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Impact of 12 Step Mutual Help Groups on Drug Use Disorder Patients across Six Clinical Trials

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Abstract

Background: 12 step mutual help groups are widely accessed by people with drug use disorder but infrequently subjected to rigorous evaluation. Pooling randomized trials containing a condition

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in which mutual help group attendance is actively facilitated presents an opportunity to assess the effectiveness of 12 step groups in large, diverse samples of drug use disorder patients.

Methods: Data from six federally-funded randomized trials were pooled (n = 1730) and subjected to two-stage instrumental variables modelling, and, fixed and random effects regression models. All trials included a 12 step group facilitation condition and employed the Addiction Severity Index as a core measure.

Results: The ability of 12 step facilitation to increase mutual help group participation among drug use disorder patients was minimal, limiting ability to employ two-stage instrumental variable models that correct for selection bias. However, traditional fixed and random effect regression models found that greater 12 step mutual help group attendance by drug use disorder patients predicted reduced use of and problems with illicit drugs and also with alcohol.

Conclusion: Facilitating significant and lasting involvement in 12 step groups may be more challenging for drug use disorder patients than for alcohol use disorder patients, which has important implications for clinical work and for effectiveness evaluations. Though selection bias could explain part of the results of traditional regression models, the finding that participation in 12 step mutual help groups predicts lower illicit drug and alcohol use and problems in a large, diverse, sample of drug use disorder patients is encouraging.

Keywords

Mutual help groups; self-help; 12 steps; recovery; continuing care; opioid addiction

1. Introduction

To cope with opioid, stimulant, and other drug use disorders, hundreds of thousands of Americans each year seek out 12 step mutual help groups such as Narcotics Anonymous, Crystal Meth Anonymous and Cocaine Anonymous (Humphreys, 2004). Mutual help groups are non-professional, peer-led sources of fellowship, emotional support, role models, and practical coping strategies for members. Like Alcoholics Anonymous (AA), which inspired their creation, 12 step groups focused on illicit drugs conceptualize recovery from addiction as involving fundamental changes in self-conception, attitudes, interpersonal relationships, and spiritual outlook, as well as permanent cessation of substance use.

Most of the effectiveness evidence available for 12 step mutual help groups comes from studies of individuals with alcohol use disorder who attend AA. As demonstrated in a new Cochrane Collaboration review of 27 rigorous studies enrolling a total of 10,565 individuals with alcohol use disorder, AA generates alcohol-related outcomes as good or better than high-quality psychosocial intervention such as cognitive-behavioral therapy (Kelly, Humphreys, & Ferri, 2020; Kelly et al., in press). The Cochrane review also found that AA reduces health care costs. Many of the positive AA evaluations in the Cochrane review enrolled some individuals with co-occurring illicit drug use, suggesting that type of substance use per se does not limit potential benefit from 12 step groups.

Relative to the AA studies included in the Cochrane Review, 12 step group evaluations focused specifically on individuals with drug use disorder are less common and also less

rigorous (see White et al. 2020, for a review). That said, some studies of drug-focused mutual help groups with a longitudinal design and reasonable (e.g., 100 or more) sample sizes have provided encouraging results.

For example, Etheridge and colleagues (1999) found that cocaine use disorder patients (n = 927) who attended more post-treatment mutual help groups had significantly lower rates of cocaine use in the year following addiction treatment across a range of modalities. Weiss et al (2005) reported that although the number of 12 group meetings attended by cocaine use disorder patients (n=487) was not associated with cocaine use at follow-up, greater 12 step group participation (e.g., not just attending meetings but also reading literature, practicing the steps, having a sponsor) predicted reduced cocaine use. In a larger study of a combined sample of 2376 alcohol and illicit drug use disorder patients, Moos and colleagues (2001) also found positive results: Number of 12 step groups attended had a strong linear association at 1 year follow-up with rate of abstinence from all substances.

Because 12-step organizations were created by white males, some concern has been raised that they might not appeal to women and to people of color. Humphreys, Mavis and Stöffelmayr (1994) addressed this question in a prospective study of 558 substance use disorder patients and found that neither race nor sex predicted 12 step group involvement at one-year follow-up. Hillhouse and Fiorentine (2001) replicated this finding in a sample of 356 patients. Both of these studies examined combined samples of alcohol and illicit drug patients, so it cannot be assumed that they would replicate in a sample comprising drug use disorder patients only.

The above studies have expanded knowledge on 12 step mutual help groups for people with drug use disorders, and the question now becomes how to build on them. One method of conducting a more rigorous test of 12 step groups' effectiveness is to pool data from randomized clinical trials that include a condition which explicitly facilitates mutual help group participation. This approach has two advantages. First, such datasets can potentially be subjected to instrumental variable analysis, an analytic approach developed in economics that removes the influence of both measured and unmeasured selection factors on estimates of effectiveness (Humphreys, Phibbs, & Moos, 1996; Sussman and Hayward, 2010; Wainer, 2000). Specifically, using randomization to a 12 step facilitation condition as an instrument allows estimation of the impact of 12 step group participation free of selection bias (see Humphreys, Blodgett, & Wagner, 2014 for an application with more extended methodological explanation). Second, whether instrumental variables modelling or other statistical techniques are employed, pooling data across trials produces larger and more diverse samples than are otherwise available, which, in turn, increases statistical power as well as generalizability of results.

Pooling clinical trial samples was successfully employed with all existent federally-funded randomized clinical trials of 12 step facilitation for alcohol use disorder patients (Humphreys, Blodgett, & Wagner, 2014). Because 12 step facilitation produced large increases in AA participation relative to a range of other treatment conditions, it was possible to use an instrumental variable analysis to estimate the effect of AA without self-

selection bias, revealing significant benefits of AA participation. This provided unusually strong evidence of AA's causal impact in a diverse sample of over 2300 individuals.

There are now a sufficient number of randomized clinical trials available to conduct a parallel analysis for mutual help groups attended by people with drug use disorders. Like our prior study of alcohol use disorder patients, this study therefore pooled all available clinical trials to create the largest sample to date for estimating the impact of 12 step groups on drug use disorder patients using best practice statistical methodology.

2. Materials and Methods

Using literature reviews (Bog et al., 2017), National Institutes of Health and Department of Veterans Affairs databases, and our own knowledge of the literature, we identified 11 completed randomized clinical trials of 12 step group facilitation with drug use disorder patients. Three could not be employed because they either destroyed their data after publication (Maude-Griffin, 1998), did not measure mutual help group attendance (Hayes et al., 2004), or did not employ the Addiction Severity Index as a core measure (Kelly et al., 2017). Two others were excluded because they employed a 12 step facilitation intervention that had no effect on mutual help group attendance (Najavits et al., 2018; McKay et al, 2005), thereby not meeting a precondition for our planned instrumental variable analysis and preventing us from testing the potential association of 12 step group attendance with outcome. The other six clinical trial datasets were usable and are described in Table 1.

The six remaining randomized clinical trials all included a condition or conditions specifically designed to facilitate 12 step mutual help group attendance to a greater extent than do the psychotherapeutic interventions in the comparison condition. None of the trials had a no treatment control. All the trials enrolled diverse samples of patients. Quite importantly from the point of view of statistical power, aggregating the samples of the trials is possible because all of them share certain follow-up windows and employed the Addiction Severity Index (ASI) as a baseline and follow-up assessment (McLellan et al., 1980).

In collaboration with the principal investigators of the six clinical trials, the Stanford-based team members combined all the datasets. As a check against errors, each trial's descriptive baseline variable values were regenerated independently and in all cases were identical to that published in the original papers.

2.1 Participants

The combined sample of 1730 individuals was 62.1% male and 50.7% unemployed. The two most prevalent racial groups were African-Americans (41.9%) and Non-Hispanic Caucasians (44.9%). Average age was 39.0 (SD = 10.0). Almost two-thirds (61.2%) had a high school education or less, and 18.6% were currently married or living in a marriage-like relationship. In the 30 days before baseline, 66% used cocaine, 9% used heroin, and 7% used opioids other heroin, 8% used amphetamine/methamphetamine, and 33% used cannabis. A total of 60% used at least some alcohol and 37% did so 5 or more days a month.

Not all the trials conducted formal diagnostic interviews and those that did used different criteria depending on the era in which they were done. Our candidly rough estimate (details available by request) are that 77% of participants would meet criteria for current cocaine use disorder, 25% for opioid use disorder, and 41% for an alcohol use disorder.

2.2 Measures

The primary outcome examined was the composite drug severity score and the secondary outcome was composite alcohol severity score of the ASI (McLellan et al., 1980). Both scales range from 0 to 1 with higher scores reflecting more severe problems with illicit drugs, and alcohol, respectively. Because they are more easily interpreted, we also report models for the individual self-report items within the ASI on days of use of different drugs. These items assessed use in the past 30 days and were available across datasets at baseline and follow-up for four drugs: Cocaine, alcohol, heroin, and cannabis.

As Curran and Hussong (2009) note, pooling data across heterogeneous studies can introduce noise that makes it more difficult to detect a signal (i.e., in this case, the effect of 12 step mutual help groups). Controlling for study level parameters helps remove this noise (Simpson, 1951). In this study, follow-up windows were not entirely uniform across the 6 trials. We handled the follow-up timing two ways. First, we conducted statistical models in which we treated follow-up timing as ordinal, allowing us to compare follow-up assessments ordered from most proximal to the end of treatment to the most distal. Second, we treated time as cardinal (i.e., weeks), although this reduced our power because the follow-up measurements did not line up. We relied on the ordinal data for our primary analysis to maximize the number of follow-up observations and then used the cardinal timing in a sensitivity analysis.

The key predictor of interest was 12 step mutual help group attendance by drug use disorder patients. This primarily means attendance at groups such as Cocaine Anonymous, Crystal Meth Anonymous, and Narcotics Anonymous. However, it also includes some AA meetings because some illicit drug use disorder patients attend AA (including some who have no alcohol use disorder). Because multiple trials used pooled questions (e.g., “How many AA/CA/NA meetings did you attend?”) and other three did not assess the same groups, we do not know the precise proportion of different types of meetings attended. That said, looking at individuals who had attended at least one 12 step mutual group meeting by the end of treatment, Carroll reported that among patients receiving 12 step group facilitation, 46% attended at least one AA meeting, 77% attended Narcotics Anonymous, and 9% attended Methadone Anonymous; Crits-Cristoph reported for all patients that 22% attended AA, 28% attended Narcotics Anonymous, and 4% had attended Cocaine Anonymous; and Donovan reported that 54% attended AA, 58% attended Narcotics Anonymous, and 9% attended Cocaine Anonymous and/or Crystal Meth Anonymous.

The trials differed in the time windows they used to collect information on 12 step mutual help group attendance (e.g., past 30 days vs. past 12 weeks). This resulted in considerable heterogeneity in the number of group meetings attended. We handled this heterogeneity in two ways. First, we pooled all measures of attendance. Second, in our statistical models, we

included clinical trial as a fixed effect, which removes the level differences between the trials to focus on the variation within the trials.

3. Results

3.1 Analysis of Twelve Step Facilitation Interventions as Predictors of 12 Step Mutual Help Group Attendance

We examined the utility of randomization to a 12-step facilitation condition as an instrumental variable. Two criteria are considered necessary for such analysis. The first is whether the instrument itself is free from self-selection, whereby the only way for it to impact the outcome is by affecting 12 step mutual help group attendance. Treatment assignment meets this first criteria because it was chosen at random. Second, the instrumental variable must not only be significantly associated with the biased covariate (12 step mutual help group attendance), but it must be a particularly strong predictor (conventionally, the standard is a partial F test of >10). Weak instruments introduce so much error that the "cure is worse than the disease" (Bound, Jaeger, & Baker, 1995; Stock, Wright, & Yogo, 2002).

Table 2 shows that assignment to a twelve step facilitation treatment condition predicted .19 (SE 1.25) more 12 step group meetings attended. 12 step facilitation had a statistically significant impact on group meeting attendance at the $p < .05$ at some waves, but overall this difference was not large enough to meet the stringent power demands of an instrumental variables analysis (i.e., the second criteria for instrumental analysis was not met). Analyses stratified by gender showed a similar result. We also analyzed whether treatment assignment was associated with the odds of any 12 step mutual help group attendance, but again the size of the effect was not sufficient for the demands of instrumental variables models. Across all models, the treatment assigned did not reach a partial F statistic greater than 3. Thus, even though within the individual trials the facilitation interventions produced statistically significantly increases in 12 step group attendance, the effect was not strong enough to meet the demands of an instrumental variables analysis. We thus abandoned our plans to estimate a two-stage residual inclusion estimator (Terza, Basu, & Rathouz, 2008).

These models also yielded one other important negative finding, namely that with the substantial statistical power of a large, diverse sample, we found no effect of race or sex on 12 step group attendance overall, nor was race a predictor within the male and female samples.

3.2 Analysis with fixed and random effects regression

To further examine the relationship between 12 step group attendance and substance use outcomes, we used more traditional regression models. Because we had repeated observations for each participant, we considered a random effect and a fixed effect (i.e., a dummy variable) for each person. The fixed-effect regression model removes any fixed differences across people, therefore we did not include baseline demographic variables because they were perfectly collinear with the person fixed effect. The results from the fixed effects models can be interpreted as what happens when a person changes their level of 12

step group attendance. The random effect model is more efficient than the fixed effect model, but it assumes the variation across individuals is random and uncorrelated with the error term. Data analysts choose fixed or random effects based on preference, Hausman (1978) tests, or report both models. We chose the latter approach. We correlated changes in participants' ASI drug and alcohol composite scores with changes in their 12 step mutual help group attendance, using both the random effect and fixed model. These analytical models cannot rule out selection bias as can an instrumental variables analysis; instead they estimate the relationship between changes in 12 step group attendance and changes in the illicit drug and alcohol composite scales. The covariates in these models were identical, and being from linear models, the coefficients are directly comparable. We ran stratified analysis by baseline drug composite scores based on a median split of 0.19 and by gender.

Table 3 shows the summary information from the fixed and random effects regression models. In the random effect model, 12 step group attendance was negatively associated with drug composite scores (beta=−0.0002, SE 0.00001; $p<0.01$). The stratified analyses also showed negative correlations, but with some notable differences. The effect was more pronounced among people who had a more versus less severe baseline drug composite scores, perhaps due to a floor effect. The association was present among men and women, but the size of the effect of was larger for the latter. Once the fixed effects were added to the models, these associations remained significant.

The random effect models yielded effects for the alcohol composite score that were significant and generally larger than the drug composite results. In the model with all participants, greater attendance at 12 step group meetings was associated with a −0.0004 (SE=0.0001; $p<0.001$) alcohol composite score decrease. After including the person fixed effects, the associations remain similar in size and highly significant. The only participants for whom 12 step group attendance and ASI alcohol composite scores were not associated was the subsample for people with a more severe drug composite score at baseline.

We also ran the same models using at outcomes use of individual substances as measured by a past 30 days item within the ASI (see Table 4). Days of use decreased significantly for all four substances.

4. Discussion

Pooling data across 6 published trials enabled this study to estimate the impact of 12 step mutual help group attendance in what we believe is the largest and most diverse sample of people with illicit drug use disorders examined to date. The two analytic approaches yielded different but equally intriguing results.

Even though 12 step facilitation produced a statistically significant increase in 12 step mutual help group attendance in the individual clinical trials examined (e.g., increasing the odds of any attendance by as much as 60% over controls), the causal link was not strong enough to meet the greater demands of an instrumental variables approach in terms of amount of variance explained. This is an important negative result: 12 step facilitation interventions have limited ability to increase mutual help group participation among drug

use disorder patients. This is in marked contrast to our prior study of alcohol-focused trials. In that study, using a virtually identical methodological approach of pooling clinical trials, individuals who received a 12 step group facilitation intervention had double to triple the amount of AA attendance as controls at every follow-up point (Humphreys, Blodgett, & Wagner, 2014). The differences between the results of our alcohol and illicit drug focused studies were not limited to relative differences in 12 step group attendance across comparison groups. In several of the drug trials studied here, average attendance at 12 step mutual help groups for patients receiving 12 step facilitation was lower in absolute terms than that of average attendance of the *control* patients in our alcohol study. A final indicator of the relative difficulty of increasing 12 step mutual help group attendance of people with illicit drug use disorders is that two published trials could not be employed here because their 12 step facilitation intervention did not increase mutual help group attendance more than did comparison treatments not including such facilitation (McKay et al. 2005; Najavits et al., 2018).

Why is promoting 12 step mutual help group involvement apparently more difficult in drug use disorder patients than alcohol use disorder patients? AA has more meetings than all illicit drug-focused mutual help organizations combined (Humphreys, 2004). This makes it practically harder for someone to get as involved in, say, Crystal Meth Anonymous, than AA, with or without a clinical nudge from 12 step facilitation. A non-competing explanation is that individuals addicted to illicit drugs, especially opioids and stimulants, may on average have more challenging lives than those addicted to alcohol, requiring more support for them to build a sustained relationship to a recovery community. Supporting this conjecture, 51% of individuals in this study were unemployed, versus only 23% of individuals in our prior pooled AA analysis (Humphreys, Blodgett, & Wagner, 2014). More generally, a large, nationally-representative, survey of recovering persons found that compared to those with primary alcohol or cannabis histories, those with primary opioid or stimulant use disorder histories had substantially lower levels of recovery capital and quality of life in the early years of recovery (Kelly et al, 2018) and needed services to sustain remission (Hoffman et al, 2019). These speculations would support evaluation of more intensive methods of linking drug use disorder patients to 12 step mutual help groups than are generally needed for alcohol use disorder patients. An expansion of online 12 step group meetings for people with drug use disorders could also be useful for individuals living in areas with few face-to-face groups.

The relatively modest effect of 12 step facilitation on drug use disorder patients' 12 step mutual help group attendance has an unfortunate implication for evaluation in that it would seem to rule out instrumental variables models, which are superior at eliminating selection bias from estimates of effectiveness. That said, despite their risk of bias, more traditional regression models can be informative, particularly in the present study when the sample is large and diverse enough to generate precise and generalizable estimates.

Our first set of models also included a more optimistic null result: Neither race nor sex predicted whether individuals with drug use disorders participated in 12 step groups. Considered in combination with two other studies reaching the same conclusion with large samples (Humphreys et al., 1994; Hillhouse & Fiorentine, 2001), we can conclude

confidently that the fact that 12 step groups were originally founded by white males is no bar to equal participation in them today by women and people of color.

Regression models here identified a predictive association between greater 12 step group attendance and fewer drug problems. In the stratified analyses, these associations were stronger among individuals with more severe drug problems at baseline and among women. Greater 12 step group attendance had an even larger and more consistent association with reduced alcohol problems. Because ASI composites are not highly sensitive to change, these associations should be seen as conservative. Also, because most patients who seek professional treatment in the U.S. have previously tried 12 step mutual help groups (Humphreys, Kaskutas, & Weisner, 1998), treatment-based studies such as ours may understate effectiveness because they leave out individuals who respond so well to 12 step groups that they never need professional treatment at all.

Regressions examining days of use of individual substances found that all were negatively associated with greater 12 step group attendance. This is consistent with 12 step organizations' goal of promoting abstinence from all substances, even those that may not be a member's focal problem.

As mentioned, we excluded two prior studies of 12 step group facilitation with drug use disorder patients because the facilitation condition did not predict group involvement (McKay et al. 2005; Najavits et al., 2018). Whether including these studies would have changed the results of the fixed and random regression models examining the relationship of mutual help group involvement to substance use outcomes is unknown.

Pooling the data across the six trials provided unique insights into the association between 12 step group attendance and drug use and problems. However, it also created a number of methodological challenges. This study's pooled analysis had to focus on outcomes and covariates that were measured in all of the trials, omitting other variables that were trial specific. Also, the trials represent work published over a 15-year span in which environmental predictors of recovery and relapse (e.g., availability of opioids) changed significantly, potentially introducing heterogeneity that reduced power to detect effects. Other sources of heterogeneity include differences in participants' drug use disorders and other problems, and the varied structure and approach of the many treatment programs involved in the multi-site trials we examined.

Because the trials from which we were drawing had different methods of measuring 12-step group attendance, we cannot determine how much the effects here are due to drug use disorder patients with co-occurring alcohol problems going to AA, but one possible explanation for the results is that AA has a larger effect on alcohol use than illicit drug focused mutual help groups have on their respective target drugs. Our clinical and research experience is that some individuals who attend both AA and an illicit drug-focused fellowship report that "the sobriety is better in AA", which is usually a reference to that organization having more long-term members available to sponsor (indeed, some drug involved individuals who have never consumed alcohol attend AA for their illicit drug problem and have been shown to do as well in AA as NA; Kelly, Greene, Bergman, 2014).

Testing this hypothesis remains a worthy goal for future studies of the impact of self-help groups on the course of substance use disorders.

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Highlights

- This is the largest, most diverse sample of illicit drug use disorder patients employed in a study of 12 step mutual help groups
- Facilitation of drug user disorder patients' involvement in 12 step mutual helps appears more challenging than facilitating involvement of alcohol use disorder patients
- Participation in 12 step groups by drug use disorder patients is associated with reduced substance use and problems over time

Table 1:

Characteristics of Included Trials of Twelve-Step Facilitation (TSF)

Author (Year)	Common treatment elements	N	Experimental conditions	Format	12-step Group Measurement
Carroll et al. (2012)	Daily methadone and group counseling	112	TSF (based on MATCH) vs 2 other therapies	12 week individual treatments	AA, NA, and MA measured separately
Crits-Christoph et al. (1999)	Group drug counseling	487	TSF based counseling vs 3 other therapies	24 week individual treatments	AA, CA, and NA measured separately
Donovan et al. (2013)	Community-based treatment program	471	TSF vs traditional drug counselling	8 week group and individual treatments	AA, CA, CMA, and NA measured separately
Petry et al. (2010)	Vouchers for attendance, draws for "homework" completion	170	TSF facilitation vs contingency management	24 week group treatment	All groups combined in one question
Schottenfeld et al. (2011)	Attendance reward vouchers	145	12 step vs community reinforcement	12 weeks of twice/week + 12 weeks of 1/week individual treatment	All groups combined in one question
Timko et al (2006)	Weekly outpatient therapy	345	Intensive vs standard referral to twelve-step groups	Two sessions	All groups combined in one question

Note: CMA = Crystal Meth Anonymous, MA = Methadone Anonymous

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Table 2:

Prediction of 12 Step Meeting Attendance from Assignment to 12 Step Facilitation Condition

	All Persons		Male		Female	
VARIABLES	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Assigned to 12 step facilitation	0.17	(1.25)	0.65	(2.52)	−0.00	(0.72)
Time after treatment						
1	2.73***	(0.38)	4.38***	(1.14)	1.56***	(0.22)
2	0.17	(0.39)	−0.92	(1.15)	1.11***	(0.22)
3	1.16**	(0.40)	2.09	(1.22)	0.74***	(0.23)
4	0.05	(0.42)	0.55	(1.30)	−0.15	(0.23)
5	0.39	(0.45)	0.92	(1.46)	0.18	(0.25)
6	0.19	(0.45)	0.66	(1.46)	0.00	(0.25)
7	0.67	(0.86)	A		0.49	(0.42)
Trial Data source						
Donovan	Reference					
Carroll	−6.24*	(2.65)	−8.96	(5.00)	−3.96*	(1.65)
Crits-Cristoph	−10.80***	(1.77)	−13.14**	(4.47)	−9.52***	(0.91)
Petry	−12.24***	(2.36)	−14.01**	(4.46)	−11.81***	(1.46)
Schottenfeld	21.83***	(2.66)	A		24.59***	(1.21)
Timko	37.64***	(2.27)	36.57***	(3.76)	75.87***	(3.94)
More than high school education	0.23	(1.32)	−0.84	(2.69)	1.00	(0.75)
Non-Hispanic Caucasian	Reference					
Non-Hispanic Black	1.36	(1.38)	1.80	(2.80)	0.61	(0.79)
Other race	1.75	(2.04)	1.75	(3.85)	2.24	(1.26)
Married	Reference					
Living alone	−0.15	(1.73)	−1.24	(3.81)	0.13	(0.92)
Separated	1.36	(1.48)	0.69	(2.92)	1.82*	(0.87)
Full time	Reference					
Not employed	−0.11	(1.86)	0.80	(3.57)	−0.77	(1.14)
Part time	−0.10	(1.45)	0.99	(3.01)	−0.69	(0.84)
Male Sex	0.05	(1.50)				
Age	−0.04	(0.08)	−0.14	(0.17)	0.09	(0.05)
Constant	12.60***	(3.46)	17.84*	(7.11)	6.97***	(1.98)
Observations	8,514		2,791		5,723	
Number of Subjects	1,632		751		881	

Note. A= Insufficient participants to generate estimate. SE = Standard errors

*** p<0.001

** p<0.01

* p<0.05

Table 3:

Association between 12 step group Meeting Attendance and Addiction Severity Index Composite Scores using Person Level Random and Fixed Effects

Drug Composite	All Persons	Less severe Drug composite	More Severe Drug Composite	Men	Women
Person Random Effect					
Attendance (number)	−0.0002 **	−0.0001	−0.0004 ***	−0.0002 *	−0.0009 ***
95% CI	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Observations	4,656	1,912	2,744	1,694	2,962
Number of Subjects	1,456	690	766	689	767
Person Fixed Effect					
Attendance (number)	−0.0003 **	−0.0001	−0.0006 **	−0.0003	−0.0003
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Observations	4,715	1,933	2,782	1,738	1,738
Number of Subjects	1,485	703	782	713	713
Alcohol Composite					
Person Random Effect					
Attendance (number)	−0.0004 ***	−0.0007 ***	−0.0000	−0.0004 ***	−0.0005
95% CI	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0003)
Observations	4,657	1,913	2,744	1,693	2,964
Number of Subjects	1,456	690	766	689	767
Person Fixed Effect					
Attendance (number)	−0.0006 ***	−0.0009 ***	−0.0002	−0.0006 ***	−0.0013 **
95% CI	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0005)
Observations	4,717	1,934	2,783	1,737	2,980
Number of Subjects	1,485	703	782	713	772

*** p<0.001

** p<0.01

* p<0.05

Standard Errors in parentheses

Severity of drug problem based on median split (0.19) of baseline ASI drug composite score

Table 4:

Association between 12-step group attendance and days of substance use in the past 30 days at follow-up

	Alcohol	Cocaine	Heroin	Cannabis
Person level fixed effect				
Number of Meetings	−0.0192**	−0.0152**	−0.0062**	−0.0137**
	(0.0030)	(0.0030)	(0.0015)	(0.0027)
Observations	5,297	5,297	4,623	4,146
Number of persons	1,492	1,492	1,483	1,183
Person level random effect				
Number of Meetings	−0.0246**	−0.0094*	−0.0053*	−0.0122**
	(0.0035)	(0.0036)	(0.0018)	(0.0032)
Observations	5,230	5,230	4,562	4,090
Number of persons	1,463	1,463	1,454	1,157

* p<.01

** p<.001

Note. Fixed effect model controls for followup visit.

Random effect model controls for followup visit, study dummy variable, education status, race, employment, gender and age.