Twelve-Step Participation and Outcomes over Seven Years among Adolescent Substance Use Patients with and without Psychiatric Comorbidity

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Abstract

This study examines the association between twelve-step participation and outcomes over seven years among 419 adolescent substance use patients with and without psychiatric comorbidities. Although level of participation decreased over time for both groups, co-morbid adolescents participated in twelve-step groups at comparable or higher levels across time points. Results from mixed-effects logistic regression models indicated that for both groups, twelve-step participation was associated with both alcohol and drug abstinence at follow-ups, increasing the likelihood of either by at least three times. Findings highlight the potential benefits of twelve-step participation in maintaining long-term recovery for adolescents with and without psychiatric disorders.

Keywords

long-term outcomes; adolescents; psychiatric comorbidity; twelve-step participation

INTRODUCTION

Psychiatric problems are highly prevalent among adolescents with substance use disorders (1–17); those entering treatment have particularly high rates, and thus more complex treatment needs. The adult literature suggests that with the exception of those with psychotic disorders, individuals with substance use and co-morbid psychiatric disorders attend twelve-step groups at rates comparable to those with substance use disorders only, and appear to benefit from them as much as those with only substance use disorders (18–20). However, little is known about patterns and effects of twelve-step participation among co-morbid adolescents. One study using data from the Drug Abuse Treatment Outcomes Studies for Adolescents (DATOS-A) found that participation of co-morbid adolescents in twelve-step groups was positively associated with post-treatment abstinence (21), but we are unaware of studies that have followed patterns of twelve-step participation for more than one year.

This study addresses a research gap about the effect of twelve-step participation in the recovery process of adolescents with substance use and co-morbid psychiatric problems. With a sample of adolescents who entered outpatient substance use treatment in a private, integrated health care delivery system, we examine twelve-step participation and its associations with long-term substance use outcomes over 7 years, among adolescents with

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and without psychiatric comorbidities. Based on the adult literature and the few studies on adolescents and twelve-step participation, we hypothesize that, compared to those without psychiatric disorders, co-morbid adolescents will participate in twelve-step groups at comparable levels after entering substance use treatment, and that for both groups, twelve-step participation would be associated with long-term positive outcomes. Findings may have implications in managing long-term recovery for this population with complex needs.

METHODS

Study Sites and Treatment Programs

The study sites were four Chemical Dependency Recovery Programs (CDRPs) of Kaiser Permanente Northern California (KPNC), a large, integrated health care delivery system with approximately 3.4 million members. Eighty-eight percent of members are commercially insured, 10% insured through Medicare, and 2% through Medicaid. Both substance use and psychiatric treatments are provided within KPNC. In general, the membership is well-educated, working and middle-class (22). Almost two-thirds of the families of the sample population reported annual household incomes between $30,000 and $75,000 (23). The adolescent substance use treatment programs offer intensive outpatient treatment, with referral to contracted residential programs as needed. Services include supportive group therapy, education, relapse prevention, and family therapy, with individual counseling and pharmacotherapy available. Programs are abstinence-based and random drug testing is conducted. Program length is one year, although actual length varies based on need. Regular twelve-step attendance is expected.

Study Subjects and Procedure

Study subjects were 419 adolescents, aged 13–18, seeking treatment at the four CDRPs between March 2000 and May 2002. We recruited 64% of all patients with an intake appointment, and 83% of those who started treatment (23). Consent for study participation was obtained from both the adolescent and an accompanying parent. The Institutional Review Boards of Kaiser Foundation Research Institute and the University of California, San Francisco approved the study. A detailed description of recruitment and the study sample has been published (23).

All adolescents completed a baseline computerized self-report and a paper-and-pencil questionnaire. Phone interviews were conducted at 1, 3, 5 and 7 years after intake, with response rates of 92%, 85%, 84% and 87%, respectively.

Measures

Psychiatric comorbidities at treatment entry—Psychiatric diagnoses were identified from KPNC's outpatient and inpatient databases, as in other studies (17,24–26). At each medical visit and inpatient stay, physicians record a primary and multiple secondary ICD-9 diagnoses in the databases. We classified adolescents with psychiatric comorbidities as those who received at least one psychiatric diagnosis in the period from 2 years prior through 6 months post the index substance use treatment entry.

Substance use outcomes—We measured quantity/frequency of substance use at baseline and each follow-up, including days of use of alcohol and 11 other substances in the prior 30 days. Items were drawn from the Comprehensive Addiction Severity Index for Adolescents (CASI-A), a widely-used, self-report questionnaire that has been shown to have concurrent validity with Diagnostic and Statistical Manual of Mental Disorders and American Society of Addiction Medicine dependence and abuse criteria (27–30). Consistent with treatment goals, we examined 30-day abstinence from alcohol and drugs (excluding

tobacco) at 3, 5 and 7 years as long-term outcome measures. Use of prescription medications not as prescribed was considered drug use.

Twelve-step participation—For the first year post treatment entry, we assessed whether adolescents had: (1) ever attended any twelve-step groups prior to treatment entry, and (2) attended 10 or more meetings in the prior 6 months at 1 year. At 3, 5 and 7 years, we used items adapted from the Alcoholics Anonymous (AA) Affiliation Scale to create separate measures of "meeting attendance" and "activity involvement" for the construct of post-treatment twelve-step participation, as suggested by the literature (31). The AA Affiliation Scale is a brief instrument developed to measure AA affiliation across a variety of AA experiences, including numbers of meetings attended and involvement in various activities (considering oneself a member, having a sponsor, having sponsored anyone, calling other members for help, reading literature for guidance, performing service activities, and having a spiritual awakening or a conversion experience), with robust validity across diverse populations and settings (32). We modified the questions to include AA, Narcotics Anonymous (NA), Cocaine Anonymous (CA), or any other twelve-step groups. "Meeting attendance" was measured by number of meetings attended in the prior 6 months, and dichotomized using a cut-point of "10+"; "activity involvement" was measured by summing positive responses to the twelve-step activities, and dichotomized using a "3+" cut-point. Our prior research suggests a minimum threshold level of twelve-step meeting attendance and activity involvement is associated with improved outcomes (33).

Individual characteristics—Demographic variables included age, gender, and race/ethnicity. The Circumstances, Motivation, and Readiness (CMR) total score, an instrument shown to possess strong reliability and validity (34), measured client perceptions of circumstances (external pressures), motivation (internal pressures), and readiness for substance use treatment at treatment entry. Substance use severity at baseline and each follow-up was measured by summing the number of alcohol and drug dependence and abuse symptoms from CASI-A, including withdrawal, consequences of use, loss of control, and physical dependence in the prior six months. It ranged from 0 to 14, with a higher number indicating greater severity (33,35,36). Baseline psychiatric problem severity was measured by the internalizing and externalizing scales of the Youth Self-Report (YSR), a structured questionnaire measuring psychiatric problem domains with solid psychometric properties across adolescent populations (17,37–40). Higher scores indicate greater severity. A composite score (range 0 to 24) measured anxiety/depression severity at each of later follow-ups by summing positive responses to items from the Adult Self-Report (ASR), which is derived from and comparable to the YSR, but designed for adults (37). A higher score represents higher severity of anxiety/depression. Computation of Cronbach's alphas (all above .85 across waves) indicated high internal consistency.

Substance use and psychiatric treatment utilization—Two dichotomous measures at baseline assessed whether participants had any substance use and psychiatric treatment before entering treatment. We created a "length of stay" measure for the index substance use treatment (in weeks, up to 1 year) with data from KPNC's automated databases, representing a count of continuous days in treatment without a 6-week break. Dichotomous measures indicating receiving psychiatric services in year one, and substance use and psychiatric services in years 2–3, 4–5 and 6–7, were created using survey data (on non-KPNC services) and health plan databases.

Statistical Analysis

We conducted all analyses with SAS version 9.1 (Cary, NC). Cross-sectional analyses comparing adolescents with and without psychiatric diagnoses in individual characteristics

at baseline as well as treatment utilization, twelve-step participation and substance use outcomes at follow-ups were conducted by using chi-square or Fisher exact tests for categorical variables and analysis of variance (ANOVA) for continuous variables. No adjustments were made for multiple comparisons (41).

We next examined associations between post-treatment twelve-step participation (meeting attendance and activity involvement) and substance use outcomes (past 30-day abstinence from alcohol and drugs) across 3, 5 and 7 years for adolescents with and without psychiatric diagnoses by fitting non-linear mixed-effects multivariate logistic regression models with a random intercept. This model examines the effects of the explanatory variables on the participants' probability of being abstinent while allowing the initial status (i.e., intercept) to vary for every subject. All models were run separately for the two groups of adolescents. For alcohol and drug abstinence separately, we began by fitting a series of initial models examining the association with each of the individual and treatment characteristics, adjusting for repeated measures of outcomes at 3, 5, and 7 years. Individual and treatment variables associated with substance use outcomes at p .10 in these models, or identified as a priori in the literature (33,35,42–44), were included in the final models. We fitted final models examining associations between twelve-step participation at prior and current follow-up and substance use outcomes over time, while controlling for the baseline and time-varying covariates. Odds ratios (ORs) and the 95% confidence intervals (CIs) for the predictor variables were calculated based on the parameter estimates.

RESULTS

There were 276 (66%) boys and 143 (34%) girls; 16% were African American, 9% Native American, 19% Hispanic, 6% Asian, and 50% White. At treatment entry, 52% and 32% met substance dependence or abuse criteria, respectively. More than half (N=230, 55%) received at least one psychiatric diagnosis in the 2 years prior through 6 months post-treatment entry. The most prevalent diagnoses were major depression (36%) and conduct disorder (27%), followed by attention deficit hyperactivity disorder (ADHD) (17%), anxiety (16%), major psychosis (8%), personality disorders (3%), and eating disorders (1%). The majority (82%) of co-morbid adolescents had more than one psychiatric diagnosis.

Patient and Treatment Characteristics of Adolescents with and without Psychiatric Comorbidities

Comparisons between those with and without psychiatric diagnoses found no difference in age or race/ethnic distributions, but more adolescents with psychiatric diagnoses were female (Table 1). At treatment entry, co-morbid adolescents had higher substance use, as well as psychiatric, severity: they used more substances, reported more abuse or dependence symptoms, and had higher YSR internalizing and externalizing scores. More of them had had prior twelve-step or psychiatric treatment experiences and higher CMR total scores.

No difference was found in index substance use treatment retention: about three-fourths of both groups initiated the index substance use treatment, respectively; and average lengths of stay were similar. No differences were found in proportions receiving additional substance use treatment within or outside the health plan during years 2–3, 4–5 and 6–7 either. Not surprisingly, more co-morbid adolescents received psychiatric services in the year after intake (60% vs. 14%, p<0.0001), and they continued to use more during the follow-ups (46%, 26% and 25% of adolescents with psychiatric diagnoses, compared to 20%, 13% and 8% among those without, all p<0.01).

Twelve-step Participation over Seven Years Post Treatment Entry

Significantly higher proportions of those with psychiatric diagnoses attended 10 or more twelve-step meetings in the prior 6 months at 1 and 3 years (33% vs. 19%, p=0.0032 and 16% vs. 7%, p=0.0106, respectively) but not at 5 and 7 years (Table 2). For both groups, attendance decreased over time. Adolescents with psychiatric diagnoses also reported higher level of twelve-step activity involvement than their counterparts at 3 years: more of them reported involvement in each of the seven twelve-step activities (with significant p-values for all but "having sponsored anyone"), and about one in seven with psychiatric diagnoses reported involvement in 3 or more activities, compared to only 2% of those without (p<0.0001). Again however, activity involvement decreased over time for both groups, and no statistically significant differences were found between the two groups at 5 and 7 years.

Substance Use Outcomes Over Seven Years Post Treatment Entry

At 1 year, the groups did not differ in past 30-day alcohol and drug abstinence rates (Table 3). At 3 years, more co-morbid adolescents were abstinent from both alcohol and drugs than those not co-morbid (48% vs. 28%, p=0.0001 and 65% vs. 48%, p=0.0011, respectively); they also had a higher average drug abstinence rate at 5 years (62% vs. 47%, p=0.0054), and a trend of a higher alcohol abstinence rate at 7 years (p=0.0704).

Associations between Twelve-step Participation and Long-term Alcohol Abstinence

Table 4 presents Mixed-effects logistic regression models examining associations of post-treatment twelve-step meeting attendance with 30-day alcohol abstinence at 3, 5 and 7 years for adolescents with and without psychiatric diagnoses, controlling for time of follow-up, age, gender, race, baseline substance use and psychiatric problem severity, baseline CMR total score, treatment experience before entering index substance use treatment, index substance use treatment length of stay, substance use treatment and psychiatric services received during follow-ups, substance use problem severity at prior time points, and psychiatric problem severity at prior and current time points. Younger age and twelve-step meeting attendance were positively associated with alcohol abstinence at follow-ups for both groups. After controlling for other covariates, adolescents with and without psychiatric comorbidities who attended 10 or more twelve-step meetings in the prior 6 months were more than three and five times as likely to be abstinent from alcohol at follow-ups as those who attended fewer or none (OR=3.02, p=0.0049 and OR=5.29, p=0.0063, respectively). Twelve-step meeting attendance at the prior time point was also positively associated with alcohol abstinence for adolescents without psychiatric comorbidities (OR=3.05, p=0.0185). In addition, female gender and higher CMR total score were both positively associated with alcohol abstinence at follow-ups for adolescents with psychiatric diagnoses. No associations were found for alcohol abstinence with index substance use treatment length of stay, additional substance use treatment or psychiatric services received post-treatment for either group.

Models examining associations of post-treatment twelve-step activity involvement with 30-day alcohol abstinence over time found similar results: after controlling for other covariates, adolescents with and without psychiatric comorbidities who involved in 3 or more twelve-step activities in the prior 6 months were more than twice and eight times as likely to be abstinence from alcohol over time as those who attended fewer or none (OR=2.55, p=0.0322 and OR=8.17, p<0.0001, respectively) (not shown).

Associations between Twelve-step Participation and Long-term Drug Abstinence

Table 5 presents Mixed-effects logistic regression models examining associations of post-treatment twelve-step meeting attendance with 30-day drug abstinence at 3, 5 and 7 years for

adolescents with and without psychiatric diagnoses, controlling for the same set of baseline and time-varying covariates. Results indicated that twelve-step meeting attendance was positively associated with drug abstinence at follow-ups for both groups. After controlling for other covariates, adolescents with and without psychiatric comorbidities who attended 10 or more twelve-step meetings in the prior 6 months were both about five times as likely to be abstinent from drugs at follow-ups as those who attended fewer or none (OR=5.40, p=0.0026 and OR=4.83, p=0.0532, respectively). Twelve-step meeting attendance at the prior time point was also positively associated with drug abstinence for adolescents without psychiatric comorbidities (OR=4.30, p=0.0208). Similar to analyses of alcohol abstinence, female gender and higher CMR total score were both positively associated with drug abstinence at follow-ups for adolescents with psychiatric diagnoses. No associations were found for drug abstinence with index substance use treatment length of stay, additional substance use treatment or psychiatric services received post-treatment for either group, while concurrent higher anxiety/depression scores were negatively associated with drug abstinence for both groups. Models controlling for other covariates also found significant associations between involvement in 3 or more twelve-step activities and drug abstinence over time for both groups (p=0.0024 and 0.0076, respectively), although the wide 95% CIs suggesting possible problems of estimates due to small numbers (not shown).

Analyses of Missing Data

Although a key advantage of the mixed-effects modeling approach is that it can be applied when participants are not measured at the same number of time points, some fraction of participants might be missing because of higher substance use or psychiatric problem severity. Post hoc analyses found that among those with co-morbid psychiatric diagnoses, 5-year interview respondents had significantly higher anxiety/depression score at 3 years than non-respondents (mean/SD=4.73/4.86 vs. 2.73/2.99, p=0.0293). Similarly, among those without co-morbid psychiatric diagnoses, 7-year interview respondents had significantly higher anxiety/depression score at 5 years than non-respondents (mean/SD=3.63/3.98 vs. 1.67/1.84, p=0.0020). No associations were found between interview status at other waves and preceding period substance use or psychiatric problem severity for either group.

To further examine the effect of missing-data pattern on the outcomes, we compared differences in substance use outcomes between those who completed all follow-up interviews (completers, N=295) and those who did not, among adolescents with and without psychiatric comorbidity. Among those with psychiatric diagnoses, fewer completers were abstinent from alcohol at 3 years than non-completers (44.2% vs. 70.4%, p=0.0116) while among those without, more completers were abstinent from drugs at 3 years than non-completers (52.3% vs. 30.6%, p=0.0207). No associations, however, were found between completers and non-completers in alcohol or drug abstinence at other waves for either group. We repeated the analyses presented in Tables 5 and 6 with two covariates added: an indicator for completing all interview waves and an interaction term of the indicator with twelve-step meeting attendance. Results indicated that there were differences between completers and non-completers in alcohol abstinence among adolescents with psychiatric comorbidity, and in drug abstinence among those without. However, the interaction term between completing all interview waves and twelve-step meeting attendance was not significant in any of the models, suggesting no moderating effect of missing-data pattern on the relationships between twelve-step meeting attendance and the outcomes for either group.

DISCUSSION

This study examined twelve-step participation and its associations with substance use outcomes over 7 years among adolescent substance use patients with and without psychiatric diagnoses. Co-morbid adolescents entered treatment with higher substance use and

psychiatric problem severity, highlighting their vulnerabilities and complex needs. They also had more prior psychiatric treatment and twelve-step experience, which may have influenced post-treatment access and utilization.

Consistent with adult studies, co-morbid adolescents participated in twelve-step groups at comparable or higher levels than their counterparts over 7 years. More of them attended 10 or more meetings at 1 and 3 years, and they reported more activity involvement at 3 years. Attendance and activity involvement decreased for both groups over time; at seven-year follow-up, the two groups reported similarly low levels of participation. Adult studies have found that, except for those with psychotic disorders, substance use patients with psychiatric disorders are as likely to attend twelve-step groups as those without (19,20,45,46). As only a small proportion of our sample had major psychosis diagnoses, we were unable to examine this subgroup specifically.

Co-morbid adolescents had comparable or better substance use outcomes than their counterparts over time. Stratified mixed-effects logistic regression models found that for both groups, twelve-step participation was associated with both alcohol and drug abstinence over time, increasing the likelihood of either by at least three times. This echoes the adult literature that some substance use patients with psychiatric disorders appear to benefit as much from twelve-step groups as patients without (20,46).

There have been concerns in the literature that substance use patients with psychiatric comorbidities face issues that complicate their twelve-step participation, including lack of empathy and acceptance from other members without psychiatric comorbidity (19,20,47). Some research also suggests that adolescents face specific barriers to engagement in twelve-step groups: lower substance problem recognition, age differences from other members, and possible developmental inappropriateness of some spiritual and psychological underpinnings of twelve-step groups, including one's powerlessness over substance use and the need to surrender to a higher power (46,48,49). Although this study did not examine how these issues affect participation or the beneficial effects of twelve-step groups among co-morbid adolescents, it is encouraging to learn that some of these adolescents may participate in and benefit from a free, widely available informal resource in their long-term recovery efforts. Nevertheless, the field still has much to learn about how policies and clinical interventions can facilitate twelve-step participation during and after substance use treatment for adolescents with and without psychiatric comorbidities.

No differences were found between adolescents with and without co-morbid psychiatric diagnoses in index treatment length of stay or proportions receiving additional substance use treatment after treatment. Further, neither length of stay in index treatment nor additional substance use treatment received after was independently associated with long-term substance use outcomes for either group. Grella et al. found similar results in their 1-year study and speculated that the low level of services received may have been insufficient to produce any detectable effects (21). Another possibility is that the effect of substance use treatment on long-term outcomes is indirect, as post hoc analyses indicated that receiving substance use treatment in the period preceding follow-ups was positively associated with twelve-step meeting attendance at follow-ups for both groups. The co-morbid group consistently received more psychiatric services during the 7 years. However, we found no associations between psychiatric services received and long-term substance use outcomes for either group. Our prior research among co-morbid adults suggests the importance of receiving services that are delivered contemporaneously (24). We were unable to examine that with the measures available in the current study but future research is warranted.

Study limitations merit attention. First, as with all observational studies, results cannot be interpreted as causal. Second, the study sample was treatment-seeking in a private non-profit integrated health care health plan; thus, findings may not be generalizable to public treatment samples or samples with more individuals having risk factors such as homelessness. Third, our measures of twelve-step participation referred to any type of twelve-step groups, without distinguishing between traditional and specialized twelve-step groups that are teen-focused or for co-morbid individuals. Fourth, the time window for measuring twelve-step participation at follow-ups was the prior 6 months, while for alcohol and drug abstinence it was the prior 30 days. Thus, the temporality is not ideal with the 30-day overlap. Finally, although we controlled for potential time-invariant and time-varying confounders, there may be selection effects from other unmeasured variables due to the study's observational nature.

Despite the limitations, this study contributes to a growing literature which suggests that twelve-step groups may be beneficial for addressing adolescent substance use problems, even among those with complex psychiatric disorders and treatment needs. Co-morbid adolescents come to treatment with higher levels of psychiatric symptomatology and higher CMR scores; their levels of distress and internal and external motivation towards recovery may make them particularly amenable to treatments both formal and informal. Their comparable level of twelve-step participation over time suggests that some co-morbid adolescents may be particularly open to the potential benefits of twelve-step groups in maintaining long-term recovery. These findings should be encouraging to patients, families and clinicians seeking options for overcoming the challenges of treating this complex population.

Acknowledgments

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Table 1

Comparisons in Individual and Treatment Characteristics between Adolescent Substance Use Patients with and without Co-morbid Psychiatric Diagnoses

	Co-morbid Psychiatric Diagnoses		
	No	Yes	
	(N=189, 45.1%)	(N=230, 54.9%)	p value
Demographics			
Female gender (%)	25.4	41.3	0.0006
Age, mean (sd)	16.21 (1.22)	16.10 (1.28)	NS
White (%)	45.0	52.8	NS
Severity at baseline			
Number of abuse/dependence symptoms, mean (sd)	4.00 (3.04)	5.04 (3.44)	0.0013
Number of substance use (excl. Tobacco), mean (sd)	2.75 (1.78)	3.47 (2.38)	0.0005
YSR internalizing score, mean (sd)	11.37 (8.06)	17.76 (10.92)	<0.0001
ASR externalizing score, mean (sd)	18.01 (8.24)	21.66 (9.50)	<0.0001
Circumstance/motivation/readiness scale at baseline, mean (sd)	45.30 (9.09)	48.53 (9.56)	0.0005
Prior treatment experience before entering treatment			
Any prior twelve-step experience (%)	15.9	24.5	0.0308
Any prior substance use treatment experience (%)	12.8	17.0	NS
Any prior psychiatric treatment experience (%)	9.0	35.2	<0.0001
Substance use treatment			
Initiated index treatment (%)	70.9	74.4	NS
Length of stay of index treatment episode in year 1 (weeks), mean (sd)	9.54 (11.34)	11.27 (12.60)	NS
Any treatment within or outside the health plan in years 2–3 (%)	26.2	34.2	NS
Any treatment within or outside the health plan in years 4–5 (%)	17.6	19.9	NS
Any treatment within or outside the health plan in years 6–7 (%)	18.1	12.4	NS
Psychiatric treatment			
Any treatment within the health plan in year 1 (%)	13.8	60.3	<0.0001
Any treatment within or outside the health plan in years 2–3 (%)	20.2	46.3	<0.0001
Any treatment within or outside the health plan in years 4–5 (%)	12.6	26.3	0.0014
Any treatment within or outside the health plan in years 6–7 (%)	8.1	24.7	<0.0001

Notes: YSR = Youth Self Report (Achenbach, 1991). NS=Not significant at p<0.05 level.

Table 2

Twelve-step Participation over Time between Adolescent Substance Use Patients with and without Co-morbid Psychiatric Diagnoses

	Co-morbid Psychiatric Diagnoses		
	No	**Yes**	
	(N=189, 45.1%)	**(N=230, 54.9%)**	**p value**
Twelve-step meeting attendance			
% Attended 10 or more meetings in the past 6 months at:			
1 year	19.2	32.6	0.0032
3 years	7.1	15.9	0.0106
5 years	6.9	12.3	NS
7 years	8.8	6.2	NS
Twelve-step activity involvement			
% Considered self a member in prior 6 months at:			
3 years	3.6	11.6	0.0049
5 years	5.7	11.2	NS
7 years	7.5	5.7	NS
% Called in prior 6 months at:			
3 years	1.8	11.1	0.0005
5 years	4.4	7.5	NS
7 years	5.0	4.6	NS
% Had a sponsor at:			
3 years	1.8	6.3	0.0328
5 years	3.1	5.4	NS
7 years	4.4	3.1	NS
% Sponsored anyone in prior 6 months at:			
3 years	0.6	1.6	NS
5 years	0.0	1.6	NS
7 years	1.3	0.5	NS
% Had spiritual awakening experience in prior 6 months at:			
3 years	1.2	7.4	0.0048
5 years	5.0	5.4	NS
7 years	4.4	4.6	NS
% Read literature in prior 6 months at:			
3 years	7.7	17.4	0.0066
5 years	9.4	12.3	NS
7 years	12.5	9.8	NS
% Performed services in prior 6 months at:			
3 years	3.0	11.6	0.0021
5 years	5.0	12.8	0.0125
7 years	5.0	5.7	NS
% Reporting 3+ activity involvement at:			

	Co-morbid Psychiatric Diagnoses		
	No	**Yes**	
	(N=189, 45.1%)	**(N=230, 54.9%)**	**p value**
3 years	1.8	13.7	<0.0001
5 years	5.7	10.7	NS
7 years	5.6	4.6	NS

Notes: NS=Not significant at p<0.05 level.

Table 3

Substance Use Outcomes over Time between Adolescent Substance Use Patients with and without Co-morbid Psychiatric Diagnoses

	Co-morbid Psychiatric Diagnoses		
	No	**Yes**	
	(N=189, 45.1%)	**(N=230, 54.9%)**	**p value**
% Abstinence from alcohol in past 30 days at:			
1 year	58.1	63.7	NS
3 years	28.0	47.9	0.0001
5 years	25.2	32.6	NS
7 years	23.8	32.5	NS
% Abstinence from drugs in past 30 days at:			
1 year	58.1	62.3	NS
3 years	47.6	64.7	0.0011
5 years	46.5	61.5	0.0054
7 years	50.6	59.3	NS

Notes: NS=Not significant at p<0.05 level.

Table 4

Mixed-effects Logistic Random Intercept Models Examining Factors Associated with Past 30-day Alcohol Abstinence at 3, 5 and 7 years, among Adolescent Substance Use Patients with and without Co-morbid Psychiatric Diagnoses

	With co-morbid psychiatric diagnoses					Without co-morbid psychiatric diagnoses				
	Estimate	Std. err.	P value	OR	95% CI	Estimate	Std. err.	P value	OR	95% CI
Time-invariant factors										
Female gender	0.6553	0.2987	**0.0295**	**1.93**	**(1.07, 3.46)**	0.3506	0.4386	0.4253	1.42	(0.60, 3.35)
Age at baseline	−0.2115	0.1091	**0.0540**	**0.81**	**(0.65, 1.00)**	−0.4378	0.1646	**0.0086**	**0.65**	**(0.47, 0.89)**
White race	−0.3371	0.2770	0.2251	0.71	(0.41, 1.23)	−0.1915	0.3736	0.6088	0.83	(0.40, 1.72)
Number of abuse/dependence symptoms at baseline	−0.0199	0.0450	0.6586	0.98	(0.90, 1.07)	−0.0266	0.0716	0.7107	0.97	(0.85, 1.12)
YSR internalizing score at baseline	0.0058	0.0168	0.7286	1.01	(0.97, 1.04)	−0.0075	0.0326	0.8179	0.99	(0.93, 1.06)
YSR externalizing score at baseline	−0.0101	0.0167	0.5463	0.99	(0.96, 1.02)	−0.0006	0.0277	0.9837	1.00	(0.95, 1.06)
Circumstance/Motivation/Readiness scale at baseline	0.0375	0.0155	**0.0162**	**1.04**	**(1.01, 1.07)**	0.0235	0.0229	0.3071	1.02	(0.98, 1.07)
Any prior twelve-step experience	0.1904	0.3280	0.5624	1.21	(0.64, 2.30)	0.6962	0.5909	0.2403	2.01	(0.63, 6.39)
Any prior psychiatric treatment	0.3076	0.2958	0.2996	1.36	(0.76, 2.43)	−0.9838	0.7605	0.1976	0.37	(0.08, 1.66)
Any prior substance use treatment	0.5516	0.3780	0.1461	1.74	(0.83, 3.64)	−0.1152	0.6560	0.8608	0.89	(0.25, 3.22)
Length of stay of index treatment (weeks)	0.0018	0.0101	0.8563	1.00	(0.98, 1.02)	−0.0025	0.0167	0.8830	1.00	(0.97, 1.03)
Any psychiatric treatment in year 1 (%)	0.1471	0.2880	0.6101	1.16	(0.66, 2.04)	−0.7156	0.5738	0.2141	0.49	(0.16, 1.51)
Time-varying factors										
Time of follow-up (coded as 2, 4, 6 at 3, 5 and 7 years)	−0.1449	0.0715	**0.0442**	**0.87**	**(0.75, 1.00)**	−0.0737	0.0868	0.3967	0.93	(0.78, 1.10)
Any substance use treatment between follow-ups	−0.1846	0.3200	0.5647	0.83	(0.44, 1.56)	−0.2257	0.4219	0.5935	0.80	(0.35, 1.82)
Any psychiatric treatment between follow-ups	0.1305	0.2855	0.6481	1.14	(0.65, 1.99)	−0.1573	0.4648	0.7355	0.85	(0.34, 2.12)
Attended 10+ meetings in the prior 6 months at prior follow-up	0.4406	0.3073	0.1533	1.55	(0.85, 2.84)	1.1166	0.4694	**0.0185**	**3.05**	**(1.22, 7.66)**
Attended 10+ meetings in the prior 6 months at current follow-up	1.1064	0.3889	**0.0049**	**3.02**	**(1.41, 6.48)**	1.6659	0.6027	**0.0063**	**5.29**	**(1.62, 17.24)**
Anxiety/depression scale at current follow-up	−0.0235	0.0310	0.4485	0.98	(0.92, 1.04)	−0.0890	0.0520	0.0887	0.91	(0.83, 1.01)
Number of abuse/dependence symptoms at prior follow-up	−0.1274	0.0715	0.0763	0.88	(0.77, 1.01)	−0.1624	0.1017	0.1120	0.85	(0.70, 1.04)
Anxiety/depression scale at prior follow-up	0.0347	0.0316	0.2739	1.04	(0.97, 1.10)	0.0970	0.0575	0.0931	1.10	(0.98, 1.23)

Note: Std. err. = Standard error; OR = Odds ratio; 95% CI = 95% Confidence Interval.

Table 5

Mixed-effects Logistic Random Intercept Models Examining Factors Associated with Past 30-day Drug Abstinence at 3, 5 and 7 years, among Adolescent Substance Use Patients with and without Co-morbid Psychiatric Diagnoses

	With co-occurring psychiatric diagnoses				Without co-occurring psychiatric diagnoses			
	Estimate	Std. err.	P value	OR	95% CI	Estimate	Std. err.	P value	OR	95% CI
Time-invariant factors										
Female gender	2.1519	0.5034	<0.0001	8.60	(3.21, 23.07)	0.8458	0.6407	0.1886	2.33	(0.66, 8.18)
Age at baseline	−0.1447	0.1706	0.3973	0.87	(0.62, 1.21)	0.0780	0.2263	0.7308	1.08	(0.69, 1.68)
White race	0.0466	0.4304	0.9139	1.05	(0.45, 2.44)	−0.0869	0.5139	0.8660	0.92	(0.33, 2.51)
Number of abuse/dependence symptoms at baseline	−0.0090	0.0711	0.8992	0.99	(0.86, 1.14)	−0.0226	0.0976	0.8170	0.98	(0.81, 1.18)
YSR internalizing score at baseline	0.0118	0.0267	0.6595	1.01	(0.96, 1.07)	0.0468	0.0431	0.2795	1.05	(0.96, 1.14)
YSR externalizing score at baseline	−0.0083	0.0256	0.7452	0.99	(0.94, 1.04)	−0.0181	0.0382	0.6369	0.98	(0.91, 1.06)
Circumstance/Motivation/Readiness scale at baseline	0.0920	0.0257	0.0004	1.10	(1.04, 1.15)	0.0474	0.0317	0.1361	1.05	(0.99, 1.12)
Any prior twelve-step experience	0.3977	0.5224	0.4474	1.49	(0.53, 4.14)	−0.6191	0.8392	0.4617	0.54	(0.10, 2.79)
Any prior psychiatric treatment	−0.2295	0.4652	0.6223	0.79	(0.32, 1.98)	−1.1192	0.9411	0.2360	0.33	(0.05, 2.07)
Any prior substance use treatment	−0.4637	0.5878	0.4312	0.63	(0.20, 1.99)	−1.2964	0.9468	0.1728	0.27	(0.04, 1.75)
Length of stay of index treatment (weeks)	−0.0076	0.0160	0.6357	0.99	(0.96, 1.02)	−0.0183	0.0240	0.4461	0.98	(0.94, 1.03)
Any psychiatric treatment in year 1 (%)	0.2218	0.4464	0.6198	1.25	(0.52, 2.99)	−0.1607	0.7924	0.8396	0.85	(0.18, 4.02)
Time-varying factors										
Time of follow-up (coded as 2, 4, 6 at 3, 5 and 7 years)	−0.0356	0.0877	0.6849	0.97	(0.81, 1.15)	0.1027	0.0968	0.2906	1.11	(0.92, 1.34)
Any substance use treatment between follow-ups	−0.7833	0.4193	0.0633	0.46	(0.20, 1.04)	0.7960	0.5095	0.1201	2.22	(0.82, 6.02)
Any psychiatric treatment between follow-ups	0.1858	0.3731	0.6191	1.20	(0.58, 2.50)	−0.5016	0.5568	0.3690	0.61	(0.20, 1.80)
Attended 10+ meetings in the prior 6 months at prior follow-up	0.3119	0.4166	0.4550	1.37	(0.60, 3.09)	1.4595	0.6253	0.0208	4.30	(1.26, 14.66)
Attended 10+ meetings in the prior 6 months at current follow-up	1.6862	0.5527	0.0026	5.40	(1.83, 15.95)	1.5741	0.8084	0.0532	4.83	(0.99, 23.54)
Anxiety/depression scale at current follow-up	−0.1766	0.0420	<0.0001	0.84	(0.77, 0.91)	−0.3287	0.0709	<0.0001	0.72	(0.63, 0.83)
Number of abuse/dependence symptoms at prior follow-up	−0.1119	0.0919	0.2246	0.89	(0.75, 1.07)	−0.2837	0.1212	0.0204	0.75	(0.59, 0.95)
Anxiety/depression scale at prior follow-up	0.0027	0.0421	0.9488	1.00	(0.92, 1.09)	0.1019	0.0692	0.1424	1.11	(0.97, 1.27)

Note: Std. err. = Standard error; OR = Odds ratio; 95% CI = 95% Confidence Interval.