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Self-initiated tobacco cessation and substance use outcomes among adolescents entering substance use treatment in a managed care organization

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Abstract

Purpose—Adolescents with substance use (SU) problems have high rates of tobacco use, yet SU treatment has historically ignored treatment for tobacco use. Barriers to such efforts include the belief that tobacco cessation could compromise other SU abstinence. This study examines self-initiated tobacco cessation and 12-month alcohol and drug abstinence in adolescents entering SU treatment in a private, managed care organization.

Results—Self-initiated tobacco cessation at 6 months, and at both 6 and 12 months, were related to higher odds of drug abstinence but not alcohol abstinence.

Conclusion—Self-initiated tobacco cessation was not related to poor SU outcomes, and may be important to maintaining drug abstinence. Implementing tobacco cessation efforts in SU treatment can be challenging, but comprised SU outcomes may not be a barrier. The positive associations for drug abstinence and lack of associations for alcohol abstinence could be due to differences in motivation, medical conditions, or to the illicit nature of drug use. Tobacco use has serious long-term health consequences, and tobacco cessation efforts in adolescent SU treatment programs need further research.

Keywords

tobacco cessation; substance use; outcomes; treatment; self-initiated

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1. Introduction

Adolescents with substance use)SU) problems have high rates of tobacco use, higher than their non-using peers, and are a complex population to treat. Although SU treatment presents an ideal opportunity to intervene, it has historically ignored treatment for tobacco use. Traditional SU treatment approaches have been heavily influenced by the clinical opinion that trying to quit tobacco use, primarily smoking, could jeopardize treatment participation as well as abstinence from other substances, but empirical evidence has emerged from adult studies that this may not be the case. In fact, these studies have found smoking cessation to be related to improved SU outcomes)Kohn, Tsoh, & Weisner 2003; Lemon, Friedmann, & Stein 2003; Prochaska, Delucchi, & Hall 2004; Satre, Kohn, & Weisner 2007).

Few studies have examined adolescents in SU treatment, and the relationship of tobacco cessation to their SU outcomes)Myers & Kelly 2006). One inpatient treatment study found even those with improved SU outcomes continued to smoke, similar to those who did not have improved SU outcomes)Myers & Brown 1994). A small pilot study of a tobacco cessation intervention in SU treatment found no relationship between quit attempts and SU outcomes, with the authors concluding that a tobacco intervention was not detrimental to SU outcomes) Myers & Brown 2000). A recent study found no evidence that a smoking ban resulted in lower completion rates among adolescents in SU treatment, although staff disliked policing smoking behavior and found implementing smoking bans difficult)Callaghan et al. 2007). Other studies of smoking among adolescents in SU treatment have focused on smoking outcomes)Myers 1999; Myers & Brown 2005; Myers & MacPherson 2004). Substance-using adolescents do exhibit interest in tobacco cessation. A study of adolescents receiving inpatient or outpatient SU treatment found that over half had tried to quit smoking in the last year, although it was difficult to maintain and most had resumed smoking within six months)Myers & MacPherson 2004).

Despite the challenges, SU treatment offers a unique opportunity to intervene with tobacco-using youth, who are at risk of serious health conditions. In addition, integrating tobacco cessation treatment with other SU treatment may be important for attaining and continuing SU abstinence. The use of tobacco may cue the use of other substances, and there is evidence that alcohol can potentiate the effects of nicotine)Myers, Doran, & Brown 2007; Rose et al. 2002). This study contributes to the literature by examining self-initiated tobacco cessation) cigarette, cigar, and chewing tobacco) and SU)alcohol and drug) outcomes 12 months post-intake in a large sample of adolescents entering outpatient SU treatment in a private, managed care organization where cessation was encouraged but not formally addressed. We examine both alcohol and drug outcomes because previous research with this sample has found correlates of alcohol and drug outcomes to vary)Sterling & Weisner 2005).

“Self-initiated” cessation refers to appearing to quit tobacco use without participating in a formal cessation effort)Sussman 2002). There have been relatively few studies of self-initiated adolescent tobacco cessation)Sussman 2002). A meta-analysis of 17 adolescent studies found higher quit rates for self-initiated cessation studies compared to formal tobacco cessation program studies, and hypothesized that this could be related to lower baseline levels of tobacco use among those who self-initiated cessation. However, this review did not include studies of adolescents in SU treatment. Findings from the present study can inform the discussion as to whether tobacco cessation is a risk factor for poor SU outcomes for youth in treatment, and inform studies of more formal tobacco cessation efforts for this high-risk group.

1.1. Conceptual framework

The primary relationship of interest is self-initiated tobacco cessation and SU outcomes. However, SU and treatment outcomes are influenced by many factors; thus we also examine

individual, treatment, and social environment measures that the literature has shown to be predictive of adolescent SU outcomes, to control for competing explanations. **Individual factors** include demographic characteristics, treatment motivation/readiness, SU severity, psychiatric, and legal problems. SU prevalence rates vary by ethnicity, age, and gender. Native Americans tend to report the highest use rates for many substances, older youth tend to be more severe at treatment entry, and girls' rates have recently approached those of boys for some substances)Rounds-Bryant & Staab 2001; Wallace et al. 2002; Wallace et al. 2003). Those with less motivation/readiness for treatment, higher SU severity, more psychiatric and legal problems, and who are older at treatment entry tend to demonstrate poorer SU outcomes) Grella, Hser, Joshi, & Anglin 1999; Melnick, De Leon, Hawke, Jainchill, & Kressel 1997; Rowe, Liddle, Greenbaum, & Henderson 2004). **Treatment** factors include length of stay in SU treatment, which is associated with improved SU outcomes)Hser et al. 2001; Sterling & Weisner 2005). **Social environment** factors include whether family and friends are using substances, which have shown a relationship with ongoing SU)alcohol or drug) and severity) Simons-Morton & Chen 2006; Wu, Lu, Sterling, & Weisner 2004). Thus, we include whether the youth lives with someone with a SU problem and peer SU in our models. Drawing on the adult literature and controlling for these model domains, we hypothesize that tobacco cessation between baseline and 12 months post-intake will be associated with improved SU outcomes at 12 months.

2. Methods

2.1 Data sources and recruitment

Data are from a study of 419 adolescents aged 13–18 entering treatment at four SU treatment programs at Kaiser Permanente)KP) Northern California, a large, nonprofit integrated health care delivery system. KP Northern California covers approximately 3.4 million members, 88% commercially insured, 10% insured through Medicare, and 2% through Medicaid. Of the adult membership, 78% has at least some college education)Gordon 2000), and approximately two-thirds of the families report annual household incomes between $30,000 and $75,000.

The four sites were selected for their geographic and population diversity. The treatment programs had similar staffing, treatment content and philosophy. Across sites, the proportion of Latinos ranged from 12% to 28%, African Americans from 5% to 49%, Native Americans from 6% to12%, and Asian Americans from 2% to 10%. The overall sample was 34% female, and had an average age of 16 years at intake)Sterling, Kohn, Lu, & Weisner 2004).

We approached patients age 18 and under at intake to the adolescent SU clinics. We recruited 64% of those who had an intake assessment)83% who had both an intake assessment and orientation session), regardless of whether they continued in the program. Patients were accompanied by a parent and, following assessment by a clinician, a research assistant explained the study and obtained consent to participate from both adolescent and a parent. Study participation was independent of receiving program services; staff did not know who was participating)Sterling & Weisner 2005). Recruitment occurred between May 2000 and June 2002. The study was approved annually by the institutional review boards of Kaiser Foundation Research Institute and the University of California, San Francisco)Sterling & Weisner 2005).

A review of intake charts indicated no differences in gender, age, school enrollment, or parental alcohol or drug problem between the study sample and those not recruited)Sterling & Weisner 2005). More Native Americans)9% vs. 3%, χ^2)1, N=622)=6.97, p<.01))p<.05) participated in the study, and more Whites were in the non-recruited group)65% vs.49%, χ^2)1, N=622) =13.13, p<.01). Compared to those not recruited, a greater percentage in the study had diagnoses of Depression)24% vs.13%, χ^2)1, N=635)=10.13, p<.05), Anxiety)7% vs. 2%,

χ^2)1, N=635)=6.95, p<.05), Conduct Disorder w/ODD)16% vs. 3%, χ^2)1, N=635)=22.50, p<.01), ADHD)10% vs. 3%, χ^2)1, N=635)=8.74, p<.05), and had used inhalants)13% vs. 7%, χ^2)1, N=635)=5.60, p<.05), club drugs)21% vs. 6%, χ^2)1, N=635)=23.92, p<.01), tobacco)75% vs. 57%, χ^2)1, N=635)=21.09, p<.01), Ritalin)12% vs. 0.9%, χ^2)1, N=635)=22.38, p<.01), and painkillers)25% vs. 8%, χ^2)1, N=635)=24.96, p<.01). A greater percentage of those not recruited had used barbiturates)6% vs. 2%, χ^2)1, N=635)=5.39, p<.05))Sterling & Weisner 2005).

The study included interviews at treatment entry, and at 6 and 12 months following entry. At baseline, adolescents completed a computerized, self-administered instrument, and a paper and pencil questionnaire that took approximately 1 hour. Research staff conducted 45-minute follow-ups by phone 6 and 12 months after intake. The 6- and 12-month response rates were 91% and 92%, respectively. Participants were given $30 music store gift certificates for completing each interview.

2.2 Treatment programs

KP SU treatment is provided internally rather than contracted out. Each of the four programs offered similar treatment modalities)intensive, structured outpatient treatment))Sterling et al. 2004). Services included supportive group therapy, education, relapse prevention and family therapy. Individual counseling was available as needed. All programs require the participation of a parent or guardian. Programs are abstinence-based, with breathalyzer and urine screening tests conducted randomly. No primary care provider referral is necessary to enter treatment. Regular attendance at NA/AA or other self-help groups is expected and monitored)Sterling & Weisner 2005).

Program length is one year, although actual length varies based on individual needs and problem severity. The programs have three treatment phases. Phase 1 provides intake/assessment and orientation, followed by immediate entry to group treatment. Patients attend treatment three times per week for eight weeks. Phase 2 focuses on continuing recovery and relapse prevention, with two group sessions per week for 8 weeks. The final phase is aftercare, which can last 10 months and entails one group session per week)Sterling & Weisner 2005). Parents are typically required to attend twice a week in the early phase of treatment and once per week during the later phases. The programs do not have a formal tobacco cessation component but discourage use of tobacco products, do not allow smoking on the premises, and can refer to KP health education and smoking cessation services.

2.3 Sample description

At baseline, 85% of the sample reported any alcohol use in the prior 6 months and 45% reported heavy drinking)5+ drinks). Prevalence of other drug use at baseline included marijuana)92%), hallucinogens)25%), party drugs)20%), the misuse of prescription painkillers)25%), stimulants)21%), cocaine)17%), inhalants)12%) and Ritalin/Dexedrine)9%). Fifty-four percent used both alcohol and drugs, and more than half reported using multiple drugs: 20% used two drugs, 10% used 3 drugs, and 21% used more than 3 drugs. The mean age of initiation for 1st substance used was 12 years)*SD*=2.6))46% first used tobacco, 28% alcohol and 27% marijuana) and 12 years)*SD*=2.0) for the 2nd substance. The average years of use at intake was 4.6)*SD*=2.7). For those who first used tobacco, the average years of SU)including tobacco) was 4.9)*SD*=2.3), 5.3)SD=3.3) for those who first used alcohol, and 3.7)*SD*=2.5) for those who first used other drugs.

At 12 months, 65% reported alcohol use in the last 6 months, 53% reported marijuana use, 14% misuse of prescription pain killers, 11% hallucinogens, 8% party drugs, 6% cocaine, 8% stimulants, 2% Ritalin/Dexedrine, and 2% inhalants.

In the first two months after intake, the average number of treatment days was 11 (*SD*=10.4). Looking at continuous days in treatment, the average length of stay was 74 days (*SD*=84.4). Of our sample, 47% completed Phase 1, 21% completed Phase 2, and 11% completed Phase 3.

2.4 SU validity

A validity test of self-report SU data at 12 months 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; each received an additional $20 music store gift certificate for the in-person visit. The urinalysis (using the Hitachi microparticle immuno assay with gas chromatography mass spectrometry, thin layer chromatography, and high pressure liquid chromatography confirmation) tested for 12 substances (alcohol, heroin, methadone, pain killers, cocaine, stimulants, marijuana, barbiturates, tranquilizers, inhalants, hallucinogens and pcp). Of those who reported abstinence, 92% had negative urine tests (kappa=.79) (Landis & Koch 1977). We found no differences between the in-person respondents and the remainder of the site survey respondents on age, sex, or alcohol or drug use at 12 months. Participants were informed that information obtained during the in-person and telephone interviews as well as the urinalyses results were used for research purposes only, and were not reported to the treatment programs. Nicotine use was not assessed.

2.5 Measures

2.5.1 Dependent variables

Substance use abstinence: Use of alcohol and 11 types of other substances was measured at baseline and 12-month interviews. We use two dichotomous measures indicating self-reported continuous alcohol or drug abstinence (excluding tobacco) for a period of 6 months, and measured at 12 months post-intake.

2.5.2 Explanatory variables – main predictors

Tobacco cessation: A dichotomous variable indicating that the respondent had not used cigarettes, cigars, chewing tobacco or another tobacco product in the prior 6 months. We measured this at baseline, and at 6 and 12 months post intake. In our regression analyses, we first use the 6-month cessation measure alone, and then a combined measure of 6- and 12-month tobacco cessation, indicating continuous cessation.

2.5.3. Explanatory variables – other individual factors

Baseline Psychiatric Severity: Mental health status was assessed using the two scales from the Youth Self-Report (YSR), a structured self-report questionnaire that measures several domains of mental health problems, and has demonstrated solid psychometric properties across a variety of adolescent and child populations (Achenbach 1991; McConaughy & Achenbach 2001; McConaughy, Stanger, & Achenbach 1992; Rowe et al. 2004; Sterling & Weisner 2005). We used the Anxious/Depressed scales, but excluded two questions about suicidality; thus the mean score on the scale is conservative (Campbell, Weisner, & Sterling 2006; Sterling & Weisner 2005). The Externalizing scale includes the Delinquent Behavior and Aggressive Behavior subscales. Higher scores indicate greater severity.

Baseline Substance Use Problem Severity: The baseline instrument included questions drawn from the Comprehensive Adolescent Severity Inventory (CASI). The CASI is widely used with adolescents and measures SU and problems, and other domains such as overall health, education, legal issues, and family relations (Donovan & Rosengren 1999; Meyers, McLellan, Jaeger, & Pettinati 1995). We used the responses to alcohol and drug dependence and abuse symptoms, including those of withdrawal, consequences of use, loss of control, and

physical dependence in the prior 6 months. The measure was created by summing the number of 'yes' answers to these items. It ranged from 0 to 14, with a higher number indicating greater severity (Campbell et al. 2006; Wu et al. 2004).

Baseline Circumstances, Motivation, Readiness (CMR) Scale: This scale was drawn from the *Adolescent Circumstances, Motivation, Readiness, and Suitability Scales for Substance Abuse Treatment (A-CMR*) instrument (De Leon 1994), and is a sum of three scales, representing adolescents' circumstances, motivation, and readiness for treatment. The three scales include items measuring: fear of jail, ability to live at home, receiving pressure to leave treatment, outside problems that hinder completing treatment, coming to treatment without pressure, needing/not needing treatment, staying in treatment under pressure to leave, feeling that use is a problem, ability to live with drugs, liking self, needing to make life changes, ability to stop use, willingness to try other treatment, being tired of substance use, and willingness to start treatment soon. Higher scores indicate higher levels of motivation/readiness.

Demographic characteristics: Age: A continuous variable, ranging from 13–18, which was self-reported by the adolescent at treatment intake. *Gender*. One indicates female. Zero indicates male, and is the referent. *Ethnicity*. Five ethnic groups were represented: African American, Native American, Latino, Asian American and Caucasian (the referent group). Adolescents selected the ethnic group they felt described them, and could choose more than one. We developed a hierarchy of mutually exclusive categories, first selecting African American responses, followed by Native American, Latino, Asian American, and Caucasian responses (Campbell et al. 2006). This approach used a framework based on the relationship of discrimination to health (Krieger 2000), and on a population health survey of California, the California Health Interview Survey (CHIS). An analysis of CHIS data at KP Division of Research has shown high correlations for self-identified and the hierarchical classification of racial categories according to N. Gordon, Ph.D. (personal communication, August 2008).

Legal problems: We asked whether the adolescent had been picked up or charged with any legal offense in the last 6 months. This was a dichotomous variable (yes=1; no=0) measured at each interview.

2.5.4 Treatment variables

Length of stay in treatment: This was a continuous variable measuring days in treatment without a break of 6 weeks or more. This was defined in consultation with KP's regional SU Oversight Committee about appropriate criteria to determine program drop out (Campbell et al. 2006). This measure used SU utilization data from the KP outpatient appointment registration system to measure treatment attendance. For the purposes of analysis, it was scaled by 7 to reflect weeks in treatment; thus a change in the value represents an additional week in treatment.

2.5.5 Social environment

Living with someone with a SU problem: This is a dichotomous variable of the adolescent's report of living with someone who has an alcohol or drug problem. Most teens reported living with their family members (i.e. 83% with parents). This was measured at each interview.

Peer alcohol/drug use: At each interview, the adolescent reported the number of friends who used alcohol or drugs in the prior 6 months (tobacco use was not included). This was dichotomized to indicate 4 or more friends versus fewer (Wu et al. 2004).

2.5.6 Control Variables

Program location: There may be organizational differences across programs such as proximity of SU treatment to mental health and medical services, which could affect treatment initiation and retention (Myers & Brown 2005). As a proxy for this and other potential organizational measures, we include site as a control. Programs are designated as Sites 1, 2, 3 and 4, in the interest of confidentiality. Site 1 is the referent.

2.6 Data analysis

Bivariate relationships between tobacco users and non-tobacco users on measures across study waves were assessed with chi-square tests and t-tests. Among tobacco users at baseline (those who had used tobacco in the prior 6 months, n=315), we then conducted logistic regression analysis to examine the relationship between alcohol and drug abstinence and tobacco cessation post-intake. Four logistic regressions were conducted: the first two examined the association of cessation at the 6 month follow-up to alcohol abstinence and to drug abstinence at 12 months; the last two examined the relationship of continuous tobacco cessation at 6 and 12 months to alcohol abstinence and to drug abstinence at 12 months. All four regressions controlled for demographics, baseline SU severity, 12-month externalizing YSR, 12-month anxiety/depression YSR, living with someone with SU problems at 12 months, peer alcohol/drug use at 12 months, length of stay in the program, and program location.

3. Results

At baseline, 75% (n=315) reported tobacco use in the prior 6 months. Of these, 96% used cigarettes, 4% used snuff, 14% used chewing tobacco, 57% used cigars, and 10% reported other type of tobacco use. Categories were not mutually exclusive. At 6 months and 12 months, 70% and 73% of all respondents at each time point reported tobacco use in the prior 6 months, respectively. Information about the different types of tobacco was not available at the follow-ups.

3.1 Bivariate analyses

Table 1 shows results of bivariate analyses comparing tobacco and non-tobacco users at baseline (SU treatment intake), 6 months and 12 months. At baseline, 6 months and 12 months, tobacco users reported higher Externalizing YSR scores ($t(412)=-2.45$, $p=.015$; $t(381)=-4.09$, $p=<.0001$; $t(379)=-3.11$, $p=.002$, respectively), baseline SU severity ($t(236)=-7.70$, $p=<.001$; $t(379)=-3.32$), $p=.001$; $t(224)=-4.55$, $p<.0001$, respectively), and were more likely to have legal problems ($\chi^2(1, N=417)=14.67$, $p=.0001$; $\chi^2(1, N=383)=15.53$, $p=<.0001$; $\chi^2(1, N=385)=13.73$, $p=.0002$, respectively). At baseline and 6 months, tobacco users were slightly older ($t(417)=-3.48$, $p=.001$; $t(380)=-2.17$, $p=.031$, respectively). At 6 and at 12 months, tobacco users reported longer lengths of stay ($t(265)=-2.45$, $p=.025$; $t(286)=-3.50$, $p=.004$, respectively). Also at 6 and at 12 months, there were lower proportions of African American tobacco users ($\chi^2(1, N=381)=6.67$, $p=.009$; $\chi^2(1, N=383)=11.54$, $p=.001$, respectively). At baseline and 12 months, peer alcohol/drug use was higher among tobacco users ($\chi^2(1, N=379)=6.25$, $p=.012$; $\chi^2(1, N=381)=4.67$, $p=.031$, respectively). At 6 months only, tobacco users were more likely to live with someone with SU problems ($\chi^2(1, N=382)=5.88$, $p=.015$), girls were less likely to report tobacco use ($\chi^2(1, N=382)=10.16$, $p=.001$), and there were higher proportions of Native Americans tobacco users ($\chi^2(1, N=381)=4.66$, $p=.031$). At 12 months only, tobacco users also reported higher anxiety/depression YSR scores ($t(239)=-4.28$, $p=.0002$).

3.2 Regression analyses

Table 2 and Table 3 present results among baseline tobacco users of the multivariate logistic regression model of alcohol abstinence and drug abstinence during the 12-month period after intake. After adjusting for covariates, tobacco cessation at the 6 month follow-up (Table 2) was not associated with alcohol abstinence at 12 months, but was associated with higher odds of drug abstinence (OR: 3.37, 95% CI=1.45–7.83, p=.004) at 12 months. The measure of continuous tobacco cessation at 6 and 12 months (Table 3) was associated with higher odds of drug abstinence (OR: 3.06, 95% CI=1.05–8.88, p=.040), but not alcohol abstinence at 12 months.

Independent of tobacco cessation, other measures from the model were significant as well. The relationships were generally consistent across the models so only results from Table 3, which uses the continuous 6- and 12-month tobacco cessation predictor, are reported here. Older age at treatment entry was associated with lower odds of alcohol (OR: 0.79, 95% CI=.62–1.00, p=.049) and drug abstinence (OR: 0.77, 95% CI=0.61–0.99, p=.039). Legal problems at 12 months were associated with higher odds of drug abstinence (OR: 2.55, 95% CI=1.25–5.18, p=.010). Length of stay was associated with higher odds of alcohol (OR 1.01, 95% CI=1.00–1.01, p=.001) and drug abstinence (OR 1.01, 95% CI=1.00–1.01, p<.001). Higher baseline motivation/readiness scores were associated with higher odds of drug abstinence (OR: 1.05, 95% CI=1.01–1.08, p=.013), as was entering treatment at Site 3 (OR: 3.98, 95% CI=1.83–8.63, p=.001) compared to Site 1. Alcohol/drug peer use at 12 months was associated with lower odds of alcohol (OR: 0.30, 95% CI=0.17–0.55, p<.0001) and drug abstinence (OR: 0.31, 95% CI=0.17–057, p<.001). Externalizing scores at 12 months were associated with lower odds of drug abstinence (0.96, 95% CI=0.92–1.00, p=.043).

4. Discussion

The multivariate relationships of tobacco use to SU outcomes show that self-initiated tobacco cessation after SU intake was not negatively associated with abstinence. In fact, it was positively associated with drug abstinence. This echoes research with adult patients across different populations (Hurt & Patten 2003; Kohn et al. 2003; Lemon et al. 2003; Prochaska et al. 2004; Satre et al. 2007). Study findings do not support the conventional clinical belief that quitting tobacco use may jeopardize recovery from other substances, a likely barrier to tobacco cessation efforts (Ziedonis, Guydish, Williams, Steinberg, & Foulds 2006), at least for self-initiated cessation.

The significant finding for drug abstinence but not for alcohol abstinence suggests self-initiated tobacco cessation may be more important for drug than alcohol abstinence among adolescents, unlike what has been found in adults (Karam-Hage, Pomerleau, Pomerleau, & Brower 2005) and deserves further research. The lack of associations for alcohol abstinence may also be because it is viewed as less harmful and more socially acceptable than illicit drugs (even though illegal for this age group). The adolescent SU treatment literature has not typically examined alcohol and drug outcomes separately; the current findings may shed some light on an important relationship that differs for alcohol and drug outcomes. Adolescents in public and private SU treatment, including this sample, have high rates of polysubstance use, not only using alcohol and drug, but multiple drugs. Further research on differences between alcohol and drug outcomes is warranted; identifying factors that are differentially related to alcohol or drug outcomes may inform treatment approaches.

Observational data cannot address causality, and there could be alternative explanations for the positive association with drug abstinence, as well as for the lack of positive associations with alcohol abstinence. Those abstinent from drugs may be more likely to change their tobacco use as well; for example, they may have poor health status or considerable medical problems

related to their drug use, and be motivated to engage in good health practices. They may also be motivated by financial constraints.

This study examined self-initiated cessation, which has implications for the findings. The literature suggests that individuals who undergo self-initiated tobacco cessation may be different – they may be less severe smokers and/or less dependent (Sussman 2002). While we do not have a measure of tobacco dependence available in these data, our treatment sample is a complex group with considerable SU severity and co-occurring problems and may not be as dissimilar in terms of their dependence and severity from those who undergo formal tobacco programs. Additionally, patients were encouraged to stop tobacco use, even though there were no formal programmatic efforts. We note these earlier studies were not conducted on treatment samples.

We recognize that we do not have verification of tobacco use, and would not be able to identify potential underreporting. However, we note that illicit substance use is more stigmatized then tobacco use, and we find that adolescents are willing to report their SU (based on our validation results as well as interviewer debriefings). Additionally, since tobacco was not addressed in treatment, respondents may feel less pressure to underreport tobacco use. Finally, we found a high percentage of respondents willing to report tobacco use at 12 months.

Overall, study findings support further research on the development and implementation of tobacco cessation programs within adolescent SU programs, and their relationship to outcomes, as well to treatment engagement and retention. We expected to find a larger effect for continuous abstinence, relative to earlier abstinence at one time point, but this was not the case. Quitting early in the recovery process may be important as continued attention to tobacco use after SU treatment for this group to maintain cessation. Continued tobacco use may be a risk factor for poorer SU outcomes among adolescents, as has been suggested in the adult literature (Kohn et al. 2003). Tobacco use is a form of substance use, with higher mortality compared to other substances, and should be addressed as such. Tobacco abstinence was low, much lower than the alcohol and drug abstinence rates observed at 6 and 12 months. The study's descriptive findings showed that tobacco users had more SU severity and other problems across the time period. Not emphasizing tobacco cessation in SU treatment, may suggest tacit approval of tobacco use, and underemphasize the risks of its use not only to patients but to families as well (Myers et al. 2007). Subject response to program interventions may be heightened by addressing tobacco use along with other substances.

Implementing tobacco cessation programs faces challenges, as it requires not only patient compliance but staff participation and buy-in (Fuller et al. 2007; Ziedonis et al. 2006). Availability of smoking cessation services is modest; a recent national study of adult outpatient treatment found that 41% offered smoking cessation services (Friedmann, Jiang, & Richter 2008). SU treatment staff often have high rates of tobacco use themselves, a possible barrier to supporting tobacco cessation in their patients (Bobo & Davis 1993; Ziedonis et al. 2006). However, Ziedonis et al (Ziedonis et al. 2006) found staff training in tobacco cessation to be effective and feasible. Another barrier may be the associated cost, for treatment organizations that typically have few resources (Friedmann, Jiang, & Richter 2007; Ziedonis et al. 2006) to provide any additional services. However, research has begun studying the efficacy of tobacco cessation interventions in adolescent SU treatment (Myers & Kelly 2006). More studies in different treatment settings (public vs. private) and with larger samples are needed, but if these efforts are successful, it would encourage their implementation in adolescent SU programs. In addition, less resource-intensive strategies to discourage tobacco use could be studied, such as integrating tobacco with other substances in group sessions or with overall "wellness" activities, and brief motivational interviewing (Ziedonis et al. 2006). This may help programs experiment with the feasibility of implementing full tobacco cessations strategies.

Youth are often not highly motivated to enter SU treatment (Melnick et al. 1997), and given their legal and other SU problems, tobacco cessation may be a low priority for them. If their SU has caused serious family disruption, tobacco cessation may also be the lowest priority for parents who are more concerned about other drug use (and who may also be more likely to be tobacco users themselves versus other substances). SU and psychiatry clinicians and primary care physicians may share these attitudes. Even when overall motivation for entering SU treatment is high, it may not extend to quitting tobacco use. Educating not only SU staff, but parents and other clinicians is crucial for implementing cessation strategies.

Limitations

The sample is privately insured and treated in a private, non-profit, managed care health plan, which limits its generalizability to public populations. However, managed care is a major setting for the delivery of behavioral health services for both public and private populations, including many state Medicaid arrangements, and private populations are understudied. We did not have a measure of tobacco dependence, so our measure is more liberal in that it includes any use. However, we find associations even for those who may not be nicotine dependent. As noted above, tobacco users tend to have greater SU severity. Although we controlled for SU severity in our analyses and this measure has been predictive in other analyses, it is possible this measure did not entirely adjust for this effect. The validation of SU at 12 months was conducted on a subsample of patients, and not the full sample, although we have found no differences between this subsample of patients and other respondents in age, gender, or alcohol or drug use.

Conclusion

Given the health risks associated with tobacco use, particularly in this age group, it should not be overlooked in SU treatment. Despite the many attitudinal and logistical barriers, SU treatment presents a unique opportunity to intervene with tobacco-using youth. Future research is needed in examining optimal timing of interventions in the treatment program and the appropriate level of intensity of cessations efforts, particularly with subgroups of patients. Evidence suggests that those who continue to use tobacco and who have the worst SU outcomes often have mental health comorbidities (Institute of Medicine 2005). Tobacco cessation efforts will need to consider these comorbidities in their approach.

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Table 1

Characteristics by tobacco use status over study period for full sample[1]

	Baseline			6 Months			12 Months		
	Non-Tobacco Users (n=104)	Tobacco Users[2] (n=315)		Non-Tobacco Users (n=115)	Tobacco Users (n=268)		Non-Tobacco Users (n=104)	Tobacc o Users (n=281)	
Individual Factors									
Anxiety/Depressed Scale (mean)	6.9	7.6		5.2	6.1		3.8	6.1	.0002
Externalizing Scale (mean)	18.1	20.6	.015	13.0	16.9	<.0001	12.0	15.0	.002
Baseline Substance Use Severity (mean)	2.8	5.2	<.0001	3.7	4.9	.001	3.4	5.0	<.0001
Baseline Motivation/Readiness Scale (mean)	45.6	47.6	.	45.9	47.7		45.6	47.5	.
Legal Problems (%)	35.0	56.7	.0001	13.0	32.5	<.0001	9.6	27.4	.0002
Length of Stay	67.6	75.4		60.0	81.0	.025	55.2	83.7	.004
Demographics									
Female (%)	31.7	34.9		46.1	29.2	.001	41.4	33.9	
African American (%)	20.2	14.3		22.8	12.4	.009	25.0	11.1	.001
Native American (%)	6.7	10.2		3.5	10.1	.031	4.8	11.1	.
Latino (%)	19.2	19.8		23.7	19.5		15.4	21.9	
Asian American (%)	4.8	6.4		3.5	6.4		4.8	6.5	
Caucasian (%)	49.0	49.4		46.5	51.7		50.0	49.5	
Age (mean)	15.8	16.3	.001	15.9	16.2	.031	16.0	16.2	
Social Environment									
Live w/ someone w/ alc/drg prb (%)	24.3	24.8		10.5	20.9	.015	15.4	17.4	
Peer alcohol/drug use (%)	61.1	74.7	.012	58.3	65.8		52.0	64.2	.031

[1] Not corrected for multiple comparisons

[2] Defined as having used a tobacco product in the last 6 months at baseline

Table 2

Logistic regressions of alcohol and drug abstinence with tobacco cessation at 6 months among tobacco users at baseline (n=315)

	Alcohol Abstinence at 12 m			Drug Abstinence at 12m		
	OR	**95% CI**	**p value**	**OR**	**95% CI**	**p value**
Cessation at 6 m	0.78	(0.34, 1.82)	0.569	3.37	(1.45, 7.83)	0.004
Female	1.55	(0.81, 2.94)	0.184	1.15	(0.60, 2.22)	0.675
African American [1]	1.80	(0.67, 4.81)	0.241	2.20	(0.82, 5.95)	0.119
Native American	2.45	(0.85, 7.07)	0.098	1.14	(0.37, 3.55)	0.824
Hispanic	0.62	(0.27, 1.42)	0.258	1.47	(0.68, 3.19)	0.325
Asian American	1.03	(0.29, 3.68)	0.966	3.28	(0.87, 12.31)	0.079
Age	0.77	(0.60, 0.99)	0.036	0.78	(0.60, 1.00)	0.049
Anxious/Depressed YSR at 12m	0.97	(0.90, 1.04)	0.401	0.95	(0.88, 1.02)	0.122
Externalizing YSR at 12m	0.99	(0.95, 1.04)	0.763	0.95	(0.90, 0.99)	0.016
Baseline Severity	0.92	(0.83, 1.02)	0.110	0.94	(0.85, 1.04)	0.251
Living with SU person 12m	0.88	(0.37, 2.05)	0.762	1.18	(0.50, 2.80)	0.699
Legal Problems 12m	1.88	(0.89, 3.99)	0.092	2.26	(1.07, 4.80)	0.029
Baseline Motivation/Readiness	1.03	(0.99, 1.07)	0.115	1.05	(1.01, 1.09)	0.008
Length of Stay	1.01	(1.00, 1.01)	0.001	1.01	(1.00, 1.01)	<.0001
Peer alcohol/drug use at 12m	0.28	(0.15, 0.52)	<.0001	0.28	(0.15, 0.53)	<.0001
Site 2 [2]	1.87	(0.56, 6.25)	0.312	2.82	(0.83, 9.61)	0.098
Site 3	1.88	(0.60, 5.90)	0.282	1.76	(0.55, 5.63)	0.338
Site 4	0.91	(0.29, 2.86)	0.877	0.91	(0.29, 2.85)	0.865

[1] Reference group is White

[2] Reference group is Site 1

Table 3

Logistic regressions of alcohol and drug abstinence with continuous tobacco cessation at 6 and 12 months among tobacco users at baseline (n=282)

	Alcohol Abstinence at 12m			Drug Abstinence at 12m		
	OR	**95% CI**	**p value**	**OR**	**95% CI**	**p value**
Continuous cessation at 6 and 12 m	1.41	(0.51, 3.95)	0.510	3.06	(1.05, 8.88)	0.040
Female	1.61	(0.86, 3.00)	0.135	1.27	(0.68, 2.38)	0.458
African American [1]	0.64	(0.30, 1.34)	0.237	1.45	(0.72, 2.93)	0.295
Native American	1.28	(0.47, 3.47)	0.631	2.10	(0.77, 5.79)	0.149
Hispanic	2.72	(0.94, 7.83)	0.064	0.84	(0.26, 2.72)	0.776
Asian American	0.91	(0.29, 2.89)	0.870	2.14	(0.66, 6.95)	0.207
Age	0.79	(0.62, 1.00)	0.049	0.77	(0.61, 0.99)	0.039
Anxious/Depressed YSR at 12m	0.97	(0.91, 1.04)	0.392	0.95	(0.89, 1.02)	0.145
Externalizing YSR at 12m	1.01	(0.97, 1.05)	0.767	0.96	(0.92, 1.00)	0.043
Baseline Severity	0.92	(0.83, 1.02)	0.101	0.96	(0.87, 1.05)	0.356
Living with SU person 12 m	0.75	(0.34, 1.68)	0.486	1.26	(0.56, 2.87)	0.575
Legal Problems 12 mos	1.94	(0.95, 3.97)	0.069	2.55	(1.25, 5.18)	0.010
Baseline Motivation/Readiness	1.03	(0.99, 1.06)	0.138	1.05	(1.01, 1.08)	0.013
Length of Stay	1.01	(1.00, 1.01)	0.001	1.01	(1.00, 1.01)	<0.001
Peer alcohol/drug use at 12m	0.30	(0.17, 0.55)	<.0001	0.31	(0.17, 0.57)	<0.001
Site 2 [2]	1.46	(0.50, 4.24)	0.490	1.02	(0.35, 2.99)	0.968
Site 3	2.61	(1.20, 5.69)	0.016	3.98	(1.83, 8.63)	0.001
Site 4	2.37	(1.10, 5.13)	0.028	1.90	(0.91, 3.99)	0.088

[1] Reference group is White

[2] Reference group is Site 1