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Twelve-step attendance trajectories over seven years among adolescents entering substance use treatment in an integrated health plan

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Abstract

Aims—This study examines twelve-step attendance trajectories over seven years, factors associated with the trajectories, and relationships between the trajectories and long-term substance use outcomes among adolescents entering outpatient substance use treatment in a private, non-profit integrated managed care health plan.

Design—Longitudinal observational study.

Setting—Four Kaiser Permanente Northern California substance use treatment programs.

Participants—391 adolescents entering treatment between 2000 and 2002 who completed at least one follow-up interview in year one, and at least one during years three to seven, after treatment entry.

Measurements—Alcohol and drug use, twelve-step meeting attendance and activity involvement, and post-treatment medical service utilization.

Findings—Semiparametric group-based modeling identified three distinct twelve-step attendance trajectory groups over seven years: low/no attendance (60%), early but not continued (26%), and continued (14%). There were lower proportions of males and of adolescents with prior substance use treatment experience in the low/no attendance group ($p=0.019$ and $p=0.003$, respectively). In addition, those in the low/no attendance group had lower perception on circumstances, motivation and readiness for treatment at baseline ($p=0.023$). Multivariate logistic generalized estimating equation analyses found that those in the continued group were more likely to be abstinent from both alcohol and drugs during follow-ups than those in the low/no attendance group ($OR=2.40$, $p=0.003$ and $OR=1.96$, $p=0.026$, respectively). However, no differences in long-term outcomes were found between those in the other two groups.

Conclusion—Robust connection with twelve-step groups appears to be associated with better long-term outcomes among adolescents with substance use disorders.

Keywords

long-term outcomes; adolescents; twelve-step attendance trajectories; continuing care

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Declarations of Interest

None.

INTRODUCTION

Studies of twelve-step attendance among adults with substance use disorders are abundant; most support its beneficial effects on short- and long-term outcomes (1–7). However, few have examined the patterns and effectiveness of twelve-step attendance among adolescents, and even fewer have examined them longitudinally (8, 9).

A study of 160 adolescent inpatients (10) found that twelve-step attendance declined sharply and steadily over time, from 83% attending at least monthly during the first six months post-treatment to about one-quarter between two to eight years, but effects related to twelve-step attendance remained significant and consistent. Few other studies have followed patterns of twelve-step attendance among adolescents for more than one year. Moreover, none has examined whether there are distinct patterns of attendance trajectories among adolescents, as in adult studies (11–13).

With a sample of adolescents entering outpatient treatment in a private, non-profit integrated managed care health plan, this paper examines: (1) trajectories of twelve-step attendance over seven years; (2) factors associated with twelve-step attendance trajectories, and (3) relationships between twelve-step attendance trajectories and outcomes, adjusting for individual and treatment characteristics. Our conceptual model is drawn from the medical and substance use utilization and outcome literature (14–18), and also informed by studies of twelve-step participation among adults and adolescents (11–13, 19–22), including our prior work (23). Based on the adult literature, we hypothesize that there are distinct clusters of adolescents with homogeneous twelve-step attendance trajectories differing in individual characteristics, service use, and outcomes over time. Findings may offer opportunities to better understand these patients and how interventions can improve long-term recovery.

METHODS

Study Sites and Treatment Programs

Study sites were four Chemical Dependency Recovery Programs (CDRPs) of Kaiser Permanente (KP) Northern California, a large, group-model, integrated health care delivery system with approximately 3.4 million members. Eighty-eight percent of members are commercially insured, 10% through Medicare, and 2% through Medicaid. Both substance use and mental health treatment are provided within KP. In general, the membership is well-educated, working, and middle-class (24). Almost two-thirds of the families in the sample population reported annual household incomes between \$30,000 and \$75,000 (25). The adolescent substance use treatment programs offer intensive outpatient treatment, with referral to residential programs when 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. Regular twelve-step attendance is expected.

Program length is one year, but varies based on individual need. It includes three treatment phases. Phase 1 begins with intake/assessment and orientation, followed by group treatment three times/week for six to eight weeks. Phase 2 focuses on continuing recovery and relapse prevention, with two group sessions/week for three to six months. Phase 3 is aftercare, one group session per week, which can continue for up to a year (25).

Study Subjects

Study subjects were 419 adolescents, aged 13–18, seeking treatment at the four CDRPs between March 2000 and May 2002. The treatment programs and staff were similar across sites. We recruited 64% of patients with an intake appointment, and 83% who started

treatment (25). There were 276 (66%) boys and 143 (34%) girls; 16% were African American, 9% Native American, 19% Hispanic, 6% Asian, and 50% White; 52% and 32% met substance dependence and abuse criteria, respectively, with 55% having at least one co-occurring psychiatric diagnosis (25, 26).

Procedure

Consent for study participation was obtained from the adolescent and accompanying parent. The Institutional Review Boards of Kaiser Foundation Research Institute and the University of California, San Francisco approved the study. A description of recruitment and the sample has been published (25). At baseline, all 419 adolescents completed a computerized self-report and a paper-and-pencil questionnaire. Phone interviews were conducted at six months, one, three, five and seven years after intake, with response rates of 92%, 92%, 85%, 84% and 87%, respectively.

Measures

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 semi-structured, self-report questionnaire measuring health and functioning (substance use and problems, education, legal issues, and family relationships), with good concurrent validity with Diagnostic and Statistical Manual of Mental Disorders and American Society of Addiction Medicine dependence and abuse criteria (27–30). Self-reported abstinence at six months was validated with urinalysis and breathalyzer testing on a sub-sample (23, 31). We used 30-day abstinence from alcohol and drugs (excluding tobacco) at three, five and seven years as longterm outcome measures. We also examined 30-day abstinence from alcohol and drugs at one year as measures of short-term outcomes in predicting long-term outcomes. Misuse of prescription medications was considered drug use.

Twelve-step attendance—We assessed whether participants had: (1) ever attended any twelve-step groups prior to treatment entry, and (2) attended 10 or more meetings in the prior six months at six-month and one-, three-, five- and seven-year follow-ups. We used a cut-point of “10+” as our prior research suggests a minimum threshold level of twelve-step attendance to be associated with improved outcomes (23). In addition, at three-, five- and seven-year follow-ups, we used questions adapted from the Alcoholics Anonymous (AA) Affiliation Scale to assess prior sixmonth 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. Literature (21) suggests that meeting attendance and activity involvement are relevant but different constructs for evaluating level of twelve-step affiliation. The AA Affiliation Scale measures affiliation across AA experiences with robust validity across diverse populations and settings (32). Questions are modified to include AA, Narcotics Anonymous (NA), Cocaine Anonymous (CA), or any other twelve-step meetings.

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 (33), assessed client perceptions on circumstances (external pressures), motivation (internal pressures), and readiness for substance use treatment at treatment entry. Baseline substance use severity was measured by summing the number of ‘yes’ answers to alcohol and drug dependence/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 (23, 34, 35). Baseline psychiatric severity was measured by the internalizing and externalizing scales of the Youth Self-Report (YSR), a structured questionnaire measuring mental health problem domains with solid psychometric properties across a variety of adolescent populations (26, 36–39). Higher scores indicate greater severity. We measured anxiety/depression severity at later follow-ups using items from the Adult Self-Report (ASR), derived from and comparable to the YSR, but designed for adults (37). For each follow-up, a composite score was created by summing positive responses to the following statements: I feel lonely, I cry a lot, I am afraid I might think or do something bad, I feel that others are out to get me, I feel worthless or inferior, I am nervous or tense, I am too fearful or anxious, I feel too guilty, I am self-conscious or easily embarrassed, I am unhappy, sad or depressed, I worry a lot, and I feel that no one loves me. A higher score represents higher severity of anxiety/depression. Computation of Cronbach's alphas (all above .85) indicated high internal consistency.

Substance use and mental health treatment within and outside KP—Two dichotomous measures assessed whether participants had any substance use and mental health treatment before entering treatment. “Length of stay” in the index treatment (up to one year) was created with data from KP's automated databases, representing a count of continuous days in treatment without a six-week break. We also created dichotomous measures indicating receiving mental health services in year one, and substance use and mental health services in years two-three, four-five and six-seven, using survey data and health plan databases.

Statistical Analyses

Data were analyzed using SAS version 9.1 (SAS Institute Inc, Cary, NC). To examine distinct twelve-step attendance trajectory groups over seven years, we used PROC TRAJ (40), which applies a semiparametric group-based modeling (SGM) approach to identify discrete trajectory groups of individuals with homogeneous longitudinal traits on the basis of their patterns of repeated measures. Individuals with missing observations are included, because PROC TRAJ uses all values available from each case to estimate an individual's timeline, making casewise deletion unnecessary. Variables used in the estimation of the latent twelve-step attendance trajectories were indicators of time (baseline, six months, and one, three, five, and seven years) and the dichotomous indicators of twelve-step attendance at each time. The model was estimated under the assumption of a varying (rather than fixed) number of latent classes. Choice of the optimal number of classes was guided by the Bayesian Information Criterion (BIC), the most-widely used criteria for model fit.

The analyses were conducted among those who had at least one follow-up interview within one year and at least one follow-up interview during years three to seven (N=391); all subjects were classified into their most probable twelve-step attendance trajectory group based on the posterior probabilities. Once each individual was assigned to a group, we conducted analyses in three steps. First, we compared individual characteristics at baseline, as well as treatment utilization and twelve-step meeting attendance and activity involvement at follow-ups, by twelve-step attendance trajectory groups, 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). Second, a series of logistic regression analyses examined association between substance use outcome and each individual and treatment characteristic, using Generalized Estimation Equation (GEE) techniques to account for repeated measures of long-term substance use outcomes at three, five, and seven years. Separate sets of models were run for 30-day drug abstinence and 30-day alcohol abstinence. Predictor variables associated with the dependent variables at $p \leq .$

10, or identified as a priori in the literature (17, 23, 34, 42, 43), were included in the final models. Third, we fit multivariate logistic GEE models to estimate the relationship between twelve-step attendance trajectory groups and long-term substance use outcomes over time, controlling for the factors identified in the second step.

RESULTS

Among the 391 adolescents in the analytical sample, 79 (20%) reported ever having attended a twelve-step group before entering treatment. One hundred and fifty (42%) reported attending at least 10 twelve-step meetings during the first year. However, only 42 (12%), 33 (10%) and 26 (7%) attended at least 10 meetings in the prior six months at three, five and seven years, respectively.

A series of analyses fitted twelve-step attendance trajectory models for two through six groups. Comparison among the two-group ($BIC=-989.89$), the three-group ($BIC=-979.89$), the four-group ($BIC=-996.99$), the five-group ($BIC=-1015.05$), and the six-group ($BIC=-1032.18$) models suggests that a three-trajectory group model offers the best fit for the data (Figure 1). Group 1 consisted of those who had low or no twelve-step attendance over time ("low/no attendance" group, $N=235$). Group 2 consisted of adolescents whose twelve-step attendance decreased sharply after the first year ("early but not continued" group, $N=103$). Group 3 consisted of adolescents whose twelve-step attendance continued after the first year but gradually decreased over time ("continued" group, $N=53$). The mean posterior probabilities of assignment to each twelve-step attendance trajectory group indicated good separations among groups (Table 1).

We found no significant differences among twelve-step attendance trajectory groups at baseline in age, race-ethnic distribution, substance use or psychiatric problem severity (Table 2). There were higher proportions of males and of adolescents with prior substance use treatment experience in the continued group, and higher CMR total scores among the early but not continued and the continued groups.

Compared to the low/no attendance group, adolescents in the other two groups were more likely to initiate the index treatment and had longer length of stay (Table 3). Compared to the low/no attendance and early but not continued groups, higher proportions in the continued group received substance use treatment during years two-three, four-five and six-seven, either within or outside the health plan. However, there were no differences in proportions receiving mental health services during follow-ups among the three groups.

Table 4 presents meeting attendance and activity involvement at three, five and seven years by twelve-step attendance trajectory groups. Those in the continued group reported a higher level of meeting attendance and activity involvement across time points than the others; however, their average numbers of meetings attended decreased over time. Similarly, proportions endorsing each activity type, as well as average total numbers of activities endorsed, also decreased over time within this group.

At one year, 235 (61%) and 232 (60%) reported abstinence from alcohol and drugs in the prior 30 days, respectively. At three, five and seven years, abstinence rates in the prior 30 days were 39%, 29%, and 29% for alcohol and 57%, 55% and 55% for drugs, respectively. Table 5 presents results of GEE logistic analyses of the relationship between twelve-step attendance trajectories and both alcohol and drug abstinence at three, five, and seven years, adjusting for gender, age, race/ethnicity; baseline substance use and psychiatric problem severity, CMR total score, and prior substance use and mental health treatment experience; study site; index treatment length of stay; short-term (at one year) alcohol and drug abstinence; and anxiety/depression severity, substance use treatment and mental health

treatment received between follow-ups. Results suggested that after adjusting for other covariates, those in the continued twelve-step attendance group were more likely to be abstinent from both alcohol and drugs during follow-ups than those in the low/no attendance group (OR=2.40, 95% CI=1.44–3.99 and OR=1.96, 95% CI=1.09–3.53, respectively), with stronger association found for alcohol abstinence. No differences in long-term alcohol and drug abstinence were found between those in the other two groups. Female gender was positively, while higher anxiety/depression severity was negatively, associated with drug abstinence at follow-ups. In addition, older age was negatively associated with alcohol abstinence during follow-ups. Similar to the adult literature, higher CMR total score at treatment entry and better one-year outcomes were strong predictors of better long-term outcomes.

DISCUSSION

Among adolescents entering treatment, the average twelve-step attendance level increased in the first year, but decreased afterwards and remained low throughout the seven-year follow-ups. Three distinct groups emerged, however, when we applied the SGM approach to examine trajectories of twelve-step attendance. The majority (60%) had no or low attendance throughout seven years. About one fourth had high probability of attendance in the first year post treatment entry but discontinued afterwards. Fewer than 15% continued twelve-step attendance throughout the seven years; compared to the other two groups, adolescents in this group also had higher levels of affiliation to the twelve-step groups, as reflected by higher average numbers of meeting attendance and activity involvement.

Results of multivariate logistic GEE models indicated that adolescents with continued twelve-step attendance had better outcomes over time, whereas those in the early but not continued group had no different long-term outcomes, compared to those in the low/no attendance group. The adult literature (11, 44, 45) and our prior investigation of this sample at three-year follow-up (23) suggested that twelve-step participations in short- and long-term follow-ups are both independent significant contributors to long-term abstinence. However, findings of the current study suggest that it is important to have not only early but also *persistent* attendance over time.

Several individual characteristics differentiated the groups of distinct twelve-step attendance trajectories. We found higher proportions of males in the continued and the early but not continued groups, adding to the growing but mixed literature on gender differences in twelve-step attendance (13). Conversely, we found no differences in age and baseline severity among the groups, although both have been found to be significant predictors of twelve-step attendance among adolescents (21, 22). Our findings of higher proportions of adolescents with prior substance use treatment experience and higher perception on circumstances, motivation and readiness for treatment at baseline in the continued and the early but not continued groups may reflect the higher perceived needs for services, or higher familiarity with the twelve-step groups, among those in the two groups.

Comparisons between the continued and the early but not continued groups provide some important insights. We found no differences in baseline individual characteristics between these two groups. Compared to the low/no attendance group, both groups had higher treatment initiation rates as well as longer length of stay for the index treatment episode. In addition, no differences were found in alcohol and drug abstinence rates between the two groups at one year. Yet after the first year post treatment entry, the continued group continued to have more twelve-step attendance and additional substance use treatment services either within or outside the health plan during follow-ups and had better long-term outcomes, whereas the early but not continued group became similar to the low/no

attendance group in patterns of service use and long-term outcomes. Our findings echo other twelve-step studies in that twelve-step groups and formal treatment “appear to strengthen or bolster each other” (19). The observed high twelve-step attendance in the first year among the continued and the early but not continued groups may be attributable to program expectations for twelve-step attendance during the index treatment episode, while the continued twelve-step attendance afterwards among the continued group may be related to their receiving additional treatment during follow-ups. The causal relationships between receiving additional treatment and twelve-step group attendance after the index treatment are beyond the scope of this paper and deserve future research. Nonetheless, findings of this study underline the importance of continuing care (formal substance use treatment or twelve-step groups or both) for long-term recovery of substance use disorders, as they are chronic and relapsing conditions better managed by ongoing monitoring and extended services than by an acute treatment approach.

However, even within the continued group, we found decreasing trends in twelve-step meeting attendance and activity involvement as well as use of additional substance use treatment services over time. A cumulative body of research has demonstrated short-term effectiveness of twelve-step facilitation (TSF) interventions among adults (46–51), but it remains unclear whether TSF interventions can promote twelve-step affiliation in the long term (52); even less is known about effectiveness of TSF among adolescents. A growing literature also suggests the important role of primary care in long-term recovery of substance use disorders among adults (53–55), but little is known about that in adolescents. From a continuing care perspective, integration is needed among primary care, specialty substance use treatment and twelve-step groups in long-term recovery management, and TSF approaches and strategies might be needed in not only specialty treatment but also non-specialty settings. Future research is warranted to examine the components for such a model and how they interplay. Findings will have international relevance, as twelve-step groups have substantial presence throughout the world, with meetings for adolescents increasing (56–58). Much more has been studied about adults than adolescents, and the field would benefit from similar studies in cross-national contexts.

Study limitations merit attention. First, as with all observational studies, results cannot be interpreted as causal. Second, the study was conducted in a private non-profit integrated managed care health plan, and may not be generalizable to other U.S. or international health care system or populations. Managed care is, however, a major organizational model for U.S. health care today, and this health plan in particular has much in common with single-payer health care systems in other countries. Its international relevance will only increase with changes to U.S. health care through impending health reform. Third, our measures of twelve-step attendance referred to any type of twelve-step meetings without distinguishing among them. The time window for twelve-step attendance at follow-ups was the six months prior, while alcohol and drug abstinence was measured for the 30 days prior, to the follow-up interviews. Thus, the temporality is not ideal with the 30-day overlap, although it provided five months prior measurement. Fourth, although we controlled for perception on circumstances, motivation and readiness for treatment at baseline, there may be other self-selection effects. Finally, significance testing may have been limited by the sample size of the continued group relative to the other two twelve-step attendance trajectory groups. Replication studies are needed in other adolescent samples and treatment settings to more fully understand patterns of twelve-step engagement and disengagement throughout recovery (11).

CONCLUSION

Among adolescents with substance use disorders, overall twelve-step attendance was low post-treatment, but robust connection with twelve-step groups was associated with better long-term outcomes. Findings highlight the importance of twelve-step attendance in supporting long-term recovery among adolescents, and suggest that strategies are needed to facilitate twelve-step attendance. Additional research is needed on how the frequency, intensity and duration of twelve-step meeting attendance, as well as the type of activity, is associated with beneficial effects, and whether the relationships vary for different subgroups. Policies to address specific adolescent sub-groups, based on severity, age, or other characteristics, could then be developed for targeting twelve-step facilitation efforts.

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Figure 1.

Observed Trajectories of the Probability of Twelve-step Attendance over Seven Years

Notes: * Meeting attendance = yes if ever attended twelve-step meetings prior to treatment entry at baseline, and if attended 10 or more meetings in the prior six months at six-month, one-year, three-year, five-year and seven-year follow-ups.

Table 1

Mean Posterior Probability of Twelve-step Attendance Trajectory Group Membership (Row) by Twelve-step Attendance Trajectory Group Assigned to (Column)

	Low/No Attendance Group	Early Not Continued Group	Continued Group
Group 1	0.93	0.18	0.11
Group 2	0.02	0.72	0.01
Group 3	0.05	0.10	0.87

Table 2

Baseline Characteristics by Twelve-step Attendance Trajectory Group

	Low/No Attendance Group (N=235, 60%)	Early Not Continued Group (N=103, 26%)	Continued Group (N=53, 14%)	p value
Demographics				
Female gender (%)	40.9	27.2	26.4	0.019 ^c
Age, mean (sd)	16.2 (1.2)	16.1 (1.2)	16.0 (1.4)	NS
White (%)	46.2	52.4	58.5	NS
Severity at baseline				
Number of abuse/dependence symptoms, mean (sd)	4.29 (3.35)	4.91 (3.31)	4.83 (3.04)	NS
YSR internalizing score, mean (sd)	14.7 (9.8)	14.8 (11.0)	15.1 (10.4)	NS
YSR externalizing score, mean (sd)	20.0 (9.4)	19.9 (9.0)	21.1 (9.4)	NS
Circumstance/Motivation/Readiness scale at baseline, mean (sd)	45.8 (9.2)	48.7 (5.0)	48.0 (11.7)	0.023 ^c
Prior treatment experience				
Any substance use treatment (%)	10.7	17.7	28.3	0.003 ^a
Any mental health treatment (%)	21.4	22.8	30.2	NS

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

^a = significant difference between Low and Continued;

^b = significant difference between Early and Continued;

^c = significant difference between Low and Early.

Table 3

Treatment Characteristics by Twelve-step Attendance Trajectory Group

	Low/No Attendance Group (N=235, 60%)	Early Not Continued Group (N=103, 26%)	Continued Group (N=53, 14%)	p value
Index treatment episode				
Initiated treatment (%)	63.4	91.3	81.1	<0.001 <i>a,c</i>
Length of stay in days, mean (sd)	40.6 (45.7)	133.8 (102.7)	119.0 (106.8)	<0.001 <i>a,c</i>
Substance use treatment at follow-ups (%)				
Years 2–3	23.4	33.3	56.0	<0.001 <i>a,b</i>
Years 4–5	16.2	11.1	42.9	<0.001 <i>a,b</i>
Years 6–7	14.2	10.3	29.2	0.010 <i>a,b</i>
Mental health treatment at follow-ups (%)				
Years 2–3	33.2	31.2	44.0	NS
Years 4–5	20.1	18.9	18.4	NS
Years 6–7	18.1	16.5	16.7	NS

Notes:

a = significant difference between Low and Continued;*b* = significant difference between Early and Continued;*c* = significant difference between Low and Early.

Table 4

Twelve-step Meeting Attendance and Activity Involvement at Three-, Five- and Seven-year Follow-ups by Twelve-step Attendance Trajectory Group

	Low/No Attendance Group (N=235, 60%)	Early Not Continued Group (N=103, 26%)	Continued Group (N=53, 14%)	p value
Number of meetings attended in past 6 months, mean (sd)				
3 year	2.2 (15.9)	0.4 (1.3)	31.9 (40.7)	<0.001 <i>a,b</i>
5 year	1.1 (6.9)	0.6 (1.6)	28.9 (43.1)	<0.001 <i>a,b</i>
7 year	3.8 (19.8)	1.5 (9.6)	10.2 (28.2)	0.037 <i>a,b</i>
Considering oneself a member (%)				
3 year	2.8	3.2	38.0	<0.001 <i>a,b</i>
5 year	3.4	4.4	36.7	<0.001 <i>a,b</i>
7 year	5.9	2.1	18.8	<0.001 <i>a,b</i>
Having a sponsor (%)				
3 year	0.9	3.2	20.0	<0.001 <i>a,b</i>
5 year	1.0	3.3	18.4	<0.001 <i>a,b</i>
7 year	3.4	1.0	10.4	0.028 <i>b</i>
Having sponsored anyone (%)				
3 year	0.9	0.0	4.0	NS
5 year	0.0	0.0	4.1	0.020 <i>a</i>
7 year	0.0	1.0	4.2	0.018 <i>a</i>
Calling other members for help (%)				
3 year	3.3	3.2	28.0	<0.001 <i>a,b</i>
5 year	1.0	3.3	30.6	<0.001 <i>a,b</i>
7 year	3.4	3.1	14.6	0.012 <i>a,b</i>
Reading literature for guidance (%)				
3 year	4.7	6.5	60.0	<0.001 <i>a,b</i>
5 year	3.9	7.8	44.9	<0.001 <i>a,b</i>
7 year	10.2	6.2	25.0	0.003 <i>a,b</i>
Performing service activities (%)				
3 year	2.3	2.2	40.0	<0.001 <i>a,b</i>
5 year	2.9	2.2	46.9	<0.001 <i>a,b</i>
7 year	2.9	3.1	18.8	<0.001 <i>a,b</i>
Having a spiritual awakening/conversion experience (%)				
3 year	1.4	2.2	22.0	<0.001 <i>a,b</i>
5 year	1.0	2.2	26.5	<0.001 <i>a,b</i>
7 year	2.0	2.1	18.8	<0.001 <i>a,b</i>
Number of activity endorsed, mean (sd)				

	Low/No Attendance Group (N=235, 60%)	Early Not Continued Group (N=103, 26%)	Continued Group (N=53, 14%)	p value
3 year	0.2 (0.8)	0.2 (0.8)	2.1 (2.1)	<0.001 <i>a,b</i>
5 year	0.1 (0.7)	0.2 (0.8)	2.1 (2.4)	<0.001 <i>a,b</i>
7 year	0.3 (1.0)	0.2 (0.8)	1.1 (2.1)	<0.001 <i>a,b</i>

Notes:

a = significant difference between Low and Continued;

b = significant difference between Early and Continued;

c = significant difference between Low and Early.

Associations between Twelve-step Attendance Trajectories and Alcohol and Drug Abstinence at Three-, Five- and Seven-year Follow-ups, GEE Logistic Regression Models

Table 5

	Abstinence from alcohol at follow-ups			Abstinence from drugs at follow-ups		
	OR	95% CI	Type 3 p value	OR	95% CI	Type 3 p value
Twelve-step attendance trajectory groups						
Early not continued vs. Low/no attendance	1.13	(0.71, 1.81)	0.610	1.01	(0.61, 1.66)	0.983
Continued vs. Low/no attendance	2.40	(1.44, 3.99)	0.003	1.96	(1.09, 3.53)	0.026
Baseline demographic characteristics						
Female gender vs. male	1.37	(0.93, 2.02)	0.118	2.44	(1.55, 3.82)	<0.001
Age (per 1 year increase)	0.84	(0.73, 0.96)	0.011	1.00	(0.85, 1.19)	0.958
White vs. non-white	0.73	(0.52, 1.03)	0.074	0.93	(0.63, 1.37)	0.696
Baseline Circumstance/Motivation/Readiness scale (per 1 unit increase)	1.02	(1.00, 1.05)	0.035	1.04	(1.01, 1.06)	0.004
Short-term outcomes at 1-year follow-up						
Abstinence from alcohol	1.71	(1.14, 2.56)	0.010	0.86	(0.57, 1.31)	0.472
Abstinence from drugs	1.51	(1.00, 2.27)	0.053	3.40	(2.24, 5.18)	<0.001
Anxiety/depression at follow-ups (per one unit increase)	0.99	(0.94, 1.03)	0.582	0.90	(0.96, 0.94)	<0.001

Notes: OR=Odds Ratio; 95% CI = 95% Confidence Interval. Models also adjusted for prior substance use and mental health treatment experience at baseline; baseline substance use and psychiatric severity; study site; index treatment length of stay; and substance use and mental health treatment received at follow-ups.