watson & Clark, 1994). These consist of 10 affective terms, each (e.g., *upset*, *excited*) rated on 5-point scales (αs = .85–.86 in the current sample).

Sensation seeking was assessed by a single indicator, a 16-item version of Zuckerman's Sensation Seeking Scale (Donohew et al., 2000; Zuckerman, 1994; α = .80 in the current sample).

Affect lability was a latent variable assessed by three indicators derived from subscales of the Affect Lability Scale—Short Form (Oliver & Simons, 2004). The three subscales assess mood lability in respect to depression/elation (8 items, α = .83), anxiety/depression (5 items, α = .86), and anger (5 items, α = .81).

Negative mood regulation expectancies was defined by a single indicator, the 30-item Negative Mood Regulation Expectancies (NMR) measure (Catanzaro & Mearns, 1990; α = .90 in the current sample).

Impulsivity was a latent variable defined by two indicators: (a) a 19-item impulsivity scale (α = .79 in the current sample; Eysenck, Pearson, Easting, & Allsopp, 1985) and (b) an 11-item impulsive decision-making scale (Donohew et al., 2000; α = .81 in the current sample).

Procedure

Participants completed questionnaires online in a computer laboratory under the supervision of a research assistant. Questionnaires were administered in small group sessions with adequate space to ensure the privacy of the individual respondents. Previous research supports the reliability of Internet-based assessment of drug use (Miller et al., 2002). All participants provided written informed consent, and all responses were anonymous.

Results

Descriptive Statistics

In order to maintain a focus on potential use-related problems among users, we included in the analyses and in the following descriptive statistics only those individuals who reported using alcohol or marijuana in the past 12 months. The predictor and criterion variables for the two university samples were compared with *t* tests for both the alcohol and marijuana analysis samples. A Bonferroni correction for familywise error rate for the 22 tests was used ($p < .002$). The results indicated that only Item 9 of the alcohol and marijuana motives ("because it is exciting") differed across the samples (ps $< .0005$). Because there were no a priori hypotheses regarding differential relationships between the universities, the data were combined into a single sample. Moreover, treating them as a single sample reduced the number of paths to be estimated in the structural models.

Thirty-seven percent (n = 309) of the sample reported using marijuana, and 88% (n = 735) of the sample reported using alcohol in the past 12 months. Thus, prevalence of marijuana use was comparable to, but slightly higher than, national college student norms (i.e., 27.4%; Gledhill-Hoyt, Lee, Strote, & Wechsler, 2000). Similarly, alcohol use was comparable to, but slightly higher than, national college student norms (i.e., 80.8%; Wechsler, Lee, Kuo, & Lee, 2000). Four individuals with missing data were excluded from the alcohol use sample, resulting in an analysis sample of 731. In the marijuana sample (n = 309), approximately 62% were women. The mean age was 20.00 years (SD = 2.32). Ninety-two percent were White, 5% were Black, 1% were Asian/Pacific Islander, and 2% were of other races. Relative to the full sample, the marijuana use sample contained a higher percentage of men, $\chi^2(1, N = 831) = 12.79$, $p < .001$. The mean ages of the full sample and the marijuana use sample were comparable, $t(829) = 1.54$, $p = .122$. Differences in race/ethnicity were not tested because of the low frequency of respective categories. In the alcohol use sample (n = 731), approximately 70% were women. The mean age was 20.17 years (SD = 2.58). Ninety percent were White, 5% were Black, 2% were Asian/Pacific Islander, and 3% were of other races. The alcohol use sample did not differ significantly from the full sample in age, $t(829) = 0.62$, $p = .53$, or gender, $\chi^2(1, N = 831) = 0.13$, $p = .719$. Ninety-nine percent of the participants in the marijuana use sample were also in the alcohol use sample. Forty-two percent of the participants in the alcohol use sample were also in the marijuana use sample.

Mean marijuana use among participants who reported some use was 7 to 12 times a year (rating scale M = 3.21, SD = 2.29, Mdn = 3 [7–12 times a year], mode = 1 [1–3 times a year]). Alcohol use was higher, at 1 to 2 times a week (rating scale M = 4.08, SD = 1.50, Mdn = 4 [1–2 times a week], mode = 5 [3–4 times a week]). The mean score on the Marijuana Problem Index was 29.51 (SD = 8.76). Approximately 35% of marijuana users reported five or more different marijuana-related problems in the past 12 months. The mean RAPI score was 31.85 (SD = 10.18). Approximately 53% of alcohol users reported five or more different alcohol-related problems on the RAPI in the past 12 months. The problem measures were positively skewed and kurtotic. A natural log transformation was used to correct for this.

Structural Equation Models

Structural equation models were estimated using LISREL 8.54 (Jöreskog & Sörbom, 2001) with covariance matrices as input using maximum likelihood estimation. All exogenous variables were covaried. Model fit was evaluated using omnibus chi-square tests, the nonnormed fit index (NNFI), comparative fit index (CFI), root-mean-square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR). Incremental fit indices (i.e., NNFI and CFI) greater than .95 are considered to represent

acceptable fit (Hu & Bentler, 1999). Standardized root-mean-square residual values less than .08, and RMSEA values less than .06, indicate acceptable fit (Hu & Bentler, 1999). We examined modification indices to evaluate whether to free additional constrained paths in the models.

Parallel models for marijuana and alcohol problems were tested (*n*s = 309 and 731, respectively). The hypothesized measurement model was as follows. Gender, negative affect, NMR, positive affect, sensation seeking, substance use, and use-related problems were all manifest variables represented by single indicators. Affect lability was a latent variable measured by three subscales of the Affect Lability Scale—Short Form (Anger, Depression–Elation, and Anxiety–Depression); impulsivity was a latent variable measured by indicators of impulsivity and impulsive decision making; coping motives was a latent variable measured by indicators of use to relieve depression or anxiety, forget worries, forget about problems, and cheer a bad mood; and enhancement motives was a latent variable measured by the following indicators of use: like the feeling, it's exciting, gives a pleasant feeling, it is fun, and to get high. Error variances for the manifest variables were estimated by the scale's variance multiplied by 1 minus alpha (Kelloway, 1998).

The structural models included eight exogenous variables (gender, negative affect, affect lability, NMR, positive affect, sensation seeking, and impulsivity). Coping and enhancement motives were the first endogenous constructs (with a covariance between their residual terms), and substance use was specified subsequent to these. Substance-related problems was the criterion. All exogenous variables covaried, and gender had paths freely estimated to all endogenous variables.

Marijuana

Measurement model. The hypothesized measurement model provided an adequate fit of the data, $\chi^2(141, N = 309) = 275.65$, $p < .01$; NNFI = .97; CFI = .98; RMSEA = .057; SRMR = .042. All factor loadings were significant at $p < .001$ (see Table 1).

Structural model. The hypothesized model fit the data well, $\chi^2(160, N = 309) = 301.71$, $p < .01$; NNFI = .97; CFI = .98; RMSEA = .054; SRMR = .054. As hypothesized, there was a significant negative association between NMR and coping motives. In addition, coping motives evidenced a direct association with both marijuana use and problems, whereas enhancement motives were indirectly associated with problems through use. Finally, impulsivity evidenced a direct association with problems. However, hypothesized paths from positive affect, sensation seeking, affect lability, and negative affect to the motives variables were not significant (see Figure 1). The following correlations among exogenous constructs were significant ($p < .05$): negative affect with lability ($r = .69$), positive affect ($r = -.25$), NMR ($r = -.56$), impulsivity ($r = .42$), and gender (coded male = 1, female = 0; $r = -.13$); lability with positive affect ($r = -.40$), NMR ($r = -.58$), and impulsivity ($r = .41$); positive affect with sensation seeking ($r = .22$) and NMR ($r = .53$); sensation seeking with NMR ($r = .22$), impulsivity ($r = .49$), and gender ($r = .28$); NMR with impulsivity ($r = -.21$); and impulsivity with gender ($r = .19$). Total effects in predicting problems are summarized in Table 2.

Table 1
Factor Loadings for the Measurement Models

Latent construct and indicator	Loading	
	Marijuana	Alcohol
Affect lability		
Depression/elation[a]	.65	.71
Depression/anxiety	.90	.83
Euthymia/anger	.62	.70
Impulsivity		
Eysenck[a]	.69	.72
IDMS	.48	.43
Coping motives		
To forget worries	.78	.79
Help when depressed/nervous[a]	.86	.78
Cheer up when in a bad mood	.81	.76
To forget about problems	.82	.85
Enhancement motives		
Like the feeling[a]	.93	.90
It's exciting	.65	.73
To get high	.85	.58
Gives a pleasant feeling	.91	.86
It's fun	.89	.82

Note. Values are standardized coefficients. Coefficients are significant at $p < .001$. IDMS = Impulsive Decision Making Scale.
[a] Not tested (loading set to 1.0 to set the measurement scale). Measurement loadings for all other constructs are 1.00 (i.e., manifest variables).

Alcohol

Measurement model. The hypothesized measurement model provided an adequate fit of the data, $\chi^2(141, N = 731) = 484.64$, $p < .01$; NNFI = .96; CFI = .97; RMSEA = .058; SRMR = .044. All factor loadings were significant at $p < .001$ (see Table 1).

Structural model. The hypothesized model fit the data well, $\chi^2(160, N = 731) = 564.08$, $p < .01$; NNFI = .96; CFI = .97; RMSEA = .059; SRMR = .063. As hypothesized, there were significant positive paths from negative affect and affect lability to coping motives. Similarly, sensation seeking was a significant predictor of enhancement motives. In addition, coping motives evidenced a direct association with alcohol problems, whereas enhancement motives was indirectly associated with problems through use. Finally, impulsivity evidenced a direct association with problems. However, hypothesized paths from positive affect and NMR to the motives variables, and from coping motives to alcohol use, were not significant (see Figure 2). The following correlations among exogenous constructs were significant ($p < .05$): negative affect with lability ($r = .60$), positive affect ($r = -.20$), NMR ($r = -.51$), and impulsivity ($r = .34$); lability with positive affect ($r = -.37$), NMR ($r = -.59$), and impulsivity ($r = .56$); positive affect with sensation seeking ($r = .12$) and NMR ($r = .53$); sensation seeking with impulsivity ($r = .63$) and gender ($r = .24$); NMR with impulsivity ($r = -.22$) and gender ($r = -.08$); and impulsivity with gender ($r = .13$). Total effects in predicting problems are summarized in Table 2.

Model Respecification

We used a conservative criterion (i.e., critical chi-square value based on the degrees of freedom of the initial model) for model modification to control Type I error to < .05 (Hancock, 1999).

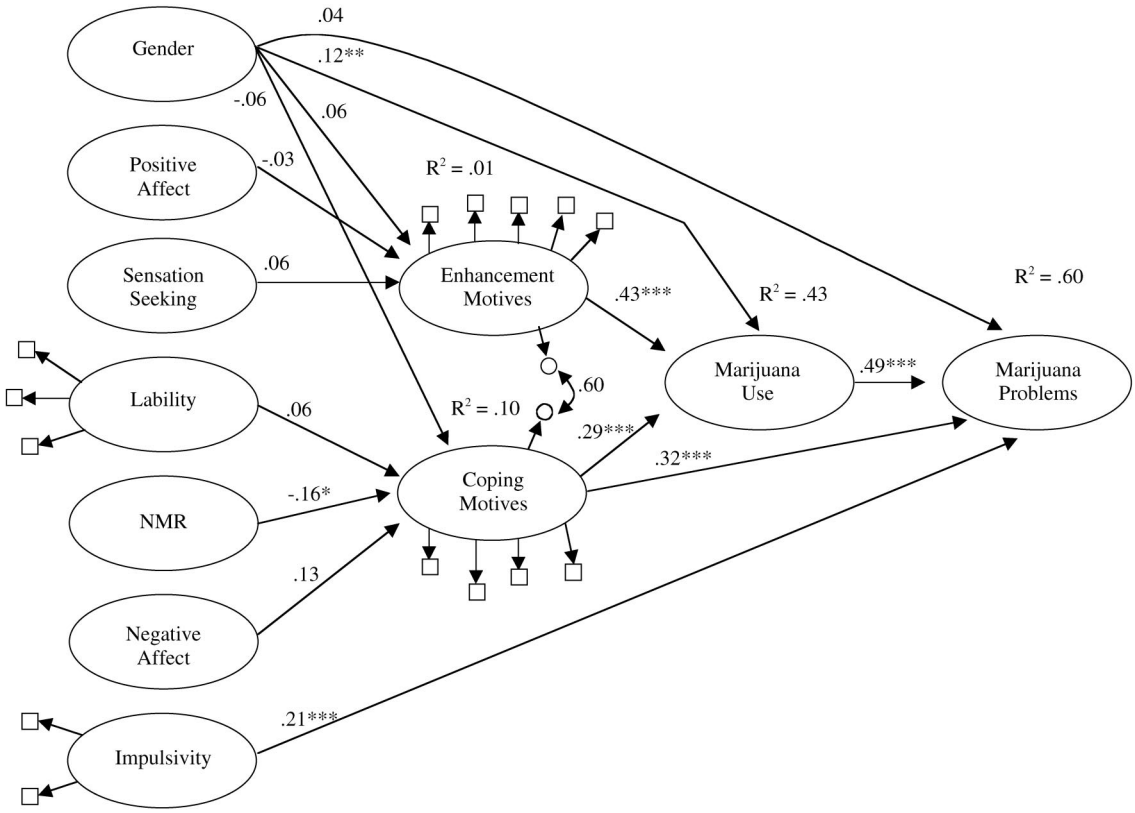

Figure 1. Structural model for the marijuana-use sample. All values are standardized coefficients. Gender is coded 1 = male, 0 = female. NMR = negative mood regulation expectancies. *$p < .05$. **$p < .01$. ***$p < .001$.

This resulted in no post hoc modifications to the models. However, for both the alcohol and marijuana measurement models the modification indices suggested that adding an error covariance between the coping motives items "to forget about your problems" and "to forget your worries" would improve model fit. In addition, it should be noted that inspection of the modification indices suggests that the fit of the alcohol model could have been improved by freeing the paths from impulsivity to coping motives, enhancement motives to problems, and sensation seeking to use. Although a modified model is not presented here, we make note of these potentially substantive differences from the hypothesized model for future research.

Table 2
Standardized Total Effects in Predicting Use and Problems

	Marijuana		Alcohol	
Variable	Use	Problems	Use	Problems
Gender	.13*	.08	.13***	.12**
Positive affect	−.01	−.01	−.01	.00
Sensation seeking	.03	.01	.19***	.07***
Negative affect	.04	.06	.01	.05*
Affect lability	.02	.03	.01	.09***
NMR	−.05*	−.07*	−.01	−.04
Impulsivity		.21***		.27***
Coping motives	.29***	.47***	.07	.43***
Enhancement motives	.43***	.21***	.53***	.19***
Use		.49***		.36***

Note. Gender is coded 1 = male, 0 = female. NMR = negative mood regulation expectancies.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Multigroup Analysis

We conducted an exploratory analysis to examine the consistency of the alcohol model across two groups. Group 1 (alcohol only, $n = 426$) consisted of individuals who reported alcohol but not marijuana use in the past 12 months. Group 2 (alcohol and marijuana, $n = 305$) consisted of individuals who reported use of both alcohol and marijuana in the past 12 months. All error variances were allowed to be free across the two models. All other parameters were constrained to be equal in the baseline model.

Measurement model. The constrained measurement model provided an adequate fit of the data, $\chi^2(347, N = 731) = 767.39$, $p < .01$; NNFI = .95; CFI = .96; RMSEA = .059; Group 1 SRMR = .066, Group 2 SRMR = .090. All factor loadings were significant at $p < .001$.

Structural model. The baseline constrained model fit the data well, $\chi^2(365, N = 731) = 815.58$, $p < .01$; NNFI = .95; CFI = .96; RMSEA = .060; Group 1 SRMR = .069, Group 2 SRMR = .088. The pattern of significant relations was the same as for the

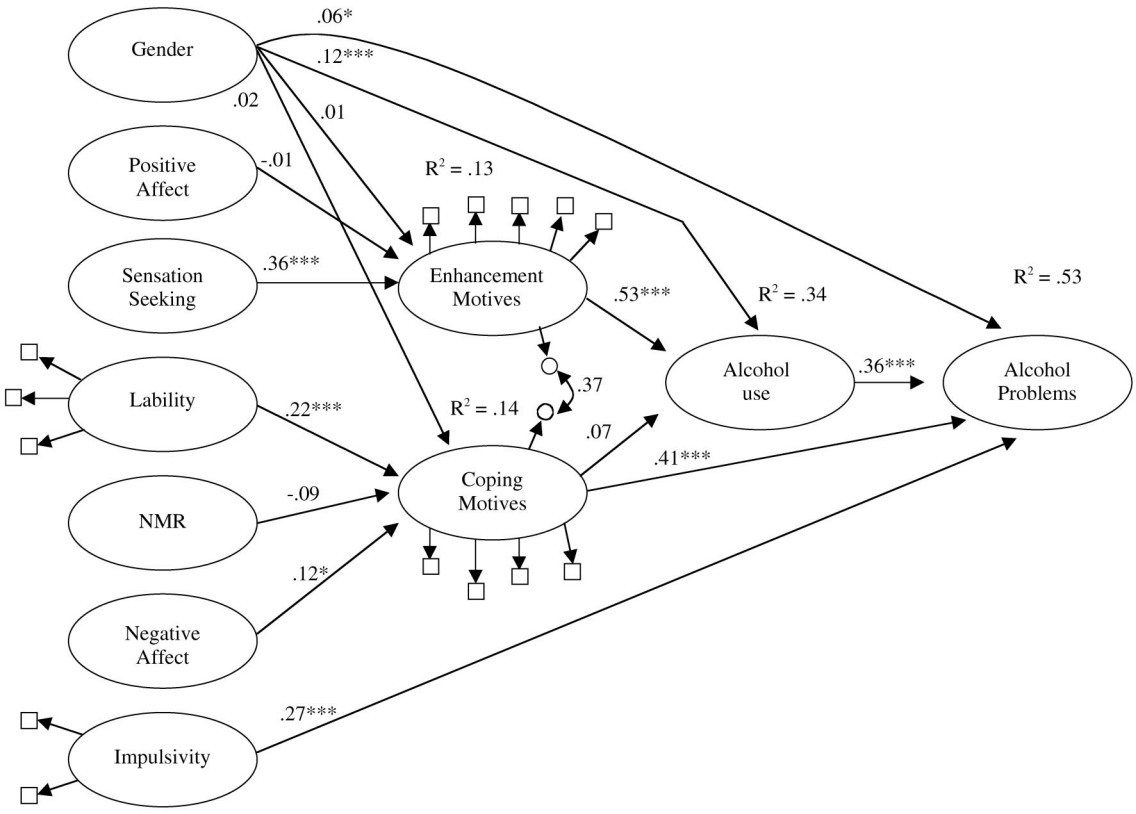

Figure 2. Structural model for the alcohol-use sample. All values are standardized coefficients. Gender is coded 1 = male, 0 = female. NMR = negative mood regulation expectancies. *$p < .05$. ***$p < .001$.

combined sample. One exception was that the gender-to-alcohol-problems relationship did not reach significance. Although the hypothesized constrained model fit well and provides a parsimonious solution, we explored potential differences in the structural relations across the samples. Structural paths with modification indices greater than 7.88 ($p < .005$) in either group were sequentially freed (i.e., one at a time) and the model reestimated. For nonhypothesized structural paths (i.e., paths constrained to zero in the baseline model), we used a criterion of a modification index of greater than 7.88 in each group for model respecification.

On the basis of these criteria, paths were freely estimated across groups from enhancement motives to use, negative affect to coping motives, and use to problems. No nonhypothesized paths were added to the models (although there was modest support for direct paths from lability and enhancement motives to problems in both models): final model, $\chi^2(362, N = 731) = 788.51$, $p < .01$; NNFI = .95; CFI = .96; RMSEA = .059; Group 1 SRMR = .065, Group 2 SRMR = .078, $\Delta\chi^2$ (3, $N = 731$) = 27.07, $p < .0001$. Enhancement motives were a stronger predictor of alcohol use in the alcohol-only group ($b = .66$, $p < .001$) than the alcohol and marijuana group ($b = .37$, $p < .001$), $\Delta\chi^2$ (1, $N = 731$) = 12.22, $p < .0005$. Negative affect was a stronger predictor of coping motives in the alcohol and marijuana group ($\gamma = .03$, $p < .001$) than in the alcohol-only group ($\gamma = .01$, $p = .44$), $\Delta\chi^2$ (1, $N = 731$) = 8.22, $p = .0041$. Use was a stronger predictor of problems in the alcohol and marijuana group ($b = .08$, $p < .001$) than in the alcohol-only group ($b = .04$, $p < .001$), $\Delta\chi^2$ (1, $N = 731$) = 6.63, $p = .0100$ (see Figure 3).

Discussion

The present study examined two parallel affective-motivational models of marijuana- and alcohol-related problems. Of note is that this study is the first to extend previous affective-motivational alcohol models to the study of marijuana use problems. The hypothesized models fit the data well for both alcohol and marijuana. As hypothesized, impulsivity was directly associated with marijuana and alcohol problems, whereas other affect-regulation measures were indirectly associated with problems through association with the motives variables. However, several hypothesized paths were not significant, and prediction of marijuana enhancement motives was not significant. Despite similar fits for the parallel alcohol and marijuana models, there were substantial differences in the models in the significant predictors of the motives variables. Differences in sample size may account for differences in the significance of some of the coefficients. For example, negative affect is a significant predictor of alcohol coping motives, but not marijuana coping motives, despite being smaller in magnitude. The multigroup analysis revealed some differences between individuals who used both alcohol and marijuana compared with those who used only alcohol. These findings are discussed in turn.

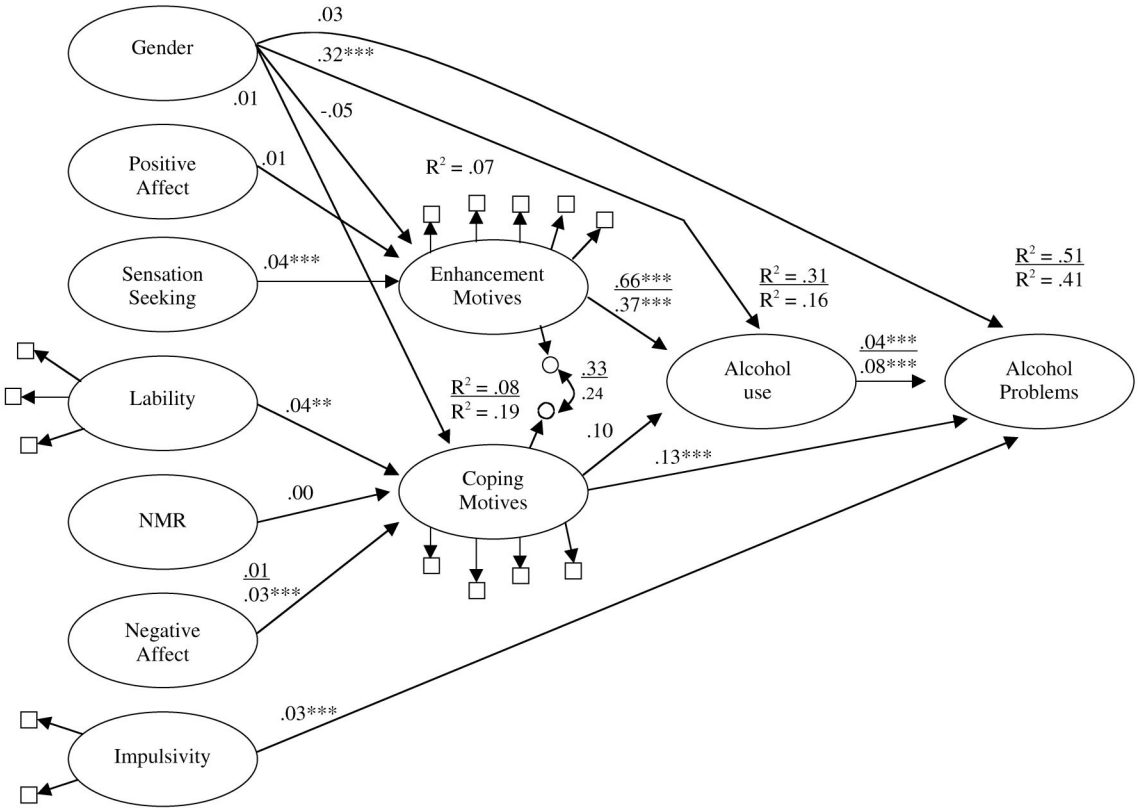

Figure 3. Structural model for the multigroup alcohol-use sample. All values are unstandardized coefficients. For coefficients that varied across groups, the alcohol-only group is above the horizontal lines, and the alcohol-and-marijuana group is below the horizontal lines. Gender is coded 1 = male, 0 = female. NMR = negative mood regulation expectancies. $^{**}p < .01$. $^{***}p < .001$.

The overall fits of the hypothesized models are consistent with previous research indicating that individual differences in affect regulation are associated with distinct reasons for substance use. Furthermore, enhancement and coping motives have distinct relations with substance use problems. Coping motives appear to have a substantial direct association with problems, whereas enhancement motives are primarily indirectly associated with problems via use. In addition, the models demonstrate a unique direct relation between impulsivity and alcohol and marijuana problems. Consistent with recent research on college student drinking (Read et al., 2003), coping motives were not significantly associated with use in the alcohol model; however, they were a significant predictor of use in the marijuana model.

The models predicted a substantial amount of variance in marijuana and alcohol use (R^2 = .43 and .34, respectively) as well as marijuana and alcohol problems (R^2 = .60 and .53). Thus, the models replicate previous work examining impulsivity and substance use motives as predictors of alcohol- and marijuana-related problems. Consistent with epidemiological studies, male gender was associated with increased marijuana use as well as alcohol use and related problems (Bell, Wechsler, & Johnston, 1997; SAMHSA, 2003). The prediction of the motives variables from the affect-regulation constructs was modest. Effects were small for both marijuana coping motives (R^2 = .10) and alcohol coping and enhancement motives (R^2 = .13–.14). Marijuana enhancement motives were not significantly predicted. This highlights the importance of other predictors of motives not included in the model, such as substance use expectancies (Cooper et al., 1995; Read et al., 2003). Affect-regulation characteristics in the absence of relevant drug expectancies may be unlikely to result in motivation to use the target drug.

In respect to associations between affective variables and substance-related problems, several significant associations were observed. Consistent with previous research, impulsivity was significantly associated with marijuana and alcohol problems (Simons, 2003; Simons & Carey, 2002). In contrast, affect lability was significantly associated with alcohol-related problems, but not with marijuana-related problems. In addition, NMR exhibited significant total effects in the marijuana model but not the alcohol model. Finally, sensation seeking and negative affect exhibited significant total effects in the alcohol model but not in the marijuana model. Positive affect was not a significant predictor in either model. Thus, overall, the results lend support to affect regulation theories of substance-related problems. Individual differences in affective functioning are associated with rates of substance related-problems. Impulsivity has a consistent direct effect with both alcohol and marijuana problems. Effects for the other variables were inconsistent across drugs but exhibited indirect effects through specific substance use motives, which in turn were

directly (coping) or indirectly (enhancement) associated with problems.

Results of the multigroup analysis provided several interesting findings. First, although the results indicated that a constrained model predicting alcohol problems provided an adequate and parsimonious fit of the data, modification indices indicated several differences between participants who used only alcohol versus those who used both alcohol and marijuana. Specifically, enhancement motives were more strongly associated with alcohol use in the alcohol-only group. Furthermore, nearly twice as much variance in alcohol use was accounted for in the alcohol-only group. This may suggest that use of alcohol among individuals who use both drugs is more determined by factors outside the model, such as the use of other drugs. Although less pronounced, a similar pattern was seen in the prediction of problems, with approximately 25% more variance accounted for in the alcohol-only group. Second, negative affect was a stronger predictor of alcohol coping motives among the alcohol-and-marijuana sample. The predictors accounted for more than twice as much variance in alcohol coping motives in the alcohol-and-marijuana group (i.e., 19% vs. 8%). Third, there was a stronger relationship between alcohol use and alcohol problems among the alcohol-and-marijuana sample. This may reflect the heightened risk of incurring problems among polydrug users. This is congruent with epidemiological data indicating that among alcohol users illicit drug use is positively associated with high-risk drinking patterns (i.e., binge drinking and heavy drinking; SAMHSA, 2003). In summary, the pattern of relations suggests that, relative to individuals who use only alcohol, those who use both alcohol and marijuana exhibit stronger relations between affective functioning and alcohol coping motives as well as stronger relations between use and related problems. In addition, use among the alcohol-only group is more strongly related to alcohol enhancement motives, whereas alcohol use among users of both drugs may be more determined by factors external to the current model (e.g., other drug use or social factors).

Ninety-nine percent of participants who used marijuana also reported using alcohol. Comparison of the two models for this group of individuals (i.e., the alcohol model in multigroup analysis and the marijuana model) demonstrates both similarities and differences in their reported use motives. For example, there was a significant association between sensation seeking and alcohol enhancement motives but not between sensation seeking and marijuana enhancement motives. Similarly, marijuana coping motives were associated with NMR, whereas alcohol coping motives were associated with lability and negative affect. Finally, coping motives were significantly associated with marijuana use but not with alcohol use. These within-group differences in predictors of alcohol and marijuana motives are intriguing and warrant further investigation in future studies.

Several limitations should be noted. First, the sample was composed of college students, most of whom were White and female. Thus, generalizability to more diverse, community, or clinical samples is limited. Further research is needed to examine the models in these populations. Second, the cross-sectional design precludes directional interpretation of the associations. Third, and equally important, modification indices suggested that the alcohol model in particular could be improved by freeing several nonhypothesized paths. However, post hoc modifications run the risk of capitalizing on chance associations (MacCallum, Roznowski, & Necowitz, 1992). We thus took a conservative approach and presented only our hypothesized model. In support of this, we note that results from the multigroup analysis did not provide compelling support for adding nonhypothesized structural relations to the models. Nonetheless, the modification indices (and significant model chi-square) indicate that our model may not be an optimal fit of the data. Thus, the path coefficients and differences across the models should be interpreted with caution. We have thus tried to emphasize some of the broad characteristics of the general model and theory rather than the importance of the individual path coefficients.

This study has several implications for the etiology and treatment of alcohol and marijuana problems. First, although the affect-regulation variables generally were associated with use motives, as hypothesized, prediction of motives was modest. As stated previously, affect-regulation characteristics in the absence of relevant drug expectancies may be unlikely to result in motivation to use the target drug. Both affect-regulation characteristics and relevant drug expectancies are important to consider in understanding use motives. More research is needed to determine how affect-regulation characteristics and early drug use experiences help shape the development of positive or negative drug expectancies. Second, impulsivity demonstrated consistent relations with problems after controlling for other affective variables, motives, and use. Both marijuana- and alcohol-related problems may be a function of difficulties in self-control. Individuals with difficulties in controlling behavior may be at increased risk for developing substance-related problems. Interventions and prevention efforts may benefit from improving self-regulation abilities in addition to reducing use itself. Third, similarities across the models reflect the fact that, despite being different drugs, alcohol and marijuana use are goal-oriented activities, and use motives are in part a function of affect-regulation characteristics of the individual. Fourth, the multigroup analysis provides some indication that determinants of alcohol use and problems may be somewhat different for individuals reporting use of both marijuana and alcohol in comparison to alcohol-only users. Of note is that the association between use and problems was markedly higher among the marijuana and alcohol users relative to the alcohol-only group, indicating that the polydrug users may be at heightened risk for alcohol-related problems. It is unclear if this heightened risk reflects a premorbid characteristic of the use or if the use of marijuana potentiates the development of alcohol-related problems.

The present study extends previous research on affective-motivational models of alcohol use to the study of marijuana. The results of the analyses indicate that individual differences in affective functioning are associated with concomitant substance-related problems in unique ways. Impulsivity exhibits a direct association with problems, whereas other affective variables are indirectly associated with problems through substance use motives.

References

Bell, R., Wechsler, H., & Johnston, L. D. (1997). Correlates of college student marijuana use: Results of a US national survey. *Addiction, 92,* 571–581.

Carey, K. B., & Correia, C. J. (1997). Drinking motives predict alcohol-

related problems in college students. *Journal of Studies on Alcohol, 58,* 100–105.

Catanzaro, S. J., & Mearns, J. (1990). Measuring generalized expectancies for negative mood regulation: Initial scale development and implications. *Journal of Personality Assessment, 54,* 546–563.

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity and sensation seeking to adolescents' motivations for alcohol, cigarette and marijuana use. *Addictive Behaviors, 26,* 803–825.

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four factor model. *Psychological Assessment, 6,* 117–128.

Cooper, M. L., Agocha, V. B., & Sheldon, M. S. (2000). A motivational perspective on risky behaviors: The role of personality and affect regulatory processes. *Journal of Personality, 68,* 1059–1088.

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.

Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of Abnormal Psychology, 97,* 168–180.

Donohew, L., Zimmerman, R., Cupp, P. S., Novak, S., Colon, S., & Abell, R. (2000). Sensation seeking, impulsive decision making, and risky sex: Implications for risk-taking and design of interventions. *Personality and Individual Differences, 28,* 1079–1091.

Drug Abuse Warning Network. (2003). *Marijuana-related emergency department visits by youth.* Rockville, MD: U.S. Department of Health and Human Services.

Eysenck, S. B., Pearson, P. R., Easting, G., & Allsopp, J. F. (1985). Age norms for impulsiveness, venturesomeness and empathy in adults. *Personality and Individual Differences, 6,* 613–619.

Gledhill-Hoyt, J., Lee, H., Strote, J., & Wechsler, H. (2000). Increased use of marijuana and other illicit drugs at US colleges in the 1990s: Results of three national surveys. *Addiction, 95,* 1655–1667.

Hancock, G. R. (1999). A sequential Scheffé-type respecification procedure for controlling Type I error in exploratory structural equation model modification. *Structural Equation Modeling, 6,* 158–168.

Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55.

Johnson, V., & White, H. R. (1989). An investigation of factors related to intoxicated driving behaviors among youth. *Journal of Studies on Alcohol, 50,* 320–330.

Jöreskog, K. G., & Sörbom, D. (2001). *LISREL 8.5*. Chicago: Scientific Software International.

Kassel, J. D., Jackson, S. I., & Unrod, M. (2000). Generalized expectancies for negative mood regulation and problem drinking among college students. *Journal of Studies on Alcohol, 61,* 332–340.

Kelloway, E. K. (1998). *Using LISREL for structural equation modeling: A researcher's guide.* London: Sage.

MacCallum, R. C., Roznowski, M., & Necowitz, L. B. (1992). Model modifications in covariance structure analysis: The problem of capitalization on chance. *Psychological Bulletin, 111,* 490–504.

Miller, E. T., Neal, D. J., Roberts, L. J., Baer, J. S., Cressler, S. O., Metrik, J., et al. (2002). Test–retest reliability of alcohol measures: Is there a difference between Internet-based assessment and traditional methods? *Psychology of Addictive Behaviors, 16,* 56–63.

Newcomb, M. D., Chou, C.-P., Bentler, P. M., & Huba, G. J. (1988). Cognitive motivations for drug use among adolescents: Longitudinal tests of gender differences and predictors of change in drug use. *Journal of Counseling Psychology, 35,* 426–438.

Oliver, M. N. I., & Simons, J. S. (2004). The Affective Lability Scales: Development of a short-form measure. *Personality and Individual Differences, 37,* 1279–1288.

Pierce, R. S., Frone, M. R., Russell, M., & Cooper, M. L. (1994). Relationship of financial strain and psychosocial resources to alcohol use and abuse: The mediating role of negative affect and drinking motives. *Journal of Health and Social Behavior, 35,* 291–308.

Read, J. P., Wood, M. D., Kahler, C. W., Maddock, J. E., & Palfai, T. P. (2003). Examining the role of drinking motives in college student alcohol use and problems. *Psychology of Addictive Behaviors, 17,* 13–23.

Simons, J. S. (2003). Differential prediction of alcohol use and problems: The role of biopsychological and social–environmental variables. *American Journal of Drug and Alcohol Abuse, 29,* 861–879.

Simons, J. S., & Carey, K. B. (2002). Risk and vulnerability for marijuana use problems: The role of affect dysregulation. *Psychology of Addictive Behaviors, 16,* 72–75.

Simons, J. S., Carey, K. B., & Gaher, R. M. (2004). Lability and impulsivity synergistically increase risk for alcohol-related problems. *American Journal of Drug and Alcohol Abuse, 30,* 685–694.

Simons, J., Correia, C. J., & Carey, K. B. (2000). A comparison of motives for marijuana and alcohol use among experienced users. *Addictive Behaviors, 25,* 153–160.

Simons, J., Correia, C. J., Carey, K. B., & Borsari, B. E. (1998). Validating a five-factor marijuana motives measure: Relations with use, problems, and alcohol motives. *Journal of Counseling Psychology, 45,* 265–273.

Simons, J. S., & Gaher, R. M. (in press). The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and Emotion.*

Stice, E., Barrera, J. M., & Chassin, L. (1998). Prospective differential prediction of adolescent alcohol use and problem use: Examining the mechanisms of effect. *Journal of Abnormal Psychology, 107,* 616–629.

Substance Abuse and Mental Health Services Administration. (1999). *National Household Survey on Drug Abuse main findings 1997* (DHHS Publication No. SMA 99–3295). Rockville, MD: U.S. Government Printing Office.

Substance Abuse and Mental Health Services Administration. (2003). *Results from the 2002 National Survey on Drug Use and Health: National findings* (DHHS Publication No. SMA 03–3836). Rockville, MD: U.S. Government Printing Office.

Watson, D., & Clark, L. A. (1994). *Manual for the Positive and Negative Affect Schedule (Expanded form)*. Iowa City: University of Iowa.

Wechsler, H., Dowdall, G. W., Maenner, G., Gledhill-Hoyt, J., & Lee, H. (1998). Changes in binge drinking and related problems among American college students between 1993 and 1997. *Journal of American College Health, 47,* 57–68.

Wechsler, H., Lee, J. E., Kuo, M., & Lee, H. (2000). College binge drinking in the 1990s: A continuing problem: Results of the Harvard School of Public Health 1999 College Alcohol Study. *Journal of American College Health, 48,* 199–210.

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50,* 30–37.

Wills, T. A., Sandy, J. M., & Yaeger, A. M. (2002). Moderators of the relation between substance use level and problems: Test of a self-regulation model in middle adolescence. *Journal of Abnormal Psychology, 111,* 3–21.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking.* Cambridge, England: Cambridge University Press.

Received June 28, 2004
Revision received September 13, 2004
Accepted September 15, 2004 ■