Do Adolescents Affiliate with 12-Step Groups? A Multivariate Process Model of Effects*

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ABSTRACT. *Objective:* Research with adolescents has revealed salutary effects for 12-step attendance on substance use outcomes, but no studies have examined the effects of 12-step affiliation, or active involvement, beyond simple measures of attendance. Prior research with adults has shown that measures of affiliation are more predictive than measures of attendance. This study (1) assessed attributes that may influence 12-step attendance and affiliation; (2) tested whether 12-step affiliation in the first 3 months posttreatment possessed unique predictive power above that attributable to attendance alone; and (3) examined the extent to which motivation, coping and self-efficacy measured at 3 months mediated the relation between 12-step affiliation and substance use outcome in the ensuing 3 months. *Method:* Adolescent inpatients ($N = 74$, 62% female), who were aged 14–18 years (mean [SD]

– 15.9 [1.19] years), were interviewed during treatment and at 3 and 6 months postdischarge. *Results:* More severely substance-involved youth were more motivated for abstinence and more likely to attend and affiliate with 12-step groups. A high degree of collinearity between 12-step attendance and affiliation suggested that those attending were also likely to be those actively involved. As a consequence, affiliation did not predict outcome over and above frequency of attendance. Motivation was found to influence the relationship between 12-step affiliation and future substance use outcome. *Conclusions:* Given the widespread treatment recommendations for adolescent 12-step involvement, more study is needed to determine what kinds and what aspects of 12-step groups and fellowships are helpful to adolescent change efforts and what alternatives should be developed. (*J. Stud. Alcohol* 63: 293–304, 2002)

SELF-HELP GROUPS, such as Alcoholics Anonymous (AA) and Narcotics Anonymous (NA), are commonly used by individuals to help with substance abuse problems. In the United States, for example, AA is the most commonly accessed source of help for an alcohol-related problem, with an estimated 9% of the U.S. population having attended an AA meeting, 3% for help with their own problems (Room and Greenfield, 1993). Furthermore, since the inception of the “Minnesota model” (McElrath, 1997) of treatment during the 1950s, 12-step philosophy has been incorporated, to a lesser or greater extent, into the overwhelming majority of professional private and public substance-use disorder treatment programs in the U.S. (Humphreys, 1997; Roman and Blum, 1998).

Adolescents make up a sizeable minority (approximately 12%) of the 1 million individuals treated each year within the U.S. alcohol and drug treatment system (Substance Abuse and Mental Health Services Administration, 1993,

1994). Most youth treatment facilities utilize an adaptation of the adult oriented 12-step modality, incorporating prescriptions to attend AA and NA as a means of maintaining treatment gains (Bukstein, 1995; Cavaia et al., 1990). Due to a lack of controlled comparative outcome studies, it is currently not known which treatment modalities or components may be optimally effective with this age group. The few quasi-experimental studies examining this approach to date have evinced salutary associations between 12-step approaches and posttreatment substance use (Alford et al., 1991; Brown, 1993; Brown et al., 1990; Hsieh et al., 1998; Kelly et al., 2000; Vik et al., 1992; Winters et al., 2000).

Although such studies have informed our understanding of the influence of 12-step groups on youth treatment outcome, criticisms have been raised regarding the adequacy of single numeric measures of 12-step meeting attendance to fully capture the effects of 12-step organization experiences. Kingree (1997) argues against single/dichotomous item measures of 12-step involvement, which often lack validity and reliability, in favor of a composite measure that taps the complex “behavioral and subjective features” associated with 12-step involvement. The Drug Abuse Treatment Outcome Study (DATOS) funded by the National Institute of Drug Abuse (NIDA), which examined prospectively more than 10,000 individuals receiving various types of alcohol and drug treatments, evinced better outcomes for those who had received more treatment (Anglin et al., 1997). Although such studies reveal that estimates of number of days in treatment or number of treatment sessions

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have predictive value, these may only serve as proxies for more direct measures of treatment involvement. Analyses of such involvement may reveal even greater predictive power over and above a simple sum of days in treatment. Thus, it would seem important to assess the degree to which 12-step meeting attendees are complying with 12-step prescriptions (e.g., working the steps, using a sponsor) and any ultimate effect this may have on substance use outcomes. Such studies may elucidate, and capture more precisely, the active ingredients and effects of participation in 12-step groups and ultimately help inform intervention strategies that may be effective in preventing posttreatment relapse.

The adult-based literature has evaluated this issue by making a distinction between "attendance" and "affiliation." The study by Room and Greenfield (1993) suggests that individuals may attend 12-step groups for many reasons, but may not rate them as important to their recovery efforts, nor engage in prescribed activities (e.g., working the 12 steps, acquiring a sponsor or making use of other social aspects of the fellowship). Within the tenets of 12-step philosophy, such activities are presumed to be the mechanism responsible for effecting salutary gains in functioning (e.g., Alcoholics Anonymous, 2001). Other measures of the affiliation construct have been proposed, including sponsoring other members (not just having a sponsor), speaking at and leading meetings, undergoing a spiritual (conversion) experience, reading 12-step literature and engaging in phone contact with other 12-step members (Humphreys et al., 1998; Tonigan et al., 1996a). Psychometric studies of the construct, using large multisite samples (Humphreys et al., 1998; Tonigan et al., 1996a), have produced disparate conclusions. A study by Tonigan and colleagues (1996a), for example, using treatment-seeking Project MATCH participants, concluded with support for a two-factor measure; an involvement factor explains 9% of the variance and an attendance factor 40%, which suggests that affiliation and attendance provide additive and unique information. The Humphreys et al. (1998) study, using a combined untreated and treated alcohol-use disorder sample, concluded that there was stronger evidence for a unidimensional AA involvement construct, suggesting a stronger overlap between attendance and affiliation. In terms of predicting substance use outcomes, studies have evinced support for a distinction between attendance and affiliation. A study by Gilbert (1991), for example, measured the extent to which individuals had engaged in working the 12 steps and found that working the steps predicted abstinence, whereas a simple measure of attendance did not. A meta-analytic review of 107 studies on AA (Emrick et al., 1993) evinced better outcomes for "more active members"; having a sponsor, for example, had the largest favorable impact on drinking outcomes. A study by Snow and colleagues (1994) revealed that cognitive (e.g., the perceived importance of

attendance to recovery) and social aspects of affiliation predicted more behavioral change processes than a simple measure of attendance. A study by Montgomery et al. (1995) revealed that the frequency of 12-step attendance did not predict outcome, but involvement (i.e., working the steps) did. A study by Tonigan et al. (2000) did not find any unique predictive effect for affiliation over attendance, however.

Although further study is needed, evidence suggests that making a distinction between attendance and affiliation may be important in estimating the utility of 12-step groups for relapse prevention; however, no studies have examined the effects of such affiliation among adolescents. Given the important differences observed between adults and adolescents treated for substance use disorders (Brown et al., 1989, 1990; Deas et al., 2000) and the unique developmental challenges of adolescence, youths may differ in the extent to which they comply with and benefit from typical 12-step prescriptions. Being less severely dependent than adults, adolescents may find that AA recommendations, devised originally to help more "desperate" alcoholics (Alcoholics Anonymous, 2001) may not be necessary or relevant.

In summary, 12-step groups are an important and pervasive component of both adult and adolescent substance use disorder treatment in the U.S. Distinguishing between simple measures of attendance and affiliation has been shown to be important in adult samples, yet no studies have empirically examined this distinction in youths. For these reasons, the principal aim of the current investigation was to examine whether affiliation with 12-step groups significantly enhanced prediction of substance-use disorder treatment outcomes above the effects of attendance.

A small number of studies examining the effects of 12-step phenomena have gone beyond the question of *whether* attendance is helpful in preventing or minimizing relapse to ask *how* or *why*. A study by Morgenstern et al. (1997) and a recent study carried out by our group (Kelly et al., 2000) examined models based in social-cognitive learning theory (Bandura, 1986) for the effects of 12-step meeting attendance on substance use outcome following inpatient substance use disorder treatment. Both studies supported the use of social-learning-based constructs (e.g., self-efficacy, motivation and coping) to help explain therapeutic effects of 12-step involvement. The current investigation extended this earlier work by testing a multivariate process model of adolescent 12-step affiliation and its influence on substance use during the initial 6 months following treatment for alcohol and drug problems. Using constructs central to social-cognitive learning theory (i.e., self-efficacy, coping and motivation), summarized in Marlatt and Gordon's (1985) explication of adult relapse, the current model was designed to assess 12-step affiliation, measured during the first 3 months postdischarge, and evaluate any additional impact that such affiliation has, over and

above simple measures of attendance, on proximal outcomes (i.e., coping, self-efficacy for abstinence, motivation for abstinence) measured at 3 months postdischarge, and ultimate outcomes (i.e., substance use) measured during Months 4-6. We also examined the extent to which substance use outcomes attributable to 12-step affiliation could be explained by these social-learning theory constructs.

First, based upon prior findings with adults (Emrick et al., 1993; Tonigan et al., 1996b; Weiss et al., 2000) and adolescents (Kelly et al., 2000), it was predicted that youths with more severe substance involvement at treatment intake would be more motivated for abstinence and, subsequently, more likely to follow the common treatment recommendations to attend and affiliate with 12-step groups. Second, it was predicted that more frequent attendance and greater affiliation with 12-step groups postdischarge would be associated with lower rates of substance involvement. Greater affiliation also was anticipated to predict substance use outcome over and above frequency of group attendance. Third, it was predicted that greater levels of 12-step affiliation during the first 3 months following treatment would be associated with increases in self-efficacy for abstinence, motivation for abstinence and coping with substance use temptations (measured at 3 months), over and above those accounted for by 12-step attendance alone. Last, the process measures of self-efficacy, motivation and coping, measured at 3 months posttreatment, were expected to mediate the effect of 12-step affiliation on substance use outcome in the following 3 months.

Method

Setting and sample

The current study is based on a sample of 74 adolescents, recruited during inpatient treatment for alcohol and drug problems, consecutively admitted to two inpatient treatment programs in metropolitan San Diego, California. These treatment facilities are based broadly on a "Minnesota model" framework, prescribing abstinence and 12-step meeting attendance during and following treatment. Some adolescents are also recommended to attend aftercare sessions at the treatment facility for support, encouragement and psychoeducation.

Adolescents between the ages of 14 and 18 were recruited into the study if they met criteria for a psychoactive substance abuse or dependence diagnosis in accordance with the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994). Diagnoses were determined by structured interview, using the Customary Drinking and Drug Use Record (CDDR; Brown et al., 1998). Other eligibility criteria were (1) participation of a resource person to provide corroborative information; (2) adequate ability to under-

stand and comprehend the measures; (3) living within 50 miles of the research facility; and (4) no history of psychotic symptoms, independent of substance use.

The original pool of eligible study participants numbered 127. A total of 85 (68%) completed interviews and all questionnaires at both follow-up time points. Because of missing data at one of the assessment time points on at least one measure, 11 cases were excluded. (Although imputation and other methods of dealing with missing data [e.g., mean substitution] are sometimes used, we felt more confident using data that were observed rather than imputed.) Univariate analyses were conducted to examine any systematic differences between included and excluded cases. Results revealed no significant differences on baseline measures of age, gender, ethnicity, socioeconomic status (SES), number of days abstinent in the past 30 days at treatment intake, substance use problem severity or any of the process (mediational) variables (i.e., motivation for abstinence, abstinence-focused coping or self-efficacy), with all p 's $> .13$.

The average (SD) age of the current sample was 15.9 (1.19) years; 62% were female. Participants were primarily white (70%), but included a substantial proportion of Hispanics (18%) and smaller proportions of blacks (8%) and Asian/Pacific Islanders (4%). Participants came from families of varying socioeconomic backgrounds, ranging from unskilled laborers to college-educated professionals (Hollingshead [1965] SES index: mean [SD] = 36.80, [14.91], range: 11-65). The sample comprised polysubstance users; the most frequently reported substances of choice were marijuana (42%), amphetamines (30%) and alcohol (13%). Frequency of use (days per month) for alcohol and other drugs in the 3 months prior to treatment entry reflected reported drugs of choice: marijuana, mean (SD) = 16.1 (11.9); amphetamines, 7.0 (10.7); beer, 7.2 (8.8); distilled spirits, 4.6 (7.2). The dimensional measure of substance use problem severity (Personal Involvement Scale [PIS; Winters et al., 1993] in the current sample revealed an average (SD) score of 62.35 (17.18), well above both DSM-III-R abuse and dependence diagnosis cutoff scores. The average length of inpatient stay was 11.9 (9.0) days.

Procedure

Participants were recruited during inpatient treatment if parent and adolescent independently consented to the adolescent's participation. Initial interviews and baseline measures of substance involvement, motivation, coping and self-efficacy were completed during hospitalization by trained master- and bachelor-level research staff. Baseline and 6-month follow-up adolescent interviews were completed face-to-face; 3-month interviews were completed by telephone. All parent interviews were conducted by telephone. Youths were not paid for the initial interview, but

were compensated \$10 and \$25 for the 3-month and 6-month interviews, respectively. Corroborative resource-person interviews (usually parents) were also completed during treatment by a different interviewer (so as not to bias independently obtained results). The same format was employed at the 3-month and 6-month follow-up points. To enhance reporting of substance use involvement during the follow-up period, saliva test strips (AlcoStrip™) were administered to detect recent use of alcohol, and urine samples for drug toxicology were obtained in cases in which the adolescent denied any substance use during the follow-up period.

Measures

Demographics. Background information regarding age, ethnicity and gender was recorded using the Structured Clinical Interview for Adolescents (SCI; Brown, 1987).

Substance involvement. The frequency of alcohol and other drug use was measured using the Timeline Follow Back (TLFB) procedure (Sobell and Sobell, 1992) adapted for multiple substances (Brown et al., 1990). Quantity of use was also assessed for alcohol, but not for other drugs because of the variability in purity/potency of illicit drugs (e.g., marijuana and methamphetamine). The TLFB was administered to assess the prior 30 days at treatment entry, and 90 days at each follow-up interview. This procedure has shown to have high test-retest reliability as well as convergent and discriminant validity (e.g., Fals-Stewart et al., 2000). Substance use problem severity was measured using the Personal Involvement Scale (PIS) of the Personal Experiences Inventory (PEI; Winters et al., 1993). This scale measures severity of substance involvement and has been shown to have excellent internal consistency, as well as good construct and criterion validity for youth (Winters et al., 1993). The internal consistency for the current sample was similarly high (Coefficient alpha = 0.96).

Twelve-step attendance. Frequency of attendance at 12-step meetings was evaluated using the TLFB technique (Sobell and Sobell, 1992). To enhance accurate recall of meeting attendance, interviewers utilized memory cues by reminding participants of significant events or holidays during the follow-up period and by inquiry into whether any noteworthy events had occurred in their own lives. This information was then entered onto the calendar in order to facilitate recall of meeting attendance.

Twelve-step affiliation. Consonant with the tenets of 12-step approaches and previous research, this construct was assessed using four items, which tap both cognitive and behavioral aspects of 12-step affiliation: (1) "How important is it to you to attend 12-step meetings?" (2) "Do you have a sponsor?" (3) "Which of the 12 steps have you worked?" and (4) "How often do you engage in 12-step social activities outside of meetings (e.g. parties, dances,

etc.)?" These aspects of 12-step organizations have been shown to be important both anecdotally, in terms of 12-step members' reported experiences (Alcoholics Anonymous, 1976), as well as empirically (Emrick et al., 1993; Snow et al., 1994).

Motivation for abstinence. Motivation was measured by two items taken from the Structured Clinical Interview for Adolescents (SCI; Brown, 1987). Participants rated questions: "On a scale of 1-10, how important is it for you not to use alcohol?" and "On a scale of 1-10, how important is it for you not to use drugs?" (1 = "not at all important" and 10 = "very important"). Given that treatment goals are defined as abstinence from alcohol and other drugs, the lowest of the two item responses was used to reflect motivation for complete abstinence from alcohol and other drugs.

Self-efficacy. Self-efficacy was measured using items taken from the Structured Clinical Interview for Adolescents (Brown, 1987). Two questions tap this construct: "On a scale of 1-10, how likely is it that you will use alcohol again in the future?" and "On a scale of 1-10, how likely is it that you will use drugs again in the future?" (10 = happen for sure). Again, the lowest rating obtained from these behavioral intent items was utilized to reflect likelihood of any future use of substances. This measure has been shown to correlate highly ($r = 0.58$; Kelly et al., 2000) with a well validated measure of situation specific self-efficacy for abstinence, the Drug Taking Confidence Questionnaire (DTCQ; Sklar et al., 1997).

Coping. Coping with substance use temptations was assessed using the abstinence-focused coping scale of the Adolescent Relapse Coping Questionnaire (ARCC; Myers and Brown, 1995). This scale measures abstinence-specific coping responses to a hypothetical, commonly reported relapse situation (i.e., at a party with other people, adolescent is offered drugs and something to drink). It has been shown to have good internal consistency (Cronbach's alpha = 0.82), as well as construct and criterion validity (Myers and Brown, 1995; Myers et al., 1993).

Results

Preliminary analyses

Statistical assumption. Variables were initially screened with regard to distributional qualities, using exploratory techniques outlined by Tukey (1977) available in SPSS 10.0. Examination of the normal quantile-quantile (Q-Q) plots revealed that one variable, the criterion (number of days abstinent), did appear to deviate from the theoretical normal distribution, producing an s-shaped curve associated with more uniform or rectangular distributions (skew = -1.65, kurtosis = 1.26) (Affifi and Clark, 1996). The histogram revealed a preponderance of a single value (i.e., Xi = 90 days abstinent) at one end of the distribution and, sub-

sequently, the variable did not respond favorably to an inverse transformation ($1/X$), usually recommended for such a distribution. In order to examine the empirical impact of the observed degree of nonnormality, nonparametric relationships (i.e., Spearman rank-ordered correlations) with predictor variables were examined and compared with parametric (i.e., Pearson Product-Moment) versions, to assess the magnitude and direction of difference. Results revealed satisfactory similarity such that the use of parametric tests could be carried out. (For example, the relationship between "number of days abstinent" and "12-step attendance" produced parametric [Pearson r] and nonparametric [Spearman r] correlations, both equal to 0.20; the parametric and nonparametric correlation between number of days abstinent and the 3-month measure of motivation for abstinence revealed r 's equal to 0.50 and 0.46, respectively). It is important to note that, in order to test whether the multivariate assumptions necessary for inferential analyses seen in Figure 2 were met, plots of studentized residuals from the full model (Figure 2) were examined. These analyses did not reveal violations with regard to the distribution of errors (Affifi and Clark, 1996).

Measurement of 12-step affiliation. The four 12-step affiliation items were analyzed to determine optimal weighting for a composite score to be used in the analyses. This empirical approach was chosen because the extent of contribution of each individual item to the affiliation construct was unknown among adolescents.

First, scores for the affiliation items were standardized to obtain consistent scaling. These four standardized items were found to possess good internal consistency (Cronbach's $\alpha = 0.78$). Factor extraction procedures consistently produced a single-factor solution, accounting for 61% of the total variability and obviating the need for factor rotation. Since the results were consistent across extractions, an alpha extraction was utilized because it more realistically assumes items are drawn from a theoretical universe of all possible items that measure "12-step affiliation" and attempts to maximize the reliability of extracted factors. Factor scores for each case were computed by multiplying the factor score coefficient by the variable value, producing a weight indicative of the relative contribution of that variable to the latent construct labeled "12-step affiliation" (Affifi and Clark, 1996). These weighted scores were used as a composite measure of 12-step affiliation. The factor loadings can be seen in Table 1.

Adolescents attended a variety of 12-step meetings, both NA and AA, ranging from all-teen to all-adult in age composition. For those who reported attending at least one 12-step meeting during the first 3 months postdischarge (i.e., 71.6%), just over one third reported having a sponsor (38%) and engaging in 12-step social activities outside of meetings (34%). Whereas 60% reported having worked at least Step 1, under a quarter (24.5%) reported working more

TABLE 1. Factor loadings for affiliation composite

	Factor loading
How often attended social activities?	.60
Has 12-step sponsor?	.73
Sum of 12-steps worked	.61
Importance of 12-step attendance	.81

Notes: Extraction method: Alpha factoring. Single factor extracted. Seven iterations required.

than the first step during the first 3 months posttreatment. Attendees' mean (SD) rating of importance for attending 12-step groups was 6.15 (3.34); range: 1 = "not at all important" to 10 = "very important").

Control variables. To control for the potential relationship between other variables and substance use outcome for these analyses, preliminary univariate analyses were conducted on (1) demographics (age, gender, ethnicity, SES); (2) baseline substance use variables (problem severity and frequency of use); (3) treatment experience variables (number of days in inpatient treatment, aftercare meetings attended, other concomitant substance abuse treatment); and (4) intake measures of the hypothesized mediators (abstinence-focused coping, self-efficacy and motivation for abstinence). None of the demographic variables (p 's $> .36$) or number of days in treatment ($p = .20$) were related to substance use outcome. Of the substance use variables, substance use problem severity was not related to outcome ($p = .12$), whereas baseline frequency of substance use was marginally significant ($r = 0.22$, $p = .06$). Of the process measures, self-efficacy was related to outcome ($r = -0.25$, $p = .04$), but coping and motivation were not (p 's $> .27$). Attendance at aftercare meetings and other concomitant substance use disorder treatment (e.g., further inpatient treatment) during the first 3 months posttreatment were unrelated to outcome in the following 3 months ($p > .19$). Both self-efficacy and baseline frequency of substance use were thus retained as control variables.

Predictors of 12-step attendance and 12-step affiliation

Correlational analyses revealed that more severe substance involvement was associated with a higher likelihood of 12-step attendance ($r = 0.21$, $p < .05$) and affiliation ($r = 0.30$, $p < .05$) in the first 3 months postdischarge. Also, greater substance use severity was associated with increased motivation for abstinence, which, in turn, was associated with higher rates of attendance ($r = 0.32$, $p < .05$), but not affiliation ($r = 0.14$, $p = 0.12$) postdischarge. To test whether motivation significantly mediated the effect of substance use problem severity on 12-step attendance, tests of mediation were conducted using EQS, with the maximum likelihood (ML) method selected (Bentler and Wu, 1995).

TABLE 2. Means (standard deviations) and correlations matrix for covariance structure model tests of mediation

	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. Motivation (0m)	5.9 (3.3)	—											
2. Motivation (3m)	6.9 (3.3)	.22	—										
3. Efficacy (0m)	6.7 (3.2)	-.25*	-.49 [†]	—									
4. Efficacy (3m)	5.2 (3.8)	-.13	-.42 [†]	.24*	—								
5. Coping (0m)	42.9 (12.0)	.46 [†]	.36 [†]	-.38 [†]	-.37 [†]	—							
6. Coping (3m)	39.6 (12.1)	.09	.46 [†]	-.40 [†]	-.25*	.49 [†]	—						
7. 12-step meetings attended (1-3m)	26.4 (30.7)	.32 [†]	.40 [†]	-.40 [†]	-.26*	.32 [†]	.32 [†]	—					
8. 12-step meetings attended (4-6m)	15.9 (25.9)	.15	.45 [†]	-.40 [†]	-.22	.23	.38 [†]	.70*	—				
9. 12-step affiliation (standardized)	0.0 (1.0)	.14	.49 [†]	-.31 [†]	-.28*	.38 [†]	.39 [†]	.66 [†]	.64 [†]	—			
10. Days abstinent (0m)	11.6 (10.6)	-.05	-.11	.21	.11	-.09	-.06	-.25*	-.27*	-.39 [†]	—		
11. Days abstinent (1-3m)	79.8 (19.4)	-.01	.50*	-.24*	-.38 [†]	.20	.28*	.28*	.24*	.19	.11	—	
12. Days abstinent (4-6m)	72.5 (28.9)	.08	.50 [†]	-.25*	-.35 [†]	.13	.25*	.20	.26*	.08	.22	.69 [†]	—

* Correlation significant at .05 level (2-tailed). [†]Correlation significant at .01 level (2-tailed).

Because EQS provides both parameter estimates (β 's) and a z test of the mediated (indirect) effects, it was considered to be a method for determining mediation preferable to observing a "reduction" in the parameter magnitude, as explicated by Baron and Kenny (1986). Results revealed a significant indirect effect of substance use problem severity on 12-step attendance ($z = 2.73$, $p = .003$).

Incremental effects of affiliation over and above attendance on substance use outcome

Bivariate analysis of concurrent 12-step attendance and substance use outcome in the first 3 months and the second 3 months postdischarge revealed small to moderate associations ($r = 0.20$, $p = .08$ and $r = 0.26$, $p = .02$, respectively). Examination of the partial correlations between attendance and substance use outcome during both time periods (controlling for baseline frequency of use) revealed a stronger association between 12-step attendance and salutory changes in substance use in the first ($sr = 0.32$, $p = .005$) and second ($sr = 0.34$, $p = .003$) follow-up periods.

As can be seen in Table 2, the zero-order relationship between the composite measure of 12-step affiliation in the first 3 months (1-3m) and substance use during the next 3 months (4-6m) revealed a small nonsignificant effect ($r = 0.08$, $p > .05$). Examination of the partial correlation between the composite 12-step affiliation measure and days abstinent, controlling for baseline measure of days abstinent, revealed a significant relationship in the first 3-month follow-up period ($sr = 0.25$, $p = .03$), which was marginally significant during the second 3-month follow-up period ($sr = 0.18$, $p = .06$).

Contrary to predictions based on adult samples, a hierarchical regression revealed no increment in predictive power when 12-step affiliation was added to the model after the measure of 12-step attendance, either when examined concurrently (i.e., during the same 3-month time period;

R^2 adj. = 0.00, $p = .56$) or when predicting future substance use in the ensuing 3 months (R^2 adj. = 0.00, $p = .89$). A significant degree of collinearity was observed between the measure of 12-step attendance and 12-step affiliation ($r = 0.66$, $p < .001$). To examine whether the lack of unique prediction for the affiliation composite was due to any disproportionate influence of the single subjective cognitively based affiliation item, "How important is it to you to attend 12-step meetings?" which was more strongly related to 12-step attendance ($r = 0.65$, $p < .001$) than having a sponsor ($r = 0.55$, $p < .001$), working the steps ($r = 0.24$, $p < .05$) or engaging in fellowship social activities ($r = 0.59$, $p < .001$), a further regression model was tested with an affiliation composite based on factor scores from the other three behaviorally based items only (i.e., having a sponsor, degree of step work, engaging in fellowship social activities). Again, no incremental prediction in outcome was observed (R^2 adj. = 0.00, $p = .54$).

Incremental effects of affiliation over and above 12-step attendance on the mediators

Significant associations were observed between 12-step affiliation during the first 3 months and motivation ($r = 0.49$, $p < .001$), self-efficacy ($r = -0.28$, $p = .02$) and coping ($r = 0.39$, $p = .001$), measured at 3 months posttreatment (Table 1). Hierarchical regression analyses examining incremental effects for 12-step affiliation over and above 12-step attendance on the hypothesized mediating variables revealed that the effect of 12-step attendance on motivation for abstinence, measured at 3 months, explained a further 12% (R^2 change = 0.12, $p < .05$) over and above the 5% explained by the intake level of motivation. The addition of 12-step affiliation explained a further 10% of variance. A small incremental effect was observed for 12-step attendance on the 3-month coping measure (R^2 change = 0.03, $p < .05$), and the effect on self-efficacy was marginally

FIGURE 1. Path diagram depicting standardized coefficients of effects for 12-Step attendance (with control variables)

significant (R^2 change = 0.03, $p < .10$). There were not significant additional increments in R^2 associated with the measure of 12-step affiliation for either coping or self-efficacy (p 's $> .16$).

Tests of mediation

As shown in Table 2, significant bivariate correlations were observed between all three mediators (i.e., motivation, self-efficacy, coping), measured at 3 months posttreatment, and future substance use during the 4- to 6-month follow-up ($r = 0.50$, $p < .001$; $r = -0.35$, $p < .01$; $r = 0.25$, $p < .05$; respectively). To examine the effects of the hypothesized mediating variables in the relationship between 12-step attendance, 12-step affiliation and ultimate substance use outcome significance tests of mediation were carried out using EQS (Bentler and Wu, 1995). Figure 1 shows the variables and magnitude of relations between 12-step attendance and process variables (self-efficacy, motivation, coping) as well as baseline levels of control variables. Fig-

ure 2 shows the complete model with 12-step affiliation added. Structural equations (e.g., those used herein for mediational analyses) generally require large samples. Due to the small sample size in this study, results from the analyses using EQS were crosschecked using the SPSS 10.0 regression module. Using ordinary least squares regression, the parameter estimates and significance findings were almost identical. The crosscheck was conducted because ordinary least squares regression does not require as large a sample size as does SEM. (For example, Green's [1991] equation for estimating sample size for a medium effect size in multiple regression is: $N \geq [8/f^2] + [m-1]$, where N is the sample size, $f^2 = 0.15$ [medium effect size for Multiple R^2] and m = the number of IVs. Thus, the largest possible analysis with seven predictors [see Figure 2] would require approximately 60 cases.)

The model provided a good fit to the data (goodness of fit index [GFI] = 0.93). The observed multiple R^2 for the model was similarly high ($R^2 = 0.38$ [$R^2 = 0.32$, adjusted], $p < .0001$).

FIGURE 2. Path diagram depicting standardized coefficients of effects for 12-Step attendance and affiliation (with control variables)

Of note was the paradoxical change in the effect of 12-step affiliation on substance use outcome (-0.24 , $p < .05$; see Figure 2). This finding suggested the presence of a suppression effect among the independent variables, such that the relationship between 12-step affiliation and substance use outcome had substantially increased in magnitude as well as changed signs from positive to negative (Tabachnick and Fidell, 1996). In order to identify the suppressor variable(s), successive regression equations were examined by systematically removing each congruent independent variable (i.e., where the correlation and regression coefficient signs matched) from the original equation and examining any change in the discrepant regression coefficients and zero-order correlations (Tabachnick and Fidell, 1996). This procedure revealed that motivation for abstinence at 3 months was found to have a suppression effect on the 12-step affiliation measure. Examination of the difference between the zero-order and partial correlations revealed that, in the presence of the other variable (i.e., motivation or 12-step affiliation), there was a much greater change in magnitude for affiliation (0.08 to -0.22) com-

pared to motivation (0.50 to 0.53), suggesting that motivation was having a suppressing effect on affiliation (Cohen and Cohen, 1983). In this context, the criterion (days abstinent, 4-6 m) is adjusted downwards to account for this. From the temporal process model perspective, shown in Figure 2, this also suggested that motivation for abstinence mediated the effect of affiliation on substance use outcome. Investigation of the tests of indirect effects revealed that this indeed was the case ($z = 3.28$, $p < .001$).

It was also apparent from the model tested in Figure 2 that the significant relation between 12-step attendance and the mediators seen in Figure 1 was considerably reduced in magnitude and rendered statistically nonsignificant with 12-step affiliation present in the model. Although these variables were measured concurrently, this suggested that 12-step affiliation was mediating the effects of 12-step attendance on the 3-month measures of motivation, coping and self-efficacy. Formal mediational analyses confirmed that the effect of 12-step attendance on motivation was fully mediated by 12-step affiliation ($z = 2.93$, $p = .002$), whereas the effect of attendance on coping and self-efficacy was

partially mediated through affiliation ($z = 1.48, p = .07$; and $z = -1.18, p = .12$; respectively). As a consequence, there was no longer a significant indirect effect for 12-step attendance ($z = 0.57, p > .05$); instead, a significant indirect effect on substance use outcome for 12-step affiliation ($z = 3.28, p < .001$) was revealed.

Results from separate analyses revealed that motivation for abstinence ($z = 3.22, p < .001$) fully mediated the effect of 12-step affiliation on substance use outcome, with partial mediation for self-efficacy ($z = 1.4, p = .08$).

Discussion

The current study examined a multivariate process model of 12-step attendance and affiliation by adolescents following treatment for alcohol and other drug problems, and assessed factors that influenced and were influenced by such behaviors. We examined the effects of 12-step affiliation on substance use outcomes over and above measures of 12-step attendance during the first 6 months following inpatient treatment. In addition, mechanisms theorized to explain the relapse process (i.e., coping, motivation and self-efficacy; Marlatt and Gordon, 1985) were investigated as possible mediators of any such effects.

Similar to findings with adults (Emrick et al., 1993; Tonigan et al., 1996a; Weiss et al., 2000), those adolescents studied here who had greater substance-use problem severity were more likely to attend the abstinence-focused 12-step groups. Knowledge of substance use severity and motivation for abstinence could enhance the specificity and efficiency of intervention strategies used in treatment settings. For youths with less severe problems, focus could be placed on increasing motivation for abstinence and 12-step group attendance. As an alternative, emphasis could be placed on ways of sustaining substance use behavior change (i.e., relapse prevention) that do not involve 12-step group attendance. Examples are family therapies, extrication from substance-using peer group, or functional analysis of substance use and discovery of likely alternatives to meet needs formerly met with substances (Brown, 1993).

Both a higher frequency of 12-step meeting attendance and, to a lesser extent, greater affiliation with 12-step groups were associated with better posttreatment substance use outcome, as predicted. The measure of affiliation used here, however, derived from adult studies, did not predict adolescent substance use outcome over and above simple measures of 12-step group attendance. This is in keeping with some adult studies (e.g., Tonigan et al., 2000) that found that affiliation did not add to the prediction of substance use outcome following early treatment; however, it contradicted other findings that had revealed unique outcome effects for measures of affiliation. The degree of collinearity

between attendance and the composite measure of affiliation observed in this study was considerably higher than in the Montgomery et al. (1995) study and the Snow et al. (1994) study with adults. This high degree of overlap suggests that adolescents who attend more often are also likely to be those with greater 12-step affiliation. Explanations for the greater degree of overlap between attendance and affiliation among adolescents in this study and the lack of unique predictive ability for affiliation found here could reflect measurement issues, life stage or some combination of the two. For example, 12-step affiliation has been measured using an array of variables assessing a range of behavioral and subjective indices (see Emrick et al., 1993). These range from single-item measures to longer multidimensional assessments (Gilbert, 1991; Humphreys et al., 1998; Tonigan et al., 1996b). For adolescents, other measures may also be important (e.g., perceived similarity to other group attendees) (Vik et al., 1992). In addition, the proportion of female subjects in this study sample was larger than in the adult studies; thus, gender may interact with indices of attendance and affiliation. An alternative explanation is that these findings may reflect developmental differences. Given the additional logistical barriers facing adolescents in getting to 12-step meetings, for example (e.g., lack of personal transport, finances, permission from parents), those who do attend more frequently are likely those who place higher value on the importance of such attendance. These youths may also be more likely to follow program suggestions regarding such aspects of affiliation as sponsorship and working the steps. Since adults face fewer logistical barriers, and because some 12-step attendance is legally mandated (Speiglman, 1997), a greater number of adults may attend but not feel the wish to become actively involved. This greater variability among adult 12-step attendees regarding affiliation could account for the unique predictive power of measures of affiliation observed in several adult studies.

Level of 12-step affiliation was shown to account for unique variance (above 12-step attendance) in motivation measured at 3 months, and also fully mediated the effect of 12-step attendance on motivation. This suggests greater 12-step affiliation is the mechanism through which attendance maintains and enhances adolescents' motivation for abstinence. From an operant behavioral perspective, contact with a sponsor and engagement in social activities with other members may provide youths the opportunity to observe and begin to experience a lifestyle devoid of substance use that may be both negatively (through the absence of former substance-related problems) and positively (through praise and support from family and other fellowship members) reinforcing. From a social-cognitive perspective, work on the 12 steps, which often includes indepth appraisal of past substance-related consequences, may influence and support cognitions supportive of abstinence.

The finding that self-efficacy and coping predicted substance use outcome in this study is in keeping with earlier work, which found these factors to be similarly predictive (Myers et al., 1993; Richter et al., 1991). In the current study, however, coping lost its significance once abstinence motivation was taken into account. This change may reflect selection criteria; the earlier study only included individuals who were deemed to be motivated for abstinence at treatment intake. Thus, a possible reason for these discrepant findings is that, in the current study, motivation is a specified measured variable, whereas in the earlier studies it was a constant (i.e., an inclusion criterion). Dimensional measurement of the motivational construct may further enhance explanatory models of the maintenance of substance use behavior change for adolescents.

Abstinence-focused self-efficacy of this sample appeared to be least affected by 12-step involvement. This is in keeping with the Morgenstern et al. (1997) study, which also found that self-efficacy, although a significant mediator in the adult sample studied, was least affected by 12-step involvement. It may be that testimonials and admonitions from individuals who have relapsed, often heard at 12-step meetings, initially thwarts confidence, despite behavioral change.

When examined from a dynamic process perspective, the pattern of results suggests that adolescents in treatment who display more severe alcohol and drug problems are also more motivated to cease their substance use. Motivation for abstinence is related to an increased likelihood of attendance at 12-step meetings. Adolescents who attend 12-step groups regularly are also likely to follow 12-step program suggestions (e.g., acquisition of a sponsor and working the steps), participate in the social aspects of the fellowship and rate highly the importance of 12-step attendance in their recovery efforts. Those who are more affiliated with 12-step groups, in turn, are more likely to realize maintenance of or increases in motivation, coping and self-efficacy. However, whereas self-efficacy and coping measured at 3 months are both associated with substance use in the ensuing 3 months, it is motivation to abstain that appears to have the most impact on future use. This finding appears consistent with adult studies that show a similar influence of motivation for change on future substance use behavior regardless of treatment orientation (Project MATCH, 1997).

Findings reported here, if replicated in other studies of adolescents, have important theoretical implications. The cognitive-behavioral model of adult relapse proposed by Marlatt and Gordon (1985) provides reasonably good fit in helping explain factors in adult relapse (Miller et al., 1996). Findings with this cohort of substance abusing youth suggest, however, a closer fit with self-regulation theory (Kanfer, 1987) and its derivative, motivational enhancement theory (Miller and Rollnick, 1991). Alcohol- and drug-abusing adolescents (who typically possess briefer substance use histories and less severe substance dependence) may

be better able to "self-regulate" their behavior once they reach a commitment to do so. The applied implications of these findings suggest greater attention be paid to cognitive factors (e.g., motivation) when attempting to influence adolescent substance use behavior. It has been noted that few, if any, youths voluntarily enter alcohol and drug treatment programs (Brown, 1993). As a consequence, a nonconfrontive empathic therapist style, a focus on problems youth are concerned about and acknowledgement of a reluctance to be in treatment may be critical early on, in order to form a therapeutic alliance and improve treatment retention and motivation for change (Jackson-Gilfort and Liddle, 1999; Wagner et al., 1994).

For several reasons, the current findings must be interpreted cautiously. The small sample size may mean that obtained estimates do not truly reflect population parameters and should be replicated with larger samples. Also, given the relatively high dropout rate, there are obvious generalizability issues. These concerns are ameliorated, however, by a failure to find any systematic differences on important baseline variables. Although structural modeling analyses undertaken in this study often assume the name "casual modeling," the lack of experimental control may mean that unspecified variables may account for observed relationships. The current study did control for possible demographic, substance use problem severity and treatment experience confounds, however, which support the validity of the conclusions. We focused on only a single outcome measure (days abstinent). Broader psychosocial domains (e.g., school/work performance, familial/interpersonal relations and emotional difficulties) would be useful to assess (Brown, 1993). In addition, the explanatory power of 12-step variables and the specified mediators, although able to explain about one third of the substance use outcome variance, implies other important factors need to be included in models of youth alcohol and drug treatment outcome. Measurement and inclusion of other theoretically important factors (e.g., family and peer variables) will likely help further explain changes in substance use and 12-step involvement.

Do adolescents affiliate with 12-step groups? Findings here suggest that youths with more severe alcohol and other drug problems do and that, for those who do, there appear to be benefits. Many youths, however, do not affiliate and others attend briefly before dropping out. Given the widespread treatment recommendations for adolescent 12-step involvement, more study is needed to determine what kinds and what aspects of 12-step groups and fellowships are helpful to adolescent change efforts and what alternatives should be developed. In addition, longer-term follow-up is needed to determine the dynamic relations between 12-step attendance and affiliation and outcomes for youth with substance use disorders and how these, in turn, might impact development trajectories into adulthood.

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