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Stopping smoking during first year of substance use treatment predicted 9-year alcohol and drug treatment outcomes

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Abstract

This study examined the association between stopping smoking at 1 year after substance use treatment intake and long-term substance use outcomes. Nine years of prospective data from 1,185 adults (39% female) in substance use treatment at a private health care setting were analyzed by multivariate logistic generalized estimating equation models. At 1 year, 14.1% of 716 participants who smoked cigarettes at intake reported stopping smoking, and 10.7% of the 469 non-smokers at intake reported smoking. After adjusting for sociodemographics, substance use severity and diagnosis at intake, length of stay in treatment, and substance use status at 1 year, those who stopped smoking at 1 year were more likely to be past-year abstinent from drugs, or in past-year remission of drugs and alcohol combined, at follow-ups than those who continued to smoke (OR = 2.4, 95% CI: 1.2 – 4.7 and OR = 1.6, 95% CI: 1.1 – 2.4, respectively). Stopping smoking at 1 year also predicted past-year alcohol abstinence through 9 years after intake among those with drug-only dependence (OR = 2.4, 95% CI: 1.2 – 4.5). We found no association between past-year alcohol abstinence and change in smoking status at 1 year for those with alcohol dependence or other substance use diagnoses when controlling for alcohol use status at 1 year. Stopping smoking during the first year after substance use treatment intake predicted better long-term substance use outcomes through 9 years after intake. Findings support promoting smoking cessation among smoking clients in substance use treatment.

Keywords

longitudinal data; tobacco; alcohol; substance use; treatment

1. INTRODUCTION

Smoking rates among those with substance use disorders are three to four times higher than among the general population (Batel et al., 1995; Burling et al., 1997; Hurt et al., 1993; Kalman, 1998; Leed-Kelly et al., 1996; National Institute on Drug Abuse, 1998; Richter et

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al., 2001; Sobell et al., 2002). In a U.S. general population sample, individuals with drug abuse or dependence in the past year were 3.2 times more likely to have a concurrent DSM-IV nicotine dependence disorder, independent of sociodemographics and comorbid psychiatric disorders (Compton et al., 2007). Data from the 2008 National Survey on Drug Use and Health (USDHHS, 2009) showed a high smoking prevalence among adults who met the DSM-IV criteria for alcohol or drug abuse or dependence, 54.8% and 71.6%, respectively. Among individuals who received any alcohol or other drug treatment in the past year, 75% smoked cigarettes (USDHHS, 2009).

A 24-year follow-up study of 405 heroin-dependent criminal offenders admitted to court-ordered treatment found that smokers were more likely to relapse to heroin use and excessive drinking (Hser et al., 1994). The mortality rate for smokers was nearly four times higher than for nonsmokers (21% vs. 6%) (Hser et al., 1994). A 33-year follow-up of 581 heroin addicts found that long-term (5 or more years) heroin abstinence was associated with abstinence from tobacco and other drugs in the previous year (Hser et al., 2001). A 12-year longitudinal study of 845 patients (75% were cigarette smokers) admitted to inpatient substance use treatment showed tobacco-related mortality rates twice as high as for the general population; half the deaths were tobacco-related (Hurt et al., 1996). The close relationship between tobacco dependence and substance use disorders has significant clinical implications, and substance use treatment is a setting uniquely appropriate for addressing both.

Considerable evidence based on adult populations supports the finding that smoking cessation attempts or concurrent smoking cessation and substance use treatment does not interfere with clients' recovery from substance use disorders (Cooney et al., 2009; Prochaska et al., 2004; Reid et al., 2008; Stein et al., 2006). Indeed, growing evidence suggests that smoking cessation treatment (Prochaska et al., 2004) or smoking abstinence (Friend and Pagano, 2005b; Kohn et al., 2003; Lemon et al., 2003; Satre et al., 2007; Shoptaw et al., 2002a) during or after substance use treatment is associated with abstinence from substance use.

The research on the association between smoking and substance use outcomes however is limited by a lack of longer follow-ups. Most studies did not exceed 18 months, and none examined prospectively the impact of smoking on long-term outcomes. In this study, we utilized 9-year data from two large randomized trials conducted with adult clients admitted to substance use treatment (Weisner et al., 2000; Weisner et al., 2001); one of the study samples (Weisner et al., 2001) was used in two previous investigations of the cross-sectional relationship between smoking and substance use status at 1 and 5 years, respectively (Kohn et al., 2003; Satre et al., 2007). This study examined the prospective association between stopping smoking in the first year after intake and three substance use outcomes at 5, 7, and 9 years: past-year abstinence from alcohol and drug use separately, and past-year remission (either complete abstinence or non-problem use for alcohol and drugs). We hypothesized that clients who smoked at intake but reported no longer smoking at 1 year later would more likely report at subsequent follow-ups past-year abstinence from alcohol and drugs and past-year remission in comparison to clients who continued to smoke cigarettes.

2. METHODS

2.1. Treatment programs

The study site was Kaiser Permanente (KP) Chemical Dependency Recovery Program (CDRP) in Sacramento, California, a private, nonprofit, group-model health plan covering 40% of the commercially insured population of the region. The CDRP provides traditional outpatient and day hospital programs. Both programs are abstinence-based and offer the

same content, including supportive group therapy, education, relapse prevention, and family therapy, with individual counseling available as needed. The day treatment provides four times the intensity of the outpatient program during the first 3 weeks. Both programs last for 8 weeks, with 10 months of aftercare available.

2.2. Study sample

Participants were drawn from two large randomized studies conducted at the study site between 1994 and 1998. The first study compared day hospital to traditional outpatient treatment, and recruited patients between 1994 and 1996 (Weisner et al., 2000). The second examined integrated delivery of medical and addiction services, and recruited patients between 1997 and 1998 (Weisner et al., 2001). The studies provided all patients at intake a study description and the choice of accepting or not accepting random assignment to a study arm. In the day hospital study, participants were randomized to receive either day hospital treatment or usual outpatient treatment (Weisner et al., 2000). In the integrated care study, participants were randomized to receive usual or integrated care (Weisner et al., 2001). Those who refused randomization or were unable to be randomized but agreed to participate in other aspects of the studies were also recruited and received “treatment assignment as usual.” Interview data were collected at intake, 1, 5, 7, and 9 years. Institutional review board approval was obtained from the Kaiser Foundation Research Institute and the University of California, San Francisco.

The combined data set included 1,951 participants. For this study, we selected participants who had provided smoking status at intake and at 1 year, and at one or more of the 5, 7, or 9 follow-ups interview ($n = 1,185$). Multivariate comparison of participants included ($n = 1,185$) and excluded ($n = 766$) found that the latter were less likely to report 30-day abstinence of alcohol use at 1 year (OR = 0.64, 95% CI: 0.44 – 0.93; $p = 0.02$), had a lower drug ASI severity composite score (OR = 0.13, 95% CI: 0.03 – 0.68; $p = 0.015$) and a higher family/social ASI severity composite score (OR = 2.05, 95% CI: 1.04 – 4.05; $p = 0.038$) at intake.

2.3. Measures

Data at intake were obtained with in-person interviews, follow-up data were obtained by telephone interviews, with response rates of 86%, 81%, 84% and 75% at 1, 5, 7, and 9 years, respectively.

2.3.1. Change in self-report smoking status between intake and 1 year—At each assessment, if participants responded yes to the question, “Are you currently smoking cigarettes?” they were categorized as smokers. Based on the responses obtained on the single question at intake and 1 year, four groups were created: 1) Continued smoking (reported smoking at both interviews); 2) Stopped smoking (reported smoking at intake but not smoking at 1 year); 3) Remained non-smoking (reported not smoking at both interviews); and 4) Started smoking (reported not smoking at intake but smoking at 1 year).

2.3.2. Demographics—At intake, we assessed the variables of age (18–39, 40–55, 55 years and older), gender, race/ethnicity (white, African American, Latino/Hispanic, other), marital status, education (no college, some college, or more), employment status (employed full time, part-time, not employed), and income (less than \$40,000 per year or at least \$40,000 per year). We obtained self-reported health status from a 5-point poor-to-excellent scale.

2.3.3. Addiction Severity Index (ASI)—At each assessment we measured past 30-day severity of substance use and related problems with the alcohol, drug, family/social,

medical, and psychiatric ASI composite scores (range from 0 = no problem to 1.0 = extreme problem) (McLellan et al., 1992).

2.3.4. Substance use diagnoses at intake—We used a checklist of questions from the Diagnostic Interview Schedule for Psychoactive Substance Dependence, *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision; *DSM-IV-TR*; American Psychiatric Association 2000) to provide a *DSM-IV-TR* diagnosis for alcohol and drug (11 substance types) dependence and abuse (Caetano and Raspberry, 2000; Ray et al., 2005; Weisner et al., 2000; Weisner et al., 2001; Weisner et al., 2003).

2.3.5. Length of stay (LOS) in treatment—We measured number of days between intake and last treatment visit based on health plan data (Mertens and Weisner, 2000).

2.3.6. Substance use outcomes—We used ASI questions on alcohol and drug use (both illicit and psychoactive prescription drug use, which includes narcotic analgesics and tranquilizers not as prescribed) to determine substance use status at each assessment. At 1 year, we examined 30-day alcohol and drug abstinence. At 5, 7, and 9 years, we examined three primary substance use outcomes: 1) past-year abstinence from alcohol use; 2) past-year abstinence from drug use; 3) past-year remission of alcohol and drug use. We conducted urinalysis as a validity test of self-reported abstinence at 6 months on 361 randomly selected participants, and found high validity: 2.5% reported no use but tested positive for alcohol, and between 0.9% and 5.8% reported no use but tested positive for other substances (Weisner et al., 2001). Past-year remission was defined as either self-reported past-year abstinence from both alcohol and drug use, or past-year non-problem substance use. Non-problem use was defined as 1) no days of drinking five or more drinks in a day, and drinking no more than four times per month in the past year; or using marijuana no more than once per month in the past year; 2) had no other drug use in the past year; 3) had no problems with friends of family, violent behavior, or suicidal ideations in the prior month, and 4) had no arrests, jail/prison, electronic home surveillance, or visits to a probation or parole officer in the prior year. This definition is consistent with other “non-problem use” and “remission” definitions in the literature (Moos and Moos, 2003; Ouimette et al., 2000) and has been used in previous research with this sample (Mertens et al., 2008).

2.4. Statistical analyses

Data were analyzed using SPSS Version 17.0. Participant characteristics at intake (demographics, specific drug use and substance use diagnoses, ASI composite scores of five domains), treatment assignment, length of stay (LOS) in treatment, and 30-day abstinence at 1 year were compared based on smoking status change at 1 year using chi-square and ANOVAs. To examine predictors associated with the three primary substance use outcomes at 5, 7, and 9 years post-intake, we conducted generalized estimating equations (GEE) for the binary outcomes with logit link in 2 stages. In the first stage, we examined the univariate association between each participant characteristic and each substance use outcome by separate GEE models adjusting for follow-up time points. Selection of variables for inclusion in the second-stage multivariate GEE model was determined by either attaining a p -value < 0.10 at the univariate GEE model, or being one of the a priori variables. The a priori variables included smoking status change at 1 year, 30-day abstinence from substance use at 1 year, treatment assignment, LOS in substance use treatment, and years of intake interview to account for potential cohort variation due to nonspecific time-covariate factors as data collection occurred over a 5-year period. Interactions between smoking status change and each predictor selected for inclusion in the multivariate GEE models were also examined. An interaction effect that attained a p -value < 0.10 and produced improvement in goodness of fit as measured by the Corrected Quasi Likelihood under Independence Model

Criterion (QICC) (Hardin and Hilbe, 2003; SPSS Inc., 2007) were included in the multivariate GEE models.

3. Results

3.1. Sample characteristics and change in smoking status at 1 year

Of 716 participants who smoked cigarettes at intake, 14.1% had stopped smoking at 1 year; of 469 participants who did not smoke at intake, 10.7% smoked at 1 year. The study sample included: 60.6% male, 94.5% under age 55 (mean age = 37.1; SD = 10.6; range: 18 to 77), 86.9% with high school or above education, 62.2% employed, 75.1% white, 57.7% alcohol-dependent with or without drug dependence, 30.5% drug-only dependent, and 11.8% with substance abuse but not dependence. For specific types of drug use at intake, a diagnosis of dependence or abuse was most prevalent for non-cocaine stimulants (28.3%), marijuana (20.0%), cocaine (8.5%) and painkillers (6.4%). Most reported their health as good to excellent (71.7%). More than half (59.0%) were admitted to the day hospital program, 41.0% to the traditional outpatient treatment, and 78.4% overall received random assignment to a treatment condition. The mean LOS in substance use treatment was 10.6 weeks (SD = 14.8; range: < 1 week to 53 weeks). At 1 year, 64.9% and 86.1% reported 30-day abstinence of alcohol use and drug use, respectively (Table 1).

3.2. Comparisons across smoking status change

As shown in Table 1, participants who had stopped smoking at 1 year were more likely to report 30-day alcohol abstinence versus those who continued to smoke (76.3% versus 59.9%, $p = 0.002$); those who continued to smoke were less likely to report 30-day abstinence from alcohol and drugs than those who remained nonsmoking (59.9% versus 69.7%, $p = 0.002$ and 83.1% versus 89.9%, $p = 0.004$, respectively). Those who remained non-smoking at 1 year were older, more educated, more likely to be employed, reported better health status, and less likely to have a drug dependence diagnosis at intake than those who continued to smoke. They also had lower psychiatric severity scores at intake compared to those who had quit or continued smoking. Compared to those who remained non-smoking, those who had started or resumed smoking from being a non-smoker at intake were younger, and more likely to have had both alcohol and drug dependence at intake; they also had the shortest LOS, but similar 30-day alcohol or drug abstinence rates at 1 year, when compared to all other smoking status change groups (Table 1).

3.3. Primary substance use outcomes

At 5, 7, and 9 years, past-year alcohol abstinence rates were 43.1% (of 1,109), 40.6% (of 1,022), and 43.6% (of 984), and past-year drug abstinence rates were 80.1% (of 1,108), 77.4% (of 1,020), and 75.6% (of 984), respectively. The proportions of participants in remission at 5, 7, and 9 years were 52.0% (of 1,106), 52.2% (of 1,018), and 52.3% (of 979), respectively. The abstinence or remission rates of the study sample were statistically similar by time points ($p > 0.05$).

3.4. Stopping smoking and long-term past-year alcohol abstinence

Figure 1 shows the past-year alcohol abstinence rates by smoking status change at 5, 7, and 9 years. Without adjusting for other covariates, participants who had stopped smoking at 1 year were more likely to report past-year alcohol abstinence in subsequent years than those who continued smoking (OR = 1.65, 95% CI: 1.13 – 2.41; $p < 0.01$) or those who had started smoking (OR = 1.86, 95% CI: 1.01 – 3.41; $p = 0.04$). After adjusting for 30-day alcohol and drug abstinence at 1 year, LOS, alcohol and drug ASI scores at intake, specific drug use at intake, treatment assignment, gender, age, marital status, education, ethnicity,

year of intake interview, and time points, the multivariate GEE model revealed a significant interaction effect between smoking status change and substance use diagnosis at intake ($p = 0.037$).

Table 2 presents unadjusted odds ratios predicting past year alcohol abstinence for the full sample as well as two GEE models predicting past-year alcohol abstinence stratified by whether or not the participants had drug-only dependence at intake. Among participants with drug-only dependence at intake, those who had stopped smoking at 1 year had twice the odds of reporting past-year alcohol abstinence through 9 years when compared to those who continued smoking ($OR = 2.35$, 95% CI: 1.22 – 4.51, $p = 0.010$). Among participants at intake with alcohol dependence (with or without drug dependence) or a substance abuse diagnosis, smoking status change was not associated with long-term past-year alcohol abstinence (Table 2).

3.5. Stopping smoking and long-term past-year drug abstinence

Figure 1 shows the past-year drug abstinence rates by smoking status change over time. Prior to adjusting for other covariates, participants who had stopped smoking ($OR = 1.63$; 95% CI: 1.04 – 2.57; $p = 0.03$) or who remained non-smoking ($OR = 1.56$; 95% CI: 1.21 – 2.02; $p = 0.001$) were more likely to report past-year drug abstinence through 9 years than those who continued to smoke (Table 3).

After including other covariates (30-day alcohol and drug abstinence at 1 year, LOS, alcohol and drug ASI scores at intake, specific drug use and substance use diagnoses at intake, treatment assignment, age, income, marital status, education, employment status, self-reported health status, year of intake interview, and time points), the GEE model showed a significant interaction effect between smoking status change and the medical ASI score ($p < 0.01$). The association between smoking status change and past-year drug abstinence at follow-ups remained significant after adjusting for other covariates selected. Participants who had stopped smoking or remained non-smoking were more likely to report past-year drug abstinence than those who continued smoking at follow-ups (Table 3).

3.6. Stopping smoking and past-year remission

Figure 1 shows the past-year remission rates over time by smoking status change. Prior to adjusting for other covariates, compared to those who continue smoking, participants who had stopped smoking ($OR = 1.85$; 95% CI: 1.26 – 2.71; $p = 0.002$) or who remained non-smoking ($OR = 1.50$; 95% CI: 1.22 – 1.86; $p < 0.001$) were more likely to report past-year remission through 9 years (Table 4).

The final multivariate GEE model (Table 4) showed smoking status change significantly predicted past-year remission after controlling for 30-day alcohol and drug abstinence at 1 year, LOS, alcohol and drug ASI scores at intake, specific drug and substance use diagnoses at intake, treatment assignment, gender, age, income, marital status, education, self-reported health status, year of intake interview, and time point. There was no significant interaction effect between smoking status change and each of the covariates included in the multivariate GEE model. Those who had stopped smoking at 1 year were more likely ($OR = 1.59$; 95% CI: 1.06 – 2.40; $p = 0.025$) than those who continued smoking to report past-year remission of substance use through 9 years. Those who remained non-smoking, started or resumed smoking were similar in remission status through 9 years when compared to those who continued smoking.

4. Discussion

This study has provided the longest period of follow-up data to date in examining prospective associations between stopping smoking at 1 year after substance use treatment intake and long-term substance use outcomes over 9 years for a large adult sample entering treatment. We examined three long-term substance use outcomes (past-year alcohol abstinence, past-year drug abstinence, and past-year remission) at 5, 7, and 9 years post-intake and found that stopping smoking at 1 year, based on self-report, was positively associated with all three outcomes at follow-ups. Importantly, the prospective association holds for the most part even when 30-day alcohol and drug abstinence status at 1 year, LOS and other covariates were adjusted. Compared to those who continued smoking, participants who stopped smoking at 1 year had 2.4 and 1.6 times the odds of reporting long-term past-year drug abstinence or remission, respectively. Stopping smoking was also associated with 2.4 times the odds of reporting long-term past-year alcohol abstinence among clients admitted with a drug-only dependence diagnosis. The findings are significant, because they clearly support the clinical value of promoting smoking cessation in substance use treatment. Stopping smoking, which has other large health benefits, also supports long-term alcohol and drug abstinence.

In this outpatient substance use treatment setting where smoking cessation was not an integral part of treatment, the quit rate of 14% at 1 year from the study sample was comparable to the quit rates (12% to 14%) reported elsewhere at 12 to 15 months after treatment intake (Chun et al., 2009; Friend and Pagano, 2005a; Kohn et al., 2003), and rates of 8.5% to 13.5% reported in primary care settings where smoking cessation treatment was not offered (Baillie et al., 1995). However, when compared to the self-report smoking cessation rate of 35% of smoking clients enrolled in the Drug Abuse Treatment Outcome Study (DATOS) (Lemon et al., 2003), the current study's quit rate was low. Participants who had stopped smoking at 1 year had similar LOS in substance use treatment and other characteristics at intake as those who continued to smoke. In prior research (Kohn et al., 2003; Lemon et al., 2003) clients who had stopped smoking at 1 year reported smoking less at intake than those who continued smoking. In this study, consistent with previous studies, those who had stopped smoking at 1 year were more likely to report 30-day alcohol abstinence at 1 year (Friend and Pagano, 2005b; Karam-Hage et al., 2005) than those who continued to smoke. In contrast to prior research where smoking abstinence was associated with drug abstinence (Kohn et al., 2003; Lemon et al., 2003; Shoptaw et al., 2002b), participants in this study who stopped smoking at 1 year were similar to those who continued smoking in 30-day drug abstinence rates at 1 year. Our findings suggest that stopping smoking did not worsen short-term drug use outcomes, which implies that providing support for smoking cessation in the first year after treatment intake would still be of clinical value.

The new finding is that stopping smoking at 1 year predicted past-year drug abstinence and remission through 9 years post-treatment intake, a prospective association not accounted for by 1-year substance use status, by LOS, or by sociodemographic characteristics, substance use severity and diagnoses. Stopping smoking might independently facilitate long-term abstinence beyond its effects from the initial treatment episode. Researchers have suggested that this might reflect shared psychological, biological and behavioral factors in maintaining abstinence from smoking and substance use (Shoptaw et al., 2002b). Smoking abstinence is predictive of short-term abstinence from opioid and cocaine use at the same period (Shoptaw et al., 2002b). Laboratory data showed that cocaine craving could be enhanced by nicotine exposure via nicotine patches (Reid et al., 1998) and reduced by a nicotine antagonist, mecamylamine (Reid et al., 1999). Ecological momentary assessment data have confirmed that craving for tobacco increased craving for other substances and vice-versa (Epstein et al.,

2010). The association between smoking and abstinence from substance use has already been well documented. This study's finding shows an extended benefit – stopping smoking during the first year after substance treatment intake may improve substance use outcomes 9 years later.

An unexpected finding was that stopping smoking predicted past-year alcohol abstinence through 9 years only among those with drug-only dependence, not among those with alcohol abuse or dependence at intake. To better understand this, we conducted a multivariate GEE model with the same set of covariates (Table 2) without 30-day alcohol abstinence at 1 year. In this model (not shown), participants who stopped smoking at 1 year were more likely to report past-year alcohol abstinence through 9 years (OR = 1.58; 95% CI: 1.07 – 2.33; $p = 0.02$) independent of dependence diagnoses at intake. The finding suggested alcohol abstinence status at 1 year might have mediated the relationship between stopping smoking at 1 year and long-term alcohol abstinence at subsequent follow-ups. Among clients with a heavy involvement (abuse or dependence) of alcohol at intake, the prospective association between smoking cessation and long-term alcohol abstinence was entirely explained by short-term alcohol abstinence at 1 year which was facilitated by stopping smoking (Friend and Pagano, 2005b). For these clients with heavy involvement of alcohol at intake, factors that explained long-term alcohol abstinence might be more specific to alcohol use and/or dependence and were unrelated to smoking. In contrast, for those with less alcohol involvement (drug-only dependence at intake), factors common to smoking and alcohol use might explain how smoking abstinence predicted both short- and long-term alcohol abstinence in this subgroup. A prior study of a large sample of middle-age males showed the levels of alcohol involvement determined the strengths of association between alcohol use and smoking (from initiation, progression to continuation) (Kahler et al., 2008). These findings imply that there are different sets of common factors shared between smoking and alcohol use according to alcohol use severity and therefore the association between stopping smoking and long-term alcohol abstinence varies by levels of alcohol involvement at intake.

4.1. Limitations

In this study, smoking status was assessed by self-report using a single item. Nicotine dependence and biochemical verification of smoking status were not assessed, although self-report of cigarette smoking has been shown to be a valid indicator of actual use (Velicer et al., 1992). We did not assess the length of smoking abstinence attained among participants who reported changing from smoking at intake to not smoking at 1 year. Similarly, we did not assess the temporal effect of abstinence from smoking and drug and alcohol use during the first year after substance use treatment intake, i.e., whether abstinence from substance use occurred prior to, concurrent with or after smoking abstinence. However, the sequence is clinically important. Another study examined the timing of smoking cessation intervention among alcoholics in intensive outpatient treatment, and suggested that a 6-month delay in treating tobacco use yielded higher alcohol abstinence at 6 months than concurrent alcohol and tobacco treatment at intake; but alcohol abstinence rates at 12 or 18 months were similar and smoking cessation outcomes did not differ (Joseph et al., 2004). Route of administration data were available only for participants in the first study and not adjusted in the analyses. Our finding of stopping smoking and long-term alcohol outcomes as applied to the drug-only dependent participants may not be generalizable to injection drug users as 95% of the drug-only dependent participants reported smoking as a usual route of administration while 16.7% reported intravenous injection as the usual route based on the available data. Future research should include route of administration in the analyses to better understand the association between change in smoking status and substance use outcomes. Our study sample was drawn from a private program, and findings may not be generalizable to substance use treatment settings of lower socioeconomic status, public, or uninsured

populations. However, this study examined 9-year prospective data for a large sample in a private program that represents the predominant setting for substance treatment in the U.S.

4.2. Conclusions

Using 9-year prospective data from a large sample of adult outpatients entering substance use treatment, we found that having stopped smoking at 1 year predicted both long-term abstinence from substance use and remission status 9 years later, independent of substance use status at 1 year and LOS in treatment. Findings confirm the current consensus that concurrent treatment of smoking cessation and substance use does not worsen substance use treatment outcomes, and indeed smoking cessation could improve long-term abstinence from substance use (Baca and Yahne, 2009; Hitsman et al., 2009; Prochaska, 2010). The findings underscore the clinical significance of integrating smoking cessation intervention for those in substance use treatment. A remaining challenge, however, is the low smoking cessation rates reported from published randomized clinical trials that tested smoking cessation interventions in substance use treatment (Hitsman et al., 2009). Preliminary pilot evidence suggests that the use of a combination of nicotine patch plus nicotine gum (Cooney et al., 2009), and varenicline (Crunelle et al., 2010) are promising in improving long-term smoking and alcohol abstinence in alcohol treatment. Clearly, both qualitative and quantitative research is warranted to better understand the best strategies for promoting smoking cessation in the context of other substance use, or recovery from other substance use.

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Figure 1.
Past-year substance use outcomes at 5, 7, 9 years post-intake by change in self-report smoking status from intake to 1 year.

Table 1

Sample characteristics by change in self-report smoking status.

	All (N = 1185)	Smoking Status Change from Intake to 1 year				p-value*
		Continued smoking (n = 615)	Stopped smoking (n = 101)	Remained non-smoking (n = 419)	Started smoking (n = 50)	
Women	39.4%	37.9%	43.6%	38.9%	54.0%	0.120
Age						
55+	5.5%	4.4%	3.0%	8.4%	0.0%	<0.001
40–54	35.9%	32.4%	33.6%	42.2%	30.0%	
18–39	58.6%	63.2%	63.4%	49.4% <i>a,b,c</i>	70.0%	
Income < 40 K	59.6%	63.6%	62.6%	52.9%	59.2%	0.007
Married	44.6%	39.7%	47.5% <i>c</i>	52.9% <i>a</i>	30.0% <i>b</i>	<0.001
Education						
> = college	42.0%	35.4%	45.5%	51.1% <i>a</i>	38.8%	<0.001
High school graduate	44.9%	47.9%	44.6%	39.6%	55.1%	
< High school	13.1%	16.7%	9.9%	9.3%	6.1%	
Employed	62.2%	57.6%	58.4%	69.8% <i>a,b</i>	62.5%	0.001
Ethnicity						
Other	5.8%	5.6%	9.0%	5.5%	4.1%	0.349
Hispanic	8.8%	6.8%	9.0%	11.5%	10.2%	
African American	10.3%	10.0%	11.0%	10.3%	12.2%	
White	75.1%	77.6%	71.0%	72.7%	73.5%	
Self-reported health status as						
poor/ fair	28.3%	30.7%	26.9%	24.6% <i>a</i>	32.7%	0.168
Dependence diagnosis at intake						
Alcohol & Drug	17.4%	17.4%	21.8%	15.0%	28.0%	0.007
Drug only	30.5%	32.0%	38.6%	25.8% <i>a,b,c</i>	34.0%	
Alcohol only	40.3%	40.0%	29.7%	44.4%	32.0%	
Abuse only	11.8%	10.6%	9.9%	14.8%	6.0%	
Dependence or abuse diagnoses for specific drugs at intake***						

	All (N = 1185)	Smoking Status Change from Intake to 1 year				p-value*
		Continued smoking (n = 615)	Stopped smoking (n = 101)	Remained non-smoking (n = 419)	Started smoking (n = 50)	
Cocaine	8.5%	8.0% ^c	8.9%	7.9% ^c	20.0% ^a	0.03
Marijuana	20.0%	20.0%	26.7%	17.7%	20.6%	0.14
Painkillers	6.4%	5.2%	5.9%	7.9%	10.0%	0.25
Non-cocaine stimulants	28.3%	31.7%	40.6%	19.8% ^{a,b,c}	32.0%	<0.001
ASI Scores at intake, Mean (SD)						
Alcohol	0.41 (0.32)	0.40 (0.32)	0.38 (0.33)	0.42 (0.31)	0.38 (0.33)	0.565
Drug	0.13 (0.13)	0.14 (0.13)	0.15 (0.13)	0.11 (0.12) ^c	0.16 (0.13)	0.003
Family/social	0.37 (0.28)	0.36 (0.28)	0.41 (0.29)	0.36 (0.29)	0.43 (0.28)	0.172
Medical	0.30 (0.41)	0.29 (0.37)	0.30 (0.39)	0.30 (0.37)	0.30 (0.41)	0.926
Psychiatric	0.40 (0.27)	0.40 (0.26) ^c	0.46 (0.28)	0.37 (0.27) ^{b,c}	0.50 (0.26) ^a	<0.001
Length of stay (weeks), Mean (SD)						
in treatment	10.6 (14.8)	10.0 (14.0) ^c	13.0 (17.1) ^c	11.5 (15.9) ^c	5.9 (8.1) ^{a,b}	0.015
30-day abstinence at 1-year post intake						
Alcohol abstinence	64.9%	59.9% ^b	76.3% ^a	69.7% ^a	63.2%	<0.001
Drug abstinence	86.1%	83.1%	89.1%	89.9% ^a	84.2%	0.009

Notes: ASI = Addiction Severity Index

* p-values for the comparison among smoking status change groups.

** Not mutually exclusive. Other drug dependence or abuse diagnoses endorsed by < 3% of the study sample not presented, which included barbiturate (0.5%), hallucinogen (1.0%), heroin (1.1%), methadone (0.6%), inhalants (0.2%), PCP (0.2%), Tranquilizer (2.8%), and other drugs (1.0%).

^a $p < 0.05$ when compared to the continued smoking group.

^b $p < 0.05$ when compared to the stopped smoking group.

^c $p < 0.05$ when compared to the started smoking group.

Selected univariate and multivariate predictors of past-year alcohol abstinence by intake substance use diagnosis at 5-, 7-, and 9-year post-intake.

Table 2

	<i>Substance use diagnosis at intake:</i>			<i>Alcohol dependence, alcohol and/or drug abuse</i>	
	<i>Unadjusted OR¹</i> (95% CI)	<i>p - value</i>	<i>Adjusted OR²</i> (95% CI)	<i>p - value</i>	<i>Adjusted OR²</i> (95% CI)
Changes in self-report smoking status from intake to 1 year					
Started Smoking	0.89 (0.53 – 1.49)	0.655	0.97 (0.51 – 1.83)	0.919	1.66 (0.59 – 4.66)
Remained non-smoking	1.24 (1.00 – 1.55)	0.054	0.99 (0.74 – 1.32)	0.927	1.20 (0.73 – 1.99)
Stopped smoking	1.65 (1.13 – 2.41)	0.009	1.21 (0.73 – 2.02)	0.460	2.35 (1.22 – 4.51)
Continued smoking	Referent		Referent		Referent
Alcohol and Drug use status at 1 year					
Alcohol use					
30-day abstinence	4.38 (3.55 – 5.42)	< 0.001	3.16 (2.32 – 4.31)	< 0.001	4.07 (2.34 – 7.09)
Not abstinent	Referent		Referent		Referent
Drug use					
30-day abstinence	2.91 (2.16 – 3.94)	< 0.001	1.50 (0.91 – 2.46)	0.111	1.26 (0.70 – 2.27)
Not abstinent	Referent		Referent		Referent
Length of stay in treatment (per Week increase)					
	1.004 (1.003 – 1.005)	< 0.001	1.02 (1.01 – 1.02)	0.001	1.03 (1.01 – 1.05)
Alcohol and drug use status and severity at intake					
ASI scores (by increment of 0.10 point)					
Alcohol	1.05 (1.02 – 1.08)	< 0.001	1.03 (0.96 – 1.10)	0.427	0.94 (0.80 – 1.10)
Drug	0.88 (0.82 – 0.95)	0.001	1.14 (0.95 – 1.38)	0.163	1.130 (0.87 – 1.38)
Family/social	1.01 (0.98 – 1.04)	0.717	Not included		Not included
Medical	1.01 (0.99 – 1.04)	0.317	Not included		Not included
Psychiatric	1.02 (0.98 – 1.05)	0.358	Not included		Not included
Dependence diagnosis					
Alcohol & Drug	0.86 (0.62 – 1.19)	0.362	1.35 (0.73 – 2.47)	0.741	--
Drug only	0.82 (0.61 – 1.11)	0.194	--		
Alcohol only	1.44 (1.07 – 1.92)	0.014	1.17 (0.73 – 1.89)	0.505	
Abuse only	Referent		Referent		

<i>Substance use diagnosis at intake:</i>		Alcohol dependence, alcohol and/or drug abuse		Drug dependence only		
Unadjusted OR ¹ (95% CI)	p - value	Adjusted OR ² (95% CI)	p - value	Adjusted OR ² (95% CI)	p - value	
Dependence or abuse diagnosis for specific drugs (Referent: absence of the diagnosis)						
Cocaine	0.57 (0.42 – 0.78)	< 0.001	0.48 (0.25 – 0.92)	0.026	0.91 (0.4 – 2.09)	0.827
Marijuana	0.36 (0.29 – 0.46)	< 0.001	0.82 (0.51 – 1.31)	0.403	0.89 (0.52 – 1.52)	0.668
Pain killers	0.75 (0.51 – 1.12)	0.159	0.64 (0.29 – 1.44)	0.281	2.44 (1.08 – 5.51)	0.031
Non-cocaine stimulants	0.51 (0.41 – 0.62)	< 0.001	0.48 (0.30 – 0.77)	0.002	1.20 (0.64 – 2.24)	0.569

Notes:

¹The unadjusted odds ratios were computed with assessment time points controlled in the GEE model for the corresponding variable without adjusting for other covariates.

²The adjusted odds ratios reported from the final multivariate models were adjusted with the predictors shown in the table and the following covariates that are not shown in the table: treatment assignment, gender, age, marital status, education, ethnicity, year of intake interview, and time points (5, 7, 9 years). Income, employment status, and self-reported health status were not included in the final multivariate models because their unadjusted ORs did not attain p-value < 0.10.

Table 3

Selected univariate and multivariate predictors of past-year drug abstinence at 5-, 7-, and 9-year follow-up.

	Unadjusted OR ¹ (95% CI)	P - value	Adjusted OR ² (95% CI)	P - value
Changes in self-report smoking status from intake to 1 year				
Started Smoking	1.01.04 (0.60 – 1.80)	0.885	1.34 (0.64 – 2.82)	0.438
Remained non-smoking	1.56 (1.21 – 2.02)	0.001	1.57 (1.09 – 2.25)	0.015
Stopped smoking	1.63 (1.04 – 2.57)	0.034	2.37 (1.2 – 4.68)	0.013
Continued smoking	Referent		Referent	
Alcohol and Drug use status at 1 year				
Alcohol use				
30-day abstinence	2.43 (1.97 – 2.99)	<0.001	1.77 (1.33 – 2.35)	<0.001
Not abstinent	Referent		Referent	
Drug use				
30-day abstinence	6.69 (5.15 – 8.69)	<0.001	3.19 (2.26 – 4.51)	<0.001
Not abstinent	Referent		Referent	
Length of stay in treatment (per week increase)	1.004 (1.003 – 1.005)	<0.001	1.01 (1.003 – 1.02)	0.011
Alcohol and drug use status and severity at intake				
ASI scores (by increment of 0.10 point)				
Alcohol	1.13 (1.09 – 1.16)	<0.001	1.04 (0.97 – 1.11)	0.239
Drug	0.63 (0.58 – 0.68)	<0.001	0.81 (0.70 – 0.95)	0.008
Family/social	0.95 (0.92 – 0.99)	0.008	1.02 (0.97 – 1.08)	0.506
Medical	1.05 (1.02 – 1.07)	0.001	--	
Medical × Started Smoking	--		0.95 (0.83 – 1.09)	0.458
Medical × Remained non-smoking	--		0.90 (0.82 – 0.98)	0.018
Medical × stopped smoking	--		0.87 (0.76 – 0.99)	0.036
Medical × Continued smoking	--		Referent	
Psychiatric	0.96 (0.92 – 0.99)	0.025	0.93 (0.88 – 0.98)	0.008
Dependence diagnosis				
Alcohol & Drug	0.50 (0.35 – 0.72)	<0.001	1.25 (0.68 – 2.31)	0.473

	Unadjusted OR ¹ (95% CI)	P - value	Adjusted OR ² (95% CI)	p - value
Drug only	0.45 (0.32 – 0.64)	<0.001	0.86 (0.51 – 1.44)	0.563
Alcohol only	1.67 (1.16 – 2.39)	0.005	1.42 (0.84 – 2.41)	0.193
Abuse only	Referent		Referent	
Dependence or abuse diagnosis for specific drugs (Referent: absence of the diagnosis)				
Cocaine	0.57 (0.42 – 0.78)	<0.001	1.09 (0.67 – 1.77)	0.733
Marijuana	0.36 (0.29 – 0.46)	<0.001	0.66 (0.47 – 0.92)	0.014
Pain killers	0.75 (0.51 – 1.12)	0.159	Not included	
Non-cocaine stimulants	0.51 (0.41 – 0.62)	<0.001	1.29 (0.93 – 1.80)	0.130

Notes:

¹ The unadjusted odds ratios were computed with assessment time points controlled in the GEE model for the corresponding variable without adjusting for other covariates.

² The adjusted odds ratios reported from the final multivariate model were adjusted with the predictors shown in the table and the following covariates that are not shown in the table: treatment assignment, age, income, marital status, education, employment status, self-reported health status, year of intake interview, and time points (5,7,9 years). Gender and ethnicity were not included in the final multivariate model because their unadjusted ORs did not attain p-value < 0.10.

Table 4

Selected univariate and multivariate predictors of past-year remission Status at 5-, 7-, and 9-year follow-up.

	Unadjusted OR ¹ (95% CI)	p - value	Adjusted OR ² (95% CI)	p - value
Changes in self-report smoking status from intake to 1 year				
Started Smoking	1.07 (0.66 – 1.74)	0.786	1.20 (0.70 – 2.06)	0.504
Remained non-smoking	1.50 (1.22 – 1.86)	<0.001	1.23 (0.96 – 1.57)	0.098
Stopped smoking	1.85 (1.26 – 2.71)	0.002	1.59 (1.06 – 2.40)	0.025
Continued smoking	Referent		Referent	
Alcohol and Drug use status at 1 year				
Alcohol use				
30-day abstinence	3.89 (3.22 – 4.71)	<0.001	2.54 (1.99 – 3.23)	<0.001
Not abstinent	Referent		Referent	
Drug use				
30-day abstinence	3.45 (2.59 – 4.58)	<0.001	1.84 (1.28 – 2.64)	<0.001
Not abstinent	Referent		Referent	
Length of stay in treatment				
(per week increase)	1.03 (1.02 – 1.04)	<0.001	1.02 (1.01 – 1.03)	<0.001
Alcohol and drug use status and severity at intake				
ASI scores (by increment of 0.10 point)				
Alcohol	1.00 (0.97 – 1.03)	0.996	Not included	
Drug	0.87 (0.81 – 0.93)	<0.001	0.92 (0.80 – 1.06)	0.234
Family/social	0.99 (0.96 – 1.02)	0.491	Not included	
Medical	1.02 (1.00 – 1.04)	0.058	1.03 (1.00 – 1.06)	0.078
Psychiatric	0.98 (0.95 – 1.01)	0.174	0.95 (0.91 – 0.99)	0.030
Dependence diagnosis				
Alcohol & Drug	0.61 (0.45 – 0.84)	0.002	1.22 (0.75 – 1.99)	0.423
Drug only	0.75 (0.56 – 0.99)	0.047	1.13 (0.73 – 1.77)	0.585
Alcohol only	0.97 (0.74 – 1.28)	0.833	0.99 (0.69 – 1.44)	0.996
Abuse only	Referent		Referent	
Dependence or abuse diagnosis for specific drugs				

	Unadjusted OR ¹ (95% CI)	p - value	Adjusted OR ² (95% CI)	p - value
(Referent: absence of the diagnosis)				
Cocaine	0.69 (0.51 – 0.93)	0.015	0.91 (0.58 – 1.42)	0.670
Marijuana	0.65 (0.53 – 0.81)	0.000	0.82 (0.59 – 1.12)	0.213
Pain killers	1.17 (0.82 – 1.66)	0.396	Not included	
Other stimulants	0.75 (0.63 – 0.9)	0.002	1.08 (0.8 – 1.47)	0.613

Notes:

¹ The unadjusted odds ratios were computed with assessment time points controlled in the GEE model for the corresponding variable without adjusting for other covariates.

² The adjusted odds ratios reported from the final multivariate model were adjusted with the predictors shown in the table and the following covariates that are not shown in the table: treatment assignment, gender, age, income, marital status, education, self-reported health status, year of intake interview, and time points (5,7,9 years). Ethnicity and employment status were not included in the final multivariate model because their unadjusted ORs did not attain p-value < 0.10.