

Twelve-Step affiliation and 3-year substance use outcomes among adolescents: social support and religious service attendance as potential mediators

Felicia W. Chi¹, Lee A. Kaskutas², Stacy Sterling¹, Cynthia I. Campbell¹ & Constance Weisner^{1,3}

Division of Research, Kaiser Permanente Northern California, Oakland, CA, USA,¹ Alcohol Research Group, Emeryville, CA, USA² and Department of Psychiatry, University of California, San Francisco, CA, USA³

ABSTRACT

Aims Twelve-Step affiliation among adolescents is little understood. We examined 12-Step affiliation and its association with substance use outcomes 3 years post-treatment intake among adolescents seeking chemical dependency (CD) treatment in a private, managed-care health plan. We also examined the effects of social support and religious service attendance on the relationship. **Design** We analyzed data for 357 adolescents, aged 13–18, who entered treatment at four Kaiser Permanente Northern California CD programs between March 2000 and May 2002 and completed both baseline and 3-year follow-up interviews. **Measures** Measures at follow-up included alcohol and drug use, 12-Step affiliation, social support and frequency of religious service attendance. **Findings** At 3 years, 68 adolescents (19%) reported attending any 12-Step meetings, and 49 (14%) reported involvement in at least one of seven 12-Step activities, in the previous 6 months. Multivariate logistic regression analyses indicated that after controlling individual and treatment factors, 12-Step attendance at 1 year was marginally significant, while 12-Step attendance at 3 years was associated with both alcohol and drug abstinence at 3 years [odds ratio (OR) 2.58, $P < 0.05$ and OR 2.53, $P < 0.05$, respectively]. Similarly, 12-Step activity involvement was associated significantly with 30-day alcohol and drug abstinence. There are possible mediating effects of social support and religious service attendance on the relationship between post-treatment 12-Step affiliation and 3-year outcomes. **Conclusions** The findings suggest the importance of 12-Step affiliation in maintaining long-term recovery, and help to understand the mechanism through which it works among adolescents.

Keywords Adolescents, long-term outcomes, mediation, religious service attendance, social support, 12-Step affiliation.

Correspondence to: Felicia W. Chi, Division of Research, Kaiser Permanente Northern California, 2000 Broadway, 3rd Floor, Oakland, CA 94612-2403, USA. E-mail: felicia.w.chi@kp.org

Submitted 9 April 2008; initial review completed 16 July 2008; final version accepted 30 December 2008

INTRODUCTION

Youth substance use (SU) is one of the most challenging public health problems in the United States [1,2]. Although evidence is accumulating that successful chemical dependency (CD) treatment leads to positive SU and psychosocial outcomes for adolescents [3,4], most studies examine short-term outcomes. Adolescent studies of outcomes longer than 1 year are uncommon.

Adults often participate in 12-Step groups as CD treatment aftercare, and studies support their beneficial effects on outcomes [5–12]. However, we know little about the patterns and effectiveness of 12-Step affiliation (TSA)

among adolescents [13–15]. As noted by Kelly and colleagues [16], some studies have found positive associations between 12-Step attendance (as treatment itself or as aftercare for formal treatment) and short-term outcomes [14,17–21], but few have examined effects of 12-Step on long-term outcomes, and none study adolescent out-patients [22].

Particularly among adolescents, we have yet to understand how and why TSA leads to positive SU outcomes. The adult literature has suggested mediating factors such as self-efficacy and motivation, increased active coping efforts, spirituality/religiosity and improved social networks [23–27]. A study of 99 adolescent in-patients

found modest beneficial effects of 12-Step attendance at 3 and 6 months post-discharge, which were mediated by motivation but not by coping or self-efficacy [14]. No adolescent studies, however, have examined social support and religiosity as mediators for longer periods, despite their importance as protective factors [28–31], or potential mediators of TSA, in long-term SU recovery among adolescents and young adults.

By conducting secondary analyses of longitudinal data of adolescents entering CD treatment, this paper examines: (i) the patterns of post-CD treatment TSA for adolescents; (ii) the associations between post-treatment TSA and SU outcomes at 3 years, adjusting for individual characteristics, 12-Step attendance at 1 year and treatment characteristics; and (iii) the extent that social support and religious service attendance affect the associations between post-treatment TSA and 3-year SU outcomes.

METHODS

Study sites and treatment programs

The 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 per cent of members are insured commercially, 10% insured through Medicare and 2% through Medicaid. The membership is generally employed, middle-class and well educated, with 78% having some college education [32].

Both CD and mental health (MH) treatment are provided within KP. The adolescent CD programs offer intensive out-patient treatment, with referral to contracted 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 12-Step attendance is expected.

Program length is approximately 1 year, with actual length based on individual needs. It includes three treatment phases. Phase 1 begins with intake/assessment and orientation, followed by group treatment sessions three times/week for 6–8 weeks. Phase 2 focuses on continuing recovery and relapse prevention, with two group sessions/week for 3–6 months. The final phase is after-care, which may last for months and entails one group session per week [33].

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 all patients with an intake appointment and 83% of those who started treatment [33]. There were 276 (66%) boys and 143 (34%) girls; 16% were African American, 9% Native American, 19% Hispanic, 6% Asian and 50% white. Thirty-three per cent reported 'legal systems' as one of the referral sources, and almost half (46%) reported receiving an ultimatum to enter treatment, including court mandates.

Procedure

Consent for study participation was obtained from both 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 detailed description of recruitment and the study sample has been published [33]. At baseline, all 419 adolescents completed a computerized self-report and a paper-and-pencil questionnaire. We conducted telephone interviews at 6 months and 1 and 3 years after intake, with response rates of 92%, 92% and 85%, respectively.

This study analyzed data of those completing the 3-year follow-up ($n = 357$). Compared to those not followed, we found a trend of more girls (35.8% versus 24.6%, $P < 0.10$) and longer index treatment stays (77.8 days versus 48.4 days, $P < 0.05$), but no differences between them in racial/ethnic distribution, age, motivation level at treatment entry and baseline SU and MH severity.

Measures

Substance use (SU) outcomes

We measured quantity/frequency of SU at baseline and each follow-up, including days of use of alcohol and 11 other substances in the prior 30 days. Many questions were drawn from the Comprehensive Addiction Severity Index for Adolescents (CASI-A), a widely used semi-structured self-report questionnaire measuring adolescent health and functioning in domains of substance use and problems, education, legal issues and family relationships. The CASI-A has been shown to have concurrent validity with the *Diagnostic and Statistical Manual of Mental Disorders* and American Society of Addiction Medicine dependence and abuse criteria [34–37].

A validity test of self-report 1-year SU data was conducted on a subsample ($n = 41$) of respondents at one site, who were asked at the completion of the telephone interview to come in for an in-person visit. The urinalysis (using Hitachi microparticle immunoassay) tested for

alcohol, heroin, methadone, pain killers, cocaine, stimulants, marijuana, barbiturates, tranquilizers, inhalants, hallucinogens and phencyclidine hydrochloride (PCP). Of those who reported abstinence, 92% had negative urine tests ($\kappa = 0.79$) [38]. We also found no differences between this subsample and the other sites' survey respondents in age, gender or SU at 1 year.

Consistent with treatment goals, this study used two dichotomous outcome measures, 30-day abstinence from alcohol and 30-day abstinence from drugs (excluding tobacco) at 3 years. Misuse of prescription medications was measured as drug use.

Twelve-Step attendance at 1 year post-treatment intake

A dichotomous measure in the 1-year follow-up interview measured whether participants attended 10 or more meetings in the previous 6 months.

Post-treatment 12-Step affiliation (TSA)

We assessed previous 6-month TSA at 3 years using questions adapted from the Alcoholics Anonymous (AA) Affiliation Scale, a brief instrument developed to measure AA affiliation across a variety of AA experiences with robust validity across diverse populations and settings [39]. The eight questions ask about meeting attendance 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 (e.g. cleaning up after a meeting) and having a spiritual awakening or a conversion experience. We modified the questions to include AA, Narcotics Anonymous (NA), Cocaine Anonymous (CA) or any other 12-Step meetings. For those reporting any 12-Step meeting attendance, we asked: 'In general, what is the typical age of those attending your 12-Step meetings?'

As the literature suggests [16], we examined 'meeting attendance' and 'activity involvement' separately for the construct of post-treatment TSA at 3 years: 'meeting attendance' was measured by numbers of meetings attended in the past 6 months; 'activity involvement' was measured by summing up positive responses to the 12-Step activities.

Social support

We assessed social support at 3 years by asking: 'How many of your family or friends have been actively supporting your efforts to reduce your drinking and/or drug use?', and examined it as a potential mediator between TSA and abstinence.

Religious service attendance

We used frequency of religious service attendance in the past 6 months at 3 years as a proxy for religiosity [40–42], and examined it as another potential mediator of TSA and abstinence.

Individual characteristics

Demographic variables included age, gender and race/ethnicity. Baseline SU severity was measured by summing the number of 'yes' answers to alcohol and drug dependence and abuse symptom questions from CASI-A, including symptoms of withdrawal, consequences of use, loss of control and physical dependence in the previous 6 months. It ranged from 0 to 14, with a higher number indicating greater severity [43,44]. Baseline MH problem severity was measured by the internalizing and externalizing scales of the Youth Self-Report (YSR), a structured questionnaire measuring MH problem domains with solid psychometric properties across a variety of adolescent populations [4,45–48]. Higher scores indicate greater severity. Motivation was measured by the Circumstances, Motivation and Readiness (CMR) total score, an instrument developed to assess client perceptions across four inter-related domains: circumstances (external pressures), motivation (internal pressures), readiness and suitability for CD treatment, which has been shown to possess strong reliability and validity [49].

Treatment utilization

We examined length of stay for the index CD treatment (up to 1 year), MH services received for 1 year and CD and MH services received during the second and the third years, both inside and outside KP. Data were collected from the survey and KP databases.

Statistical analyses

According to the model proposed by Baron & Kenny [50], we conducted analyses in three steps. First, to demonstrate significant relationships between the independent and dependent variables, we conducted χ^2 tests of 12-Step attendance at 1 year, TSA at 3 years and alcohol and drug abstinence at 3 years. For TSA at 3 years, we examined each of the seven activities and number of meetings attended, then created two summary measures—meeting attendance and activity involvement.

Second, to establish the possible mediating effects of social support and religious service attendance on the relationship between TSA and abstinence at 3 years, we examined the associations between the potential mediators and both the independent variables (meeting attendance and activity involvement) and the dependent

variables (alcohol and drug abstinence), using χ^2 tests for categorical variables, and Wilcoxon rank-sum tests for continuous variables due to violation of normality.

Thirdly, to examine whether the mediators significantly reduce the strength of the relationships between the independent and dependent variables in multivariate models, for each summary measure of TSA (meeting attendance and activity involvement) we ran a series of up to four multivariate logistic regression models predicting 3-year abstinence. We first examined TSA alone as the main independent variable. Next, each mediator was added in addition to TSA; finally, TSA and both mediators were included. Based on health services and treatment outcomes literature, and on findings from our empirical studies [14,18,43,51–57], each model controlled for individual characteristics (age, gender, race/ethnicity, baseline SU and MH severity, motivation at treatment entry), 12-Step attendance at 1 year and treatment utilization (length of stay for the index CD treatment, CD re-admission in second and third years within and outside KP, MH services in each follow-up year within and outside KP). Program site was not associated significantly with SU outcomes and was thus not included in the models. We examined both alcohol and drug abstinence. We also estimated the extent of possible mediation effects for social support and religious service attendance by calculating the percentage change in the effect of TSA measures on the outcome [58]. Analyses were performed using SAS version 9.1 (SAS Institute, Inc., Cary, NC, USA).

RESULTS

Sample characteristics

A total of 357 adolescents (35.9% girls) completed baseline and 3-year interviews; 176 (49.4%) were white, with mean age of 16.1 years [standard deviation (SD) 1.3]. The length of index treatment stay ranged from 0 to 366, with mean of 77.6 days (SD 87.9). During the 2 years following the index treatment year, 64 (17.9%) adolescents received additional out-patient CD treatment with mean of 5.51 visits (SD 19.69) per member year; among them, 48 (75.0%) received all their CD treatment through KP. Another 42 (11.8%) reported receiving CD treatment only outside KP in years 2–3. At 3 years, 137 (38.4%) reported abstinence from alcohol and 203 (56.9%) from drugs in the previous 30 days, with 107 (30.0%) reporting abstinence from both alcohol and drugs (excluding tobacco).

Twelve-Step affiliation: meeting attendance and activity involvement

At 1 year post-intake, 93 adolescents (26%) reported having attended 10 or more meetings in the previous 6

months. Bivariate analyses found that attending 10 or more meetings in the previous 6 months at 1 year was associated with higher alcohol, but not drug, abstinence at 3 years (50.5% versus 34.5%, $P < 0.01$ and 62.4% versus 56.4%, $P > 0.05$, respectively) (results not shown). At 3 years, we examined 12-Step meeting attendance and activity involvement in greater depth. Sixty-eight (19%) adolescents attended at least one meeting in the previous 6 months, among whom 42 attended 10 or more meetings. Forty-nine (14%) reported involvement in one or more of the seven activities. Two activities—having had a spiritual awakening/conversion experience, and having sponsored anyone—were not associated with alcohol or drug abstinence (not shown); the other five—considering themselves a member, having called a member for help, having a sponsor, reading literature, or performing service activities—were associated with alcohol and drug abstinence (all $P < 0.05$) (Table 1).

Because the literature suggests no clear relationship between level of TSA and positive SU outcomes among adolescents, we conducted exploratory analyses to examine alcohol and drug abstinence by various groupings of attendance and activity involvement. Findings at the bottom of Table 1 indicate that adolescents involved in three or more activities had significantly higher abstinence rates from alcohol and drugs than those reporting fewer; while those involved in one to two activities had abstinence rates no different from those with none. Similarly, adolescents who attended 10–19 or 20 or more meetings had alcohol and drug abstinence rates significantly higher than those reporting fewer. Those who attended one to nine meetings had alcohol and drug abstinence rates that were lower or not different from non-attendants, respectively (Table 1). Guided by these results, we created two dichotomized summary measures of TSA: attending 10 or more meetings and participating in three or more activities.

Associations among TSA, SU outcomes, social support and religious service attendance

Table 2 presents bivariate associations between the two hypothesized mediators (social support and religious service attendance) and the independent variables (the two measures of TSA at 3 years) and the dependent variables (alcohol and drug abstinence). Social support was associated positively with both TSA measures. Similarly, attending weekly religious services was related to participating in three or more 12-Step activities, as well as attending 10 or more 12-Step meetings. Social support was associated positively with both alcohol and drug abstinence (both $P < 0.0001$). However, frequency of religious service attendance was associated with drug

Table 1 Post-treatment 12-Step affiliation and substance use outcomes at 3 years ($n = 357$).

		Alcohol abstinence rate (%)	P-value	Drug abstinence rate (%)	P-value
Involvement of 12-Step activities					
Have considered yourself a member of a 12-Step program in the previous 6 months					
No	($n = 329$)	35.3	<0.0001 ^a	54.4	0.0013 ^a
Yes	($n = 28$)	75.0		85.7	
Have called a 12-Step member for help in the previous 6 months					
No	($n = 333$)	36.0	0.0007 ^a	54.7	0.0017 ^a
Yes	($n = 24$)	70.8		87.5	
Have a 12-Step program sponsor					
No	($n = 342$)	36.8	0.0044 ^a	55.6	0.0173 ^a
Yes	($n = 15$)	73.3		86.7	
Have read 12-Step meeting literature in the previous 6 months					
No	($n = 311$)	35.4	0.0024 ^a	55.0	0.0624 ^a
Yes	($n = 46$)	58.7		69.6	
Have performed services in the previous 6 months					
No	($n = 330$)	35.5	<0.0001 ^a	55.2	0.0225 ^a
Yes	($n = 27$)	74.1		77.8	
Number of 12-Step activities involved (range 0–5)					
0	($n = 309$)	35.3	0.0006 ^b	54.7	0.0212 ^b
1	($n = 10$)	40.0		50.0	
2	($n = 11$)	27.3		45.5	
3	($n = 8$)	62.5		87.5	
4	($n = 11$)	81.8		90.9	
5	($n = 8$)	87.5		87.5	
Attendance of 12-Step meetings					
Number of meetings attended in the previous 6 months:					
0	($n = 289$)	36.7	0.0125 ^a	54.7	NS ^a
1–9	($n = 26$)	23.1		57.7	
10–19	($n = 10$)	60.0		70.0	
≥20	($n = 32$)	59.4		71.9	

NS: non-significant. ^a P values from χ^2 tests. ^b P values from Fisher's exact tests.

($P < 0.001$), but not alcohol, abstinence. Thus, we examined the mediating effects of both religious service attendance and social support on the associations between TSA and drug abstinence, and of only social support on the associations between TSA and alcohol abstinence.

Inter-relationships among 12-Step meeting attendance, alcohol abstinence and social support

Multivariate logistic regression analyses controlling for individual characteristics and treatment utilization across time found that 12-Step attendance at 1 year predicted 3-year alcohol [odds ratio (OR) 1.81, 95% confidence interval (CI) 1.01, 3.22], but not drug (OR 1.41, 95% CI 0.79, 2.53), abstinence (results not shown). We next added meeting attendance for the 3-year time-point to the multivariate models. When 12-Step measures at both time-points were included, 1-year attendance was related marginally to 3-year alcohol, but not drug, abstinence, while 3-year attendance predicted higher alcohol and drug abstinence at 3 years (Model 1 in Table 3 and Model 1 in Table 4).

Table 3 also presents the mediating effect of social support between 12-Step meeting attendance and alcohol abstinence at 3 years. Model 1 shows that after controlling for other covariates, adolescents attending 10 or more 12-Step meetings in the previous 6 months at the 3-year interview had 2.58 times the odds (95% CI 1.18, 5.64) of reporting 30-day abstinence from alcohol as those attending fewer or none ($P < 0.05$). However, including social support in Model 2 reduced the effect of meeting attendance by 30.4%, and social support itself was associated positively with alcohol abstinence (OR 1.09, 95% CI 1.04, 1.13).

Inter-relationships among 12-Step meeting attendance, drug abstinence and religious service attendance and social support

Table 4 presents multivariate logistic regression analyses predicting drug abstinence. In all four models, 1-year 12-Step attendance was not associated with drug abstinence at 3 years. Model 1 indicates that after controlling for other covariates, adolescents attending 10 or more

Table 2 Associations between post-treatment 12-Step affiliation, substance use outcomes and social support and religiosity at 3 years (*n* = 357).

		Number of family members and friends who support reducing or quitting substance use			Frequency of religious services attended (%)			
		Mean (SD)	Median	<i>P</i> -value	Never	≤1~1-2/month	Weekly	<i>P</i> -value
12-Step affiliation measures								
Number of 12-Step activities involved in the previous 6 months								
0-2	(<i>n</i> = 330)	5.2 (6.9)	2.0	<0.0001 ^a	47.0	45.8	7.3	0.0217 ^b
3-5	(<i>n</i> = 27)	9.4 (6.0)	9.5		33.3	44.4	22.2	
Number of 12-Step meetings attended in the previous 6 months								
0-9	(<i>n</i> = 315)	5.2 (6.8)	2.0	0.0003 ^a	48.6	44.4	7.0	0.0035 ^b
≥ 10	(<i>n</i> = 42)	8.3 (6.8)	7.0		26.2	54.8	19.1	
Substance use outcomes								
Abstinence from alcohol in the previous 30 days								
No	(<i>n</i> = 220)	4.0 (5.9)	2.0	<0.0001 ^a	49.1	44.6	6.4	NS ^b
Yes	(<i>n</i> = 137)	8.0 (7.7)	5.0		40.9	47.5	11.7	
Abstinence from drugs in the previous 30 days								
No	(<i>n</i> = 154)	3.6 (5.6)	2.0	<0.0001 ^a	57.1	38.3	4.6	0.0005 ^b
Yes	(<i>n</i> = 203)	7.0 (7.5)	4.0		37.4	51.2	11.3	

NS: non-significant. ^a*P*-values from Wilcoxon's rank-sum tests; ^b*P* values from χ^2 tests. SD: standard deviation.

Table 3 Multivariate logistic regression analyses predicting alcohol abstinence status at 3 years.

		Model 1	Model 2
		OR (95% CI)	OR (95% CI)
Age	(as continuous)	NS	NS
Gender	(boy versus girl)	0.59** (0.34, 1.00)	0.61* (0.35, 1.07)
Race/ethnicity	(white versus non-white)	NS	NS
Baseline mental health (MH) severity			
YSR internalizing score	(as continuous)	NS	NS
YSR externalizing score	(as continuous)	NS	NS
Baseline substance use (SU) severity			
No. of abuse/dependent symptoms	(as continuous)	NS	NS
Baseline CMR total score	(as continuous)	NS	NS
Treatment characteristics			
Index chemical dependency (CD) treatment LOS in days	(as continuous)	NS	NS
No. of CD visits in years 2-3 within the health plan	(as continuous)	0.98** (0.96, 1.00)	0.98** (0.96, 1.00)
Receiving any CD treatment in years 2-3 outside the health plan	(yes versus no)	NS	NS
No. of MH visits in year 1 within the health plan	(as continuous)	NS	NS
No. of MH visits in years 2-3 within the health plan	(as continuous)	NS	NS
Receiving any MH treatment in years 2-3 outside the health plan	(yes versus no)	NS	NS
12-Step meeting attendance at 1 year			
Attended 10+ meetings in the prior 6 months	(yes versus no)	1.68* (0.93, 3.03)	1.77* (0.94, 3.32)
Post-treatment 12-Step meeting attendance at 3 years			
Attended 10+ meetings in the prior 6 months	(yes versus no)	2.58** (1.18, 5.64)	2.10** (0.92, 4.78)
Social support			
No. of families/friends who support reduce/quit substance use	(as continuous)	-	1.09‡ (1.04, 1.13)
Percentage change in the estimated effect of 12-Step meeting attendance		-	30.4
Significance of likelihood ratio test		-	<i>P</i> < 0.05

Percentage change in the estimated effect of 12-Step = 100 × [(OR_{m-} - OR_{m+})/(OR_{m-} - 1)], where OR_{m-}: odds ratio (OR) for 12-Step meeting attendance obtained from the regression model that does not consider the potential mediator (i.e. social support), and OR_{m+}: OR for 12-Step meeting attendance obtained from the regression model that does include the potential mediator (i.e. social support). YSR: youth self-report; CMR: circumstances, motivation and readiness; LOS: length of stay; NS: non-significant; CI: confidence interval. **P* < 0.10; ***P* < 0.05; ‡*P* < 0.001.

meetings had 2.53 times the odds (95% CI 1.08, 5.92) of being abstinent from drugs as those attending fewer or none ($P < 0.05$). Model 2 shows that the odds of being abstinent from drugs for those who never attended religious services were only one-third of those who attended weekly ($P < 0.01$); including religious service attendance reduced the effect of meeting attendance by 35.9%. Model 3 shows that social support was associated with drug abstinence (OR 1.09, 95% CI 1.04, 1.13) and reduced the effect of meeting attendance on drug abstinence by 22.2%. In Model 4, the inclusion of both religious service attendance and social support accounted for almost 44.4% of the effect of meeting attendance.

Inter-relationships among 12-Step activity involvement, SU outcomes and religious service attendance and social support

We also examined the relationships between 12-Step activity involvement at 3 years and alcohol and drug abstinence, and the potential mediating effects of religious service attendance and social support on the relationships (not shown). Involvement in three or more activities was associated with alcohol (OR 4.94, 95% CI 1.74, 14.05, $P < 0.01$) and drug (OR 7.54, 95% CI 1.98, 28.74, $P < 0.01$) abstinence. Frequency of religious service attendance was associated with drug, but not alcohol, abstinence, and reduced the effects of activity involvement on drug abstinence by 7.2%. Number of family members and friends supporting less SU was associated with both alcohol and drug abstinence (OR 1.08, 95% CI 1.04, 1.13, $P < 0.0001$ and OR 1.08, 95% CI 1.03, 1.13, $P < 0.001$, respectively), and accounted for the effects of activity involvement on alcohol and drug abstinence by 27.4% and 21.4%, respectively. Together, religious service attendance and social support accounted for 30.0% of the effects of activity involvement on drug abstinence.

Potential mediating effects between TSA and SU outcomes

Figure 1 summarizes the results of examining potential mediating effects of social support and religious service attendance on the relationships between TSA and SU outcomes at 3 years. Results suggest social support as a potential mediator of the relationships between TSA and abstinence from both alcohol and drugs. However, we found possible mediating effects of religious service attendance for relationship between TSA and abstinence from only drugs, but not alcohol.

Factors associated with post-treatment TSA

We conducted additional analyses to examine factors associated with post-treatment TSA at 3 years. Higher

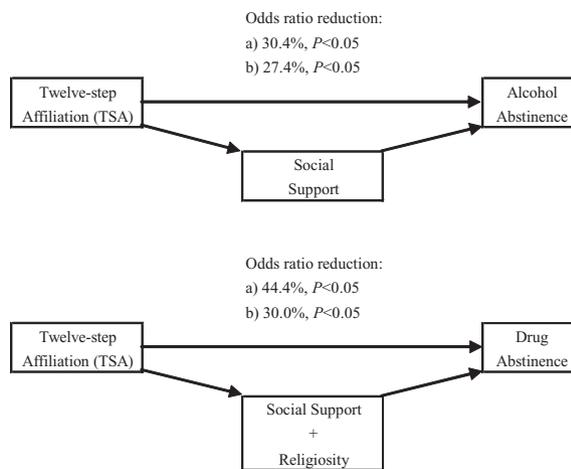


Figure 1 Potential mediating effects of the relationship between 12-Step affiliation (TSA) and substance use (SU) outcomes at 3 years. (a) TSA: 12-Step meeting attendance; (b) TSA: 12-Step activity involvement. P -values from the likelihood ratio tests of model comparisons

baseline and 1-year SU severity was associated with a higher likelihood of TSA at 3 years (all $P < 0.05$). We also found significant associations between numbers of CD visits within KP during years 2–3 and attending 10 or more 12-Step meetings or involving three or more 12-Step activities at 3 years (both $P < 0.05$). Similarly, having CD treatment outside the health plan during years 2–3, or receiving any MH treatment within or outside the health plan during years 2–3, were associated significantly with TSA at 3 years (all $P < 0.05$) (not shown). We found no associations between TSA and baseline characteristics of age, gender, race/ethnicity or having family members with SU problems. At baseline, adolescents who attended 10 or more meetings or were involved in three or more activities reported more peers using drugs in the previous 6 months (18.9 versus 11.8, $P < 0.05$ and 20.2 versus 12.0, $P < 0.05$, respectively). At 3 years, however, we found no differences in numbers of peers using drugs in the previous 30 days by levels of meeting attendance or activity involvement (5.7 versus 7.2, $P > 0.05$ and 3.2 versus 7.3, $P > 0.05$, respectively) (not shown).

DISCUSSION

This study found that 1-year 12-Step attendance predicted 3-year alcohol abstinence, and even remained marginally significant when including the proximal measure of 3-year TSA. This has implications for clinical approaches, because CD programs have the option of facilitating 12-Step attendance. It also suggests that early 12-Step attendance might help to maintain better long-term alcohol abstinence for adolescents. Although early 12-Step attendance did not predict 3-year drug

Table 4 Multivariate logistic regression analyses predicting drug abstinence status at 3-year follow-up.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Age	NS	NS	NS	NS
Gender	0.54** (0.32, 0.92)	0.58** (0.33, 1.00)	0.56** (0.32, 0.97)	0.59* (0.34, 1.04)
Race/ethnicity (white versus non-white)	NS	NS	NS	NS
Baseline mental health (MH) severity (as continuous)	NS	NS	NS	NS
YSR internalizing score (as continuous)	NS	NS	NS	NS
YSR externalizing score (as continuous)	NS	NS	NS	NS
Baseline substance use (SU) severity (as continuous)	NS	NS	NS	NS
No. of abuse/dependent symptoms (as continuous)	1.04† (1.01, 1.07)	1.04** (1.01, 1.07)	1.04** (1.01, 1.07)	1.04** (1.01, 1.07)
Baseline CMR total score (as continuous)	NS	NS	NS	NS
Treatment characteristics				
Index chemical dependency treatment (CD) LOS in days (as continuous)	NS	NS	NS	NS
No. of CD visits in years 2–3 within the health plan (as continuous)	0.99* (0.97, 1.00)	0.99* (0.97, 1.00)	0.99* (0.97, 1.00)	0.99* (0.97, 1.00)
Receiving any CD treatment in years 2–3 outside the health plan (yes versus no)	NS	NS	NS	NS
No. of MH visits in year 1 within the health plan (as continuous)	NS	NS	NS	NS
No. of MH visits in years 2–3 within the health plan (as continuous)	NS	NS	NS	NS
Receiving any MH treatment in years 2–3 outside the health plan (yes versus no)	NS	NS	NS	NS
12-Step meeting attendance at 1 year				
Attended 10+ meetings in the previous 6 months (yes versus no)	1.32 (0.73, 2.40)	1.38 (0.75, 2.54)	1.42 (0.76, 2.64)	1.46 (0.78, 2.75)
Post-treatment 12-Step meeting attendance at 3 years				
Attended 10+ meetings in the previous 6 months (yes versus no)	2.53** (1.08, 5.92)	1.98 (0.83, 4.72)	2.19* (0.91, 5.29)	1.73 (0.70, 4.24)
Religiosity				
Frequency of service attendance (never versus weekly)	–	0.33† (0.13, 0.87)	–	0.34** (0.12, 0.90)
(≤1–1–2/month versus weekly)	–	0.69 (0.26, 1.81)	–	0.65 (0.24, 1.75)
Social support				
No. of families/friends who support reduce/quit substance use (as continuous)	–	–	1.09‡ (1.04, 1.13)	1.08‡ (1.03, 1.13)
Percent change in the estimated effect of 12-Step meeting attendance	–	35.9	22.2	44.4
Significance of likelihood ratio test	–	P < 0.05	P < 0.05	P < 0.05

Percentage change in the estimated effect of 12-Step = $100 \times [(OR_m - OR_{m-1}) / (OR_m - 1)]$, where OR_m = odds ratio (OR) for 12-Step meeting attendance obtained from the regression model that does not consider the potential mediator (i.e. social support, religiosity), and OR_{m-1} = OR for 12-Step meeting attendance obtained from the regression model that does include the potential mediator (i.e. social support, religiosity). YSR: youth self-report; CMR: circumstances, motivation and readiness; LOS: length of stay; NS: non-significant. * $P < 0.10$; ** $P < 0.05$; † $P < 0.01$; ‡ $P < 0.001$. CI: confidence interval.

abstinence, the proximal 6-month measure of 12-Step meeting attendance and activity involvement at 3 years predicted both alcohol and drug abstinence at 3 years while controlling for individual characteristics, treatment services across time and 1-year 12-Step attendance. Although level of TSA among adolescents was low at 3 years, those who attended more meetings or were involved in more activities had better SU outcomes than their counterparts.

Several factors may contribute to post-treatment TSA among adolescents. Consistent with Kelly *et al.* [16], we found that higher baseline and 1-year SU severity were associated with a higher likelihood of 3-year TSA. Those with higher severity may be more willing to utilize such resources; they are also more likely to be in controlled environments that restrict substance use and require 12-Step attendance. The availability of teen-focused 12-Step groups may also be a determinant. *Post-hoc* analyses found that among those who attended any meetings at 3 years, 90% reported that the typical age in their group was 18 years or older, and only 10% reported ages more similar to their own ages, 16–18 years old. As greater age similarity is associated positively with 12-Step attendance among adolescents [59], the relative dearth of adolescent 12-Step groups may pose a challenge.

Instead of a dose–response relationship, our findings suggest that minimum threshold levels of TSA were associated with improved outcomes. Adolescents attending 10 or more meetings in the previous 6 months were twice, and those involved in three or more activities were more than five times as likely to be abstinent from alcohol and drugs as their counterparts. Interestingly, those who attended fewer than 10 meetings or were involved in fewer than two activities had abstinence rates similar to those who reported no attendance or activities. This is similar to adult findings, that weekly or more frequent 12-Step attendance is associated with abstinence [60]. Our findings also echo adult studies in that TSA in short- and long-term follow-ups post-treatment are both independent significant contributors to long-term abstinence [27,61,62], thus highlighting the importance of TSA in long-term continuing care after an initial CD treatment episode [63–65]. Additional research is needed to examine more extensively whether a minimum threshold of frequency and intensity is associated with the benefits of TSA among adolescents, whether affiliation levels increase as adolescents move into adulthood, how the relationship between TSA and outcomes changes over time and whether the relationship varies for alcohol versus drugs.

Consistent with other studies [53,54,66–68], we found that at 3 years girls had higher alcohol and drug abstinence rates. This may be an artifact of the gender

differences in problem characteristics [4], response to treatment [54] and SU development over time [69]. Numbers of CD visits received within KP during years 2–3 were negatively associated with alcohol, but not drug, abstinence. In addition, no associations were found between receiving CD treatments outside KP, or receiving MH services within or outside KP, and abstinence at 3 years. The lack of unique predictive ability for the treatment measures may be explained partially by the significant associations between receiving additional CD and MH treatments and TSA.

Our findings suggest that social support mediates the relationship between TSA and both alcohol and drug abstinence. This is consistent with the adult literature [24,25,27]. Participation in 12-Step programs may alter members' social networks by increasing the number of acquaintances who support quitting (development of a 'dry' social network), or inoculate members from the negative influence of a 'wet' social network encouraging SU [70].

A recent 1-year study of adult CD patients found that spiritual change partially mediated the relationship between increased 12-Step involvement and abstinence [71]. This study found that frequent religious service attendance mediated only the relationships between TSA and drug, but not alcohol, abstinence. Our measure, frequency of attendance at religious services, is only a narrow operationalization of the religiosity construct. Religiosity and spirituality are closely related constructs [72,73], yet there is little agreement among researchers about the theoretical and operational definitions of religiosity and spirituality [42,72,74,75], especially among adolescents. While 12-Step groups described themselves as 'spiritual and not religious', some argue that 'the distinction is debatable' [76], and the religious overtones have been recognized in court decisions [77]. For some individuals, religious participation may be a means of cultivating a spiritual connection or change [73], resulting from TSA. Whether or not there is a causal role for spiritual or religious change in the beneficial effects of 12-Step participation warrants research to understand the constructs and interrelationships between TSA, religiosity and spirituality within different subgroups.

A main limitation of this study is the lack of proper temporality among post-treatment TSA at 3 years, the dependent variables (alcohol and drug abstinence) and the potential mediators (social support and religious service attendance). The time window for both measures of post-treatment TSA, and for frequency of religious service attendance, was the 6 months prior to the 3-year interview and was open-ended for the social support measure. Alcohol and drug abstinence rates were measured for the 30 days prior to the 3-year interview.

However, we found robust predictive power of religious service attendance and social support when comparing multivariate models including and not including TSA at 3 years (results not shown), suggesting that the associations between TSA and abstinence were explained by the mediators, versus the other way around. Future studies with more precise sequencing of measures are needed.

There are other limitations. First, the study was conducted in a private managed-care health plan, and may not be generalizable to other health plans or public populations. Managed care is, however, a major model for private and public health care. The follow-up sample had marginally more girls and longer index CD treatment stays. Although we controlled for both variables in our multivariate analyses, caution should be used when interpreting and generalizing the results. Secondly, as with other observational studies, our results cannot be interpreted as causal. A randomized comparison of TSA to a no-TSA condition on SU outcomes would control more properly for possible confounding factors, but this would be difficult to conduct given the availability of AA/NA. Although observational, our data highlight the potential of TSA in positive outcomes, and may help to explain the mechanisms through which TSA works among adolescents (for a review of the evidence of effects of TSA, see Kaskutas [78]).

Third, because only a small proportion attended 12-Step meetings and were involved in 12-Step activities, it is possible that some, but not all, adolescents may benefit from TSA. For example, our findings that those with TSA were more severe at baseline and 1 year suggest that the effects of TSA on outcomes might be moderated by severity. Other potential self-selection effects include motivation. Better understanding of who is more or less likely to benefit from 12-Step affiliation, and why, will help to tailor treatment and continuing care accordingly in long-term recovery [79].

Fourth, our measures of TSA referred to any type 12-Step meetings without distinguishing among them. We also did not have detailed information on discharge type and reasons for CD treatments that might be related to 12-Step attendance. Finally, our social support measure generates an absolute total number rather than a proportion of the social support for the respondent's effort to reduce SU, and the use of a single-item measure as a proxy for religiosity may have limitations [80].

The current findings are encouraging for adolescents, their families and treatment providers as they suggest that a free, widely available informal resource may help long-term recovery efforts. Nevertheless, there is much to learn about how policies and clinical interventions can facilitate TSA during and after treatment for this popula-

tion. Research is warranted to better understand barriers to, and effectiveness of, TSA among adolescents, particularly as they transition to adulthood.

Declarations of interest

None.

Acknowledgements

This study was funded by the Robert Wood Johnson Foundation (RWJF), the Center for Substance Abuse Treatment (CSAT), the National Institute on Drug Abuse (NIDA) and the National Institute on Alcohol Abuse and Alcoholism (NIAAA). We thank the counselors, therapists and program directors of the adolescent CD programs for their support of the project, the Northern California Kaiser Permanente Adolescent Chemical Dependency Coordinating Committee and recruiters Georgina Berrios, Melanie Jackson-Morris,Carolynn Kohn, Cynthia Perry-Baker and Sandra Wolters, and interviewer Barbara Pichotto, for their assistance. We also thank Joe V. Selby MD, MPH and Sarah E. Zemore PhD, for comments and review of the manuscript, and Agatha Hinman BA, for project coordination and editorial assistance. We are grateful to the parents and adolescents who shared their experiences and opinions in the interviews for this study.

References

1. Johnston L. D., O'Malley P. M., Bachman J. G., Schulenberg J. E. Monitoring the future national results on adolescent drug use: overview of key findings 2004. 2005. Available at: <http://www.drugabuse.gov/PDF/overview2004.pdf> (accessed 16 October 2008).
2. Office of Applied Studies, Substance Abuse and Mental Health Services Administration. Substance use treatment need among adolescents: 2003–2004. *The NSDUH Report* 2006, 24. Available at: <http://www.oas.samhsa.gov/2K6/youthTXneed/youthTXneed.pdf> (accessed 2 March 2009).
3. Hser Y. I., Grella C. E., Hubbard R. L., Hsieh S. C., Fletcher B. W., Brown B. S. *et al.* An evaluation of drug treatments for adolescents in 4 US cities. *Arch Gen Psychiatry* 2001; 58: 689–95.
4. Sterling S., Weisner C. Chemical dependency and psychiatric services for adolescents in private managed care: implications for outcomes. *Alcohol Clin Exp Res* 2005; 25: 801–9.
5. Fiorentine R. After drug treatment: are 12-step programs effective in maintaining abstinence? *Am J Drug Alcohol Abuse* 1999; 25: 93–116.
6. Miller N. S., Ninonuevo F. G., Klamen D. L., Hoffmann N. G., Smith D. E. Integration of treatment and posttreatment variables in predicting results of abstinence-based outpatient treatment after one year. *J Psychoact Drugs* 1997; 29: 239–48.
7. McKellar J., Stewart E., Humphreys K. Alcoholics anonymous involvement and positive alcohol-related outcomes:

- cause, consequence, or just a correlate? A prospective 2-year study of 2319 alcohol-dependent men. *J Consult Clin Psychol* 2003; **71**: 302–8.
8. Tonigan J. S., Miller W. R., Schermer C. Atheists, agnostics and Alcoholics Anonymous. *J Stud Alcohol* 2002; **63**: 534–41.
 9. Connors G. J., Tonigan J. S., Miller W. R. A longitudinal model of intake symptomatology, AA participation and outcome: retrospective study of the project MATCH outpatient and aftercare samples. *J Subst Abuse* 2001; **62**: 817–25.
 10. Timko C., Billow R., DeBenedetti A. Determinants of 12-step group affiliation and moderators of the affiliation-abstinence relationship. *Drug Alcohol Depend* 2006; **83**: 111–21.
 11. Moos R. H., Moos B. S. Long-term influence of duration and frequency of participation in alcoholics anonymous on individuals with alcohol use disorders. *J Consult Clin Psychol* 2004; **72**: 81–90.
 12. Moos R. H., Moos B. S. Participation in treatment and Alcoholics Anonymous: a 16-year follow-up of initially untreated individuals. *J Clin Psychol* 2006; **62**: 735–50.
 13. Humphreys K., Wing S., McCarty D., Chappel J., Gallant L., Haberle B. *et al.* Self-help organizations for alcohol and drug problems: toward evidence-based practice and policy. *J Subst Abuse Treat* 2004; **26**: 151–8.
 14. Kelly J. E., Myers M. G., Brown S. A. A multivariate process model of adolescent 12-step attendance and substance use outcome following inpatient treatment. *Psychol Addict Behav* 2000; **14**: 376–89.
 15. Bukstein O. G. *Adolescent Substance Abuse: Assessment, Prevention, and Treatment*. New York: John Wiley; 1995.
 16. Kelly J. E., Myers M. G., Brown S. A. Do adolescents affiliate with 12-step groups? A multivariate process model of effects. *J Stud Alcohol* 2002; **63**: 293–304.
 17. Alford G. S., Koehler R. A., Leonard J. Alcoholics Anonymous–Narcotics Anonymous model inpatient treatment of chemically dependent adolescents: a 2-year outcome study. *J Stud Alcohol* 1991; **52**.
 18. Hsieh S., Hoffmann N. G., Hollister C. D. The relationship between pre-, during-, post-treatment factors, and adolescent substance abuse behaviors. *Addict Behav* 1998; **23**: 477–88.
 19. Winters K. C., Stinchfield R. D., Opland E., Weller C., Latimer W. W. The effectiveness of the Minnesota Model approach in the treatment of adolescent drug abusers. *Addiction* 2000; **95**: 601–12.
 20. Brown S. A., Mott M. A., Myers M. G. Adolescent alcohol and drug treatment outcome. In: Watson R. R., editor. *Drug and Alcohol Abuse Prevention*. Totowa, NJ: Humana Press; 1990, p. 373–403.
 21. Kennedy B. P., Minami M. The Beech Hill Hospital/Outward Bound Adolescent Chemical Dependency Treatment Program. *J Subst Abuse Treat* 1993; **10**: 395–406.
 22. Kelly J. E., Myers M. G. Adolescents' participation in Alcoholics Anonymous and Narcotics Anonymous: review, implications and future directions. *J Psychoact Drugs* 2007; **39**: 259–69.
 23. Fiorentine R., Hillhouse M. P. Exploring the additive effects of drug misuse treatment and twelve-step involvement: does twelve-step ideology matter? *Subst Use Misuse* 2000; **35**.
 24. Humphreys K., Mankowski E. S., Moos R. H., Finney J. W. Do enhanced friendship networks and active coping mediate the effect of self-help groups on substance abuse? *Ann Behav Med* 1999; **21**: 54–60.
 25. Kaskutas L. A., Bond J., Humphreys K. Social networks as mediators of the effect of Alcoholics Anonymous. *Addiction* 2002; **97**: 891–900.
 26. Morgenstern J., Labouvie E., McCrady B. S., Kahler C. W., Frey R. M. Affiliation with Alcoholics Anonymous following treatment: a study of its therapeutic effects and mechanisms of action. *J Consult Clin Psychol* 1997; **65**: 768–77.
 27. Bond J., Kaskutas L. A., Weisner C. The persistent influence of social networks and Alcoholics Anonymous on abstinence. *J Stud Alcohol* 2003; **6**: 579–88.
 28. Ellickson P. L., Tucker J. S., Klein D. J. Reducing early smokers' risk for future smoking and other problem behavior: insights from a five-year longitudinal study. *J Adolesc Health* 2008; **43**: 394–400.
 29. Cleveland M. J., Feinberg M. E., Bontempo D. E., Greenberg M. T. The role of risk and protective factors in substance use across adolescence. *J Adolesc Health* 2008; **43**: 157–64.
 30. Gorsuch R. L. Religious aspects of substance abuse and recovery. *J Soc Issues* 1995; **51**: 65–83.
 31. Cotton S., Zebracki K., Rosenthal S. L., Tsevat J., Drotar D. Religion/spirituality and adolescent health outcomes: a review. *J Adolesc Health* 2006; **38**: 472–80.
 32. Gordon N. P. Characteristics of adult health plan members in the Northern California Region membership, as estimated from the 1999 Member Health Survey. 2000. Available at: http://dor-ent1.kaiser.org/dor/mhsnet/pdf_99/mhs99reg.pdf (accessed 28 January 2008).
 33. Sterling S., Kohn C. S., Lu Y., Weisner C. Pathways to substance abuse treatment for adolescents in an HMO. *J Psychoact Drugs* 2004; **36**: 439–53.
 34. Meyers K., McLellan A. T., Jaeger J. L., Pettinati H. M. The development of the Comprehensive Addiction Severity Index for Adolescents (CASI-A). An interview for assessing multiple problems of adolescents. *J Subst Abuse Treat* 1995; **12**: 181–93.
 35. Whitmore E. A., Mikulich S. K., Thompson L. L., Riggs P. D., Aarons G. A., Crowley T. J. Influences on adolescent substance dependence: conduct disorder, depression, attention deficit hyperactivity disorder, and gender. *Drug Alcohol Depend* 1997; **47**: 87–97.
 36. Donovan D. M., Rosengren D. B. Motivation for behavior change and treatment among substance abusers. In: Tucker J. A., Donovan D. M., Marlatt G. A., editors. *Changing Addictive Behavior: Bridging Clinical and Public Health Strategies*. New York: Guilford Press; 1999, p. 126–59.
 37. Myers M. G., MacPherson L. Adolescent reasons for quitting smoking: initial psychometric evaluation. *Psychol Addict Behav* 2008; **22**: 129–34.
 38. Landis J. R., Koch G. G. The measurement of observer agreement for categorical data. *Biometrics* 1977; **33**: 159–74.
 39. Humphreys K., Kaskutas L. A., Weisner C. The Alcoholics Anonymous Affiliation Scale: development, reliability, and norms for diverse treated and untreated populations. *Alcohol Clin Exp Res* 1998; **22**: 974–8.
 40. Miller L., Davies M., Greenwald S. Religiosity and substance use and abuse among adolescents in the National Comorbidity Survey. *J Am Acad Child Adolesc Psychiatry* 2000; **39**: 1190–7.
 41. Wallace J. M. Jr, Forman, T. A. Religion's role in promoting

- health and reducing risk among American youth. *Health Educ Behav* 1998; **25**: 721–41.
42. Rew L., Wong Y. J. A systematic review of associations among religiosity/spirituality and adolescent health attitudes and behaviors. *J Adolesc Health* 2006; **38**: 433–42.
 43. Campbell C. I., Weisner C., Sterling S. Adolescents entering chemical dependency treatment in private managed care: ethnic differences in treatment initiation and retention. *J Adolesc Health* 2006; **38**: 343–50.
 44. Wu N. S., Lu Y., Sterling S., Weisner C. Family environment factors and substance abuse severity in an HMO adolescent treatment population. *Clin Pediatr* 2004; **43**: 323–33.
 45. Rowe C. L., Liddle H. A., Greenbaum P. E., Henderson C. E. Impact of psychiatric comorbidity on treatment of adolescent drug abusers. *J Subst Abuse Treat* 2004; **26**: 129–40.
 46. Achenbach T. M. *Manual for the Youth Self-Report and 1991 Profile*. Burlington, VT: University of Vermont Department of Psychiatry; 1991.
 47. McConaughy S. H., Stanger C., Achenbach T. M. Three-year course of behavioral/emotional problems in a national sample of 4- to 16-year-olds: I. Agreement among informants. *J Am Acad Child Adolesc Psychiatry* 1992; **31**: 932–40.
 48. McConaughy S. H., Achenbach T. M. *Manual for the Semistructured Clinical Interview for Children and Adolescents*, 2nd edn. Burlington, VT: University of Vermont Research Center for Children, Youth, and Families; 2001.
 49. De Leon G., Melnick G., Kressel D., Jainchill N. Circumstances, motivation, readiness, and suitability (the CMRS scales): predicting retention in therapeutic community treatment. *Am J Drug Alcohol Abuse* 1994; **20**: 495–515.
 50. Baron R. M., Kenny D. A. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986; **51**: 1173–82.
 51. Anderson K. G., Ramo D. E., Schulte M. T., Cummins K., Brown S. A. Substance use treatment outcomes for youth: integrating personal and environmental predictors. *Drug Alcohol Depend* 2007; **88**: 42–8.
 52. Brown S. A., D'Amico E. J., McCarthy D. M., Tapert S. F. Four-year outcomes from adolescent alcohol and drug treatment. *J Stud Alcohol* 2001; **62**: 381–88.
 53. Duncan S. C., Alpert A., Duncan T. E., Hops H. Adolescent alcohol use development and young adult outcomes. *Drug Alcohol Depend* 1997; **49**: 39–48.
 54. Grella C. E., Joshi V. Treatment processes and outcomes among adolescents with a history of abuse who are in drug treatment. *Child Maltreat* 2003; **8**: 7–18.
 55. Latimer W. W., Winters K. C., Stinchfield R., Traver R. E. Demographic, individual, and interpersonal predictors of adolescent alcohol and marijuana use following treatment. *Psychol Addict Behav* 2000; **14**: 162–273.
 56. Riggs P. D., Baker S., Mikulich S. K., Young S. E., Crowley T. J. Depression in substance-dependent delinquents. *J Am Acad Child Adolesc Psychiatry* 1995; **34**: 764–71.
 57. Winters K. C., Stinchfield R. D., Latimer W. W., Stone A. Internalizing and externalizing behaviors and their association with the treatment of adolescents with substance use disorder. *J Subst Abuse Treat* 2008.
 58. Aneshensel C. *Theory-Based Data Analysis for the Social Sciences*. Thousand Oaks, CA: Pine Forge Press; 2002, p. 158–90.
 59. Kelly J. F., Myers M. G., Brown S. A. The effects of age com-
position of 12-step groups on adolescent 12-step participation and substance use outcome. *J Child Adolesc Subst* 2005; **15**: 63–72.
 60. Fiorentine R. Counseling frequency and the effectiveness of outpatient drug treatment: revisiting the conclusion that 'more is better'. *Am J Drug Alcohol Abuse* 2001; **27**: 617–31.
 61. Kaskutas L. A., Ammon L., Delucchi K., Room R., Bond J., Weisner C. Alcoholics Anonymous careers: patterns of AA involvement five years after treatment entry. *Alcohol Clin Exp Res* 2005; **29**: 1983–90.
 62. Moos R. H., Moos B. S. The interplay between help-seeking and alcohol-related outcomes: divergent processes for professional treatment and self-help groups. *Drug Alcohol Depend* 2004; **75**: 155–64.
 63. Weisner C., Delucchi K., Matzger H., Schmidt L. The role of community services and informal support on five-year drinking trajectories of alcohol dependent and problem drinkers. *J Stud Alcohol* 2003; **64**: 862–73.
 64. Institute of Medicine. *Improving the Quality of Health Care for Mental and Substance-Use Conditions: Quality Chasm Series*. Washington, DC: National Academies Press; 2005.
 65. Witbrodt J., Bond J., Kaskutas L. A., Weisner C., Jaeger G., Pating D. et al. Day hospital and residential addiction treatment: randomized and nonrandomized managed care clients. *J Consult Clin Psychol* 2007; **75**: 947–59.
 66. Moon D. G., Jackson K. M., Hecht M. L. Family risk and resiliency factors, substance use, and the drug resistance process in adolescence. *J Drug Educ* 2000; **30**: 373–98.
 67. Rivers S. M., Greenbaum R. L., Goldberg E. Hospital-based adolescent substance abuse treatment: comorbidity, outcomes, and gender. *J Nerv Ment Dis* 2001; **189**: 229–37.
 68. Rounds-Bryant J. L., Staab J. Patient characteristics and treatment outcomes for African American, Hispanic, and White adolescents in DATOS-A. *J Adolesc Res* 2001; **16**: 624–41.
 69. Duncan S. C., Alpert A., Duncan T. E., Hops H. Adolescent alcohol use development and young adult outcomes. *Drug Alcohol Depend* 1997; **49**: 39–48.
 70. Longabaugh R., Wirtz P. W., Zweben A., Stout R. L. Network support for drinking, Alcoholics Anonymous and long-term matching efforts. *Addiction* 1998; **93**: 1313–33.
 71. Zemore S. E. A role for spiritual change in the benefits of 12-step involvement. *Alcohol Clin Exp Res* 2007; **31**: 768–98.
 72. King D. E., Blue A., Mallin R., Thiedke C. Implementation and assessment of a spiritual history taking curriculum in the first year of medical school. *Teach Learn Med* 2004; **16**: 64–8.
 73. Carrico A. W., Gifford E. V., Moos R. H. Spirituality/religiosity promotes acceptance-based responding and 12-step involvement. *Drug Alcohol Depend* 2007; **89**: 66–73.
 74. Wong Y. J., Rew L., Slaikeu K. D. A systematic review of recent research on adolescent religiosity/spirituality and mental health. *Issues Ment Health Nurs* 2006; **27**: 161–83.
 75. Benson P. L. Commentary: emerging themes in research on adolescent spiritual and religious development. *Appl Dev Sci* 2004; **8**: 47–50.
 76. Atkins R. G. Jr, Hawdon, J. E. Religiosity and participation in mutual-aid support groups for addiction. *J Subst Abuse Treat* 2007; **33**: 321–31.
 77. Egelko B. Appeals court says requirement to attend AA unconstitutional. 2007. Available at: <http://>

- www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/08/BA99S1AKQ.DTL (accessed 5 December 2008).
78. Kaskutas L. A. Alcoholics Anonymous effectiveness: faith meets science. *J Addict Dis*; in press; 2009.
79. Kelly J. E., Brown S. A., Abrantes A., Kahler C. W., Myers M. Social Recovery model: an 8-year investigation of adolescent 12-step group involvement following inpatient treatment. *Alcohol Clin Exp Res* 2008; **32**: 1468–78.
80. Hill P. C., Pargament K. I. Advances in the conceptualization and measurement of religion and spirituality. Implications for physical and mental health research. *Am Psychol* 2003; **58**: 64–74.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.