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**Cigarette Smoking And Long-Term Alcohol And Drug Treatment Outcomes:  
A Telephone Follow-up at Five Years**

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## ABSTRACT

This prospective study examined the relationship between cigarette smoking and 5-year substance abuse treatment outcomes. Of 749 individuals who began private outpatient treatment, 598 (80%) were re-interviewed by telephone at 5 years. At 5-year follow-up, 53% reported smoking cigarettes in the prior 30 days. Smokers were less likely to be abstinent from alcohol and drugs in the prior 30 days (48.3% vs. 64.0%); had higher Addiction Severity Index (ASI) scores in employment, alcohol, drug, psychiatric, and family/social problems; worse self-reported health; and greater self-reported depression. Findings inform understanding of long-term substance abuse treatment outcomes and potential service needs of smokers.

Key words: smoking, substance abuse, depression, treatment outcome

## INTRODUCTION

Individuals with an alcohol or drug problem are much more likely to smoke cigarettes compared to the general population, resulting in high rates of tobacco-related illness and increased mortality.<sup>1</sup> In both clinical and community samples, smoking has been associated with higher rates of depression in adults and adolescents, in a complex relationship that may include bi-directional influences and potentially shared etiology.<sup>2</sup> Among substance abuse patients, smoking status is a predictor of co-occurring physical and mental illness.

Continued smoking has been linked to worse substance abuse treatment outcomes.<sup>3</sup> Quitting smoking during treatment has been associated with reduced alcohol and drug use<sup>4,5</sup> and may be acceptable to patients dually diagnosed with other psychiatric disorders.<sup>6</sup> However, although individuals in substance abuse treatment express the desire to quit smoking<sup>7</sup> and frequently attempt to do so either during or after treatment,<sup>8,9</sup> few programs offer formal smoking cessation services.

Obstacles to implementation of smoking cessation include institutional culture of treatment programs,<sup>10</sup> concern about relapse to alcohol and drug use if smoking cessation is attempted concurrently,<sup>11</sup> and a lack of research on patients in programs who attempt to quit smoking.<sup>7</sup> With few exceptions,<sup>9,12,13</sup> prior outcome studies investigating the effects of smoking status have had short follow-up periods,<sup>14</sup> significant attrition,<sup>15</sup> small samples,<sup>4</sup> and have almost exclusively examined community or residential treatment samples.<sup>9</sup> Private outpatient treatment programs have been under-investigated, yet have become significant providers of substance abuse services.<sup>16</sup>

This prospective study investigates the relationship between smoking status and long-term substance abuse treatment outcomes, for the purpose of informing services for patients who smoke. In our previous investigation of this sample,<sup>13</sup> we examined 12-month outcomes of patients based on smoking status. Results found that those who were non-smokers at the 12-month follow-up reported more days of continuous abstinence from alcohol and drugs than smokers at follow-up. The current

report hypothesized that those smoking cigarettes at 5 years (based on self-report obtained through telephone follow-up) would report more use of alcohol and drugs, worse health, and greater psychiatric and substance-related problems compared with those not smoking at 5 years. We also hypothesized that those who quit smoking between baseline and 5 years would report less use of alcohol and drugs and less psychiatric problems than patients smoking at 5 years.

## METHODS

### Program and Study Site

The study site was the Kaiser Permanente Chemical Dependency Recovery Program (CDRP) in Sacramento, CA. Northern California Kaiser Permanente is a large (3 million membership), group-model integrated health plan. Substance abuse services in the health plan are provided internally. Patients were self-referred or referred to treatment through several sources, including medical providers and employers. Data were part of a study in which participants were randomized to receive their primary health care from physicians within the CDRP or off-site in primary care clinics.<sup>17</sup> There were no significant differences between the groups at baseline in terms of smoking status, and therefore all participants were examined together.

CDRP services included a day hospital or a traditional outpatient program. In both treatment programs, sessions included supportive group therapy, education, relapse prevention and family-oriented therapy. Treatment philosophy was based on total abstinence. Individual counseling, physician appointments, and pharmacotherapy were available as needed. Patients were expected to attend regular 12-step meetings off-site. Patients received random breathalyzer and urine screens weekly during the first 4 weeks and monthly thereafter during the year-long program, and a random sub-sample received such testing at each follow-up.<sup>17</sup>

The CDRP allows smoking in designated outside areas only. Formal smoking cessation services were not provided within the program. The risks of smoking were addressed in an educational

format within the treatment program as part of Medical Education. Patients had free access to smoking cessation aids and to a low cost smoking cessation program provided off-site.

### Participants

Participants were 747 men and women aged 18 and over who met criteria for drug or alcohol abuse or dependence based on the DSM-IV,<sup>18</sup> who were admitted to the program between April 1997 and December 1998. The health plan membership is insured primarily through employment; income and employment levels are higher, and addiction severity is somewhat lower than in public samples.<sup>19</sup> The most prevalent substances of dependence in the sample were alcohol, stimulants, marijuana, narcotic analgesics, cocaine and tranquilizers.

A total of 598 participants (80 percent) completed the 5-year follow up interview, between April 2002 and April 2004. Differences between participants who were retained at follow-up versus those who were not were examined by t-tests and chi-square analyses of baseline data, which found no differences between the two groups by age, gender, ethnicity, education level, type of substance dependence or smoking status.

### Procedures

Written informed consent from participants was obtained and baseline interviews conducted with all patients who were ready to begin treatment. We used an “intent to treat” design, including all those recruited at intake, whether or not they agreed to be randomized or actually began treatment. Follow-up telephone interviews assessing treatment outcomes were conducted from the Kaiser Permanente Division of Research 5 years after intake.

### Measures

*Demographic characteristics and smoking status.* The baseline questionnaire included items for age, gender, race, and education. Smoking status was determined by response to the question “Are you currently smoking cigarettes?” asked at baseline and 5-year follow-up. Patients were categorized as “smokers” if they answered “yes” to this question, and were asked how many cigarettes per day they

had smoked in the previous 30 days; smoking intensity was categorized as light (< 10 per day), medium (10-19 per day), and heavy (20+ per day). Details of smoking behaviors, smoking history (ever smoked vs. never smoked), nicotine dependence, and biochemical verification of smoking status were not assessed.

We chose smoking status at 5 years, rather than baseline smoking, as a measure of tobacco use more clinically relevant to treatment results at 5 years, to investigate relationships between post-treatment smoking and alcohol and drug abstinence and other long term outcomes. However, smoking at year 5 was highly correlated with baseline smoking (among those smoking at 5 years,  $n = 314$ , 90% (281 of 314 participants) reported smoking at baseline). Although power is limited due to small sample size, we report substance use outcomes of the 10% (33 of 314 participants) who started smoking between baseline and 5 years. We previously found that outcomes of those who started smoking between baseline and 1 year was worse than outcomes of non-smokers or those who quit smoking.<sup>13</sup>

*Treatment.* Length of stay was measured in number of days between intake and last treatment visit using health plan administrative data.<sup>20</sup> Patients were considered to have dropped out if they were absent for 7 continuous days during the first 8 weeks of treatment (i.e., the rehabilitation phase), or 30 continuous days after the first 8 weeks of treatment (i.e., the aftercare phase). This was consistent with the program's definition of dropout.

*Substance use and substance-related problems.* A modified version<sup>17</sup> of the Addiction Severity Index (ASI)<sup>21</sup> was used to assess severity of substance use and psychosocial problems at baseline and 5-year follow-up. The ASI is a valid and reliable instrument<sup>21</sup> that measures the number, frequency, and duration of symptoms in the prior 30 days and provides composite scores from 0 to 1.0 for each of seven problem areas (alcohol, drug, medical, employment, legal, psychiatric and family/social); higher scores indicate greater severity. The composite score obtained in each area indicates problem severity in the 30 days prior to the interview.<sup>22</sup>

*Substance abuse treatment outcomes.* Alcohol and drug use data were obtained from 5-year telephone follow-up interviews. To be categorized as abstinent, all ASI questions on alcohol and drug use during the past 30 days had to be negative. To measure stability of abstinence, we asked patients whether they were abstinent from alcohol and drugs during the previous 12 months. A validity test of self-reported abstinence in the sample using urinalysis conducted at the 6-month follow-up on 361 randomly selected participants found high self-report validity: rates of reporting no use but testing positive were 2.5% for alcohol, and between 0.9% and 5.8% for other substances.<sup>17</sup>

At 5-year follow-up, participants were asked “in general, would you say your health is excellent, very good, good, fair or poor.” This measure is predictive of morbidity<sup>23</sup> and mortality.<sup>24</sup> Patients were asked if they were depressed in the prior 30 days (yes/no), as part of the ASI (“During the past 30 days, have you had a significant period (that was not a direct result of drug/alcohol use) in which you have experienced severe depression?”). We used this as a rough indicator of mood, cautioning that this measure is not sufficient for diagnosis. Studies have found single-item depression measures to have adequate specificity, but limited sensitivity.<sup>25</sup>

### Analyses

Baseline participant characteristics (demographics, psychiatric, and substance use history and severity) and length of stay in substance abuse treatment were compared based on smoking status at 5 years using chi-square and t-tests. With data collected at 5 years, abstinence from alcohol and drugs, psychiatric status and self-reported health were compared between smokers and non-smokers using chi-square and t-tests; among smokers, the relationship of alcohol and drug abstinence at 5 years to smoking intensity (light, medium, or heavy) was tested using chi-square. In a sub-analysis, we examined individuals who reported smoking at baseline, comparing the alcohol and drug abstinence rates and self-reported depression of those in this group who reported smoking at 5 years to those who reported no smoking at 5 years, using chi-square. Logistic regression analysis examined effect of smoking at 5 years on 30-day abstinence from alcohol and drugs, controlling for variables associated



with both smoking and with alcohol and drug use outcomes in our sample (age, gender, type of substance dependence, and length of stay in treatment). We also controlled for the effect of baseline smoking, to separate effects of baseline smoking from 5-year smoking on alcohol and drug abstinence.

## RESULTS

In this treatment sample of 598 respondents, 315 (52.7%) participants reported smoking in the 30 days prior to the 5-year follow-up interview, with a mean of 13.9 (SD = 9.8) cigarettes smoked per day. This included 28.7% light, 30.7% medium, and 40.7% heavy smokers. Demographic and clinical differences between study participants smoking cigarettes at year 5 and those not smoking were found (Table 1). Smokers were younger and had less education compared to non-smokers. Smokers were more likely to be diagnosed with drug dependence or with both alcohol and drug dependence, and non-smokers were more likely to be diagnosed as alcohol dependent only. Smokers were likely to have stayed less time in treatment than non-smokers. Smokers scored significantly higher on baseline ASI composite scores for drug problems and family/social problems.

Significant treatment outcome differences between smokers and non-smokers at year 5 were observed (Table 2). Compared to non-smokers, smokers were less likely to report abstinence from alcohol and drugs in the previous 30 days and during the previous 12 months, and they had higher ASI composite scores for alcohol, drug, employment, psychiatric and family/social problems. Smokers were less likely to rate their health as excellent or very good, and were more likely to report experiencing depression in the previous 30 days. Among those not smoking at baseline, participants who had begun smoking at 5 years were less likely to be abstinent from alcohol and drugs (33.3 % abstinent) than those who remained non-smokers (60.5% abstinent),  $X^2 = 8.56, 1 df, n = 243, p = .003$ .

We also examined outcomes of those who quit smoking. Among individuals who smoked at baseline ( $n = 354$ ), those who reported not smoking at 5 years ( $n = 73$ ) had higher alcohol and drug abstinence rates than those who continued to smoke at 5 years ( $n = 281$ ), (54 of 73 respondents (74.0%) vs. 141 of 281 respondents (50.2%),  $X^2 = 13.26, 1 df, n = 354, p < .001$ ). Those who quit smoking also

had lower rates of depression than those who continued smoking, (10 of 73 respondents (13.7%) vs. 78 of 281 respondents (27.8%),  $X^2 = 7.17$ , 1 *df*,  $n = 354$ ,  $p = .028$ , not shown in Table 2). Baseline smoking intensity was not associated with alcohol and drug abstinence at 5 years.

Among smokers at 5 years, 41.0% of light smokers, 41.3% of medium smokers, and 59.8% of heavy smokers were abstinent from alcohol and drugs,  $X^2 = 10.44$ , 2 *df*,  $n = 314$ ,  $p = .005$ . To investigate a potential explanation for this finding, we examined rates of starting smoking after treatment baseline. We found that heavy smokers were less likely to have started smoking since baseline (2.5% of heavy smokers vs. 9.8% of medium smokers and 20.2% of light smokers had started smoking,  $X^2 = 18.77$ , 2 *df*,  $n = 313$ ,  $p < .001$ ).

Logistic regression analysis examined the association between smoking status and abstinence from alcohol and drugs at 5 years (not shown). In the analysis we controlled for age, gender, baseline smoking status, substance diagnosis (drug dependence or alcohol and drug dependence compared with either alcohol dependence only or alcohol/drug abuse only), and length of stay in treatment, because these variables differed between the smoking and nonsmoking groups and have been consistently associated with abstinence at different follow-up points in the sample.<sup>13, 17, 26</sup> We also included smoking intensity. Results found that 5-year smoking was independently associated with lower abstinence rate, OR = 2.99,  $p < .001$ . Also significant were baseline smoking status, OR = 1.67,  $p = .039$ , and length of stay in treatment measured in days, OR = 1.00,  $p < .001$ . Lower smoking intensity (< 20 vs. 20 + cigarettes per day) was associated with lower alcohol and drug abstinence rate, OR = 1.88,  $p = .011$

## DISCUSSION

This study analyzed the characteristics of individuals who smoked cigarettes following substance abuse treatment compared with those who did not smoke, to examine the association between post-treatment smoking and 5-year outcomes. Results found that smokers have worse

outcomes in multiple domains including lower abstinence rates, more substance-related problems, poorer self-rated health, and higher rates of self-reported depression. Quitting smoking (among baseline smokers) or not starting smoking (among baseline non-smokers) was associated with abstinence from alcohol and drugs at 5 years. Light smokers were less likely to have been smoking at baseline than heavy smokers and had worse alcohol and drug use abstinence rates, suggesting that smoking onset rather than intensity may be a marker for poor substance abuse treatment outcomes. While these correlational results do not establish a causal relationship between smoking and worse outcomes, findings provide important information regarding the clinical features and relatively poor long-term treatment outcomes of substance abuse patients who smoke cigarettes.

The independent association of smoking at 5 years with lower abstinence rates indicates that covariates associated with smoking and poor outcomes (drug dependence, younger age, and shorter length of stay in treatment) do not fully account for the relationship observed between smoking and abstinence. It is possible that smoking cigarettes following treatment may have a negative impact on outcomes. Alternatively, smoking may be a marker of greater substance abuse and psychiatric severity. Quitting smoking (smoking at baseline but not at 5 years) was associated with better alcohol and drug abstinence rates—even higher than abstinence rates of those who reported not smoking at baseline. While patient characteristics (such as lower substance abuse severity) or other common factors may have contributed to quitting cigarettes as well as alcohol and drugs, results suggest that offering smoking cessation as an integral part of substance abuse treatment may benefit substance use outcomes in addition to general health outcomes.<sup>5, 8</sup>

Prior studies have investigated the complex relationships between smoking and psychiatric disorders. One recent investigation found that both current and past smoking was associated with elevated risk for depression.<sup>27</sup> In our results, self-rated depression was half as prevalent among those who quit smoking as it was among those who continued to smoke. While we caution that our findings

are correlational, it is possible that long-term improvements in mood and health are benefits of smoking cessation among substance abuse patients.

Greater substance abuse treatment duration is strongly associated with better outcomes.<sup>28</sup> Because smokers tend to drop out of treatment sooner than non-smokers, it is important to identify these individuals early on and encourage them to remain in treatment (e.g., use of Motivational Interviewing techniques)<sup>29</sup> in order to be able to provide the additional services they may need. The positive effect of treatment retention on 5-year abstinence from alcohol and drugs observed in our study suggests that targeting smokers to help them remain in treatment may have significant long-term benefits.

### Limitations

There were several limitations to this study. Mood symptom findings should be interpreted with caution, since the study relied on a single-item screening question for depression rather than established diagnostic measures. In addition, there was no biochemical verification of smoking at 5 years, and we did not analyze biochemical verification of substance use at 5 years. However, strengths of this study include a large sample size, low attrition, a 5-year follow-up period, and multiple outcome measures. Although individuals in privately insured samples such as this one have lower problem severity than those in public samples, it is important to examine this setting since private programs represent the predominant mode of U.S. substance abuse treatment.

### Conclusions

This investigation into long-term alcohol and drug treatment outcomes of cigarette smokers versus non-smokers found significant differences between the two groups at 5 years, indicating that those who were smoking at the 5-year follow-up also had worse outcomes in multiple domains including substance-related problems and depression. Those who were not smoking at 5 years had higher alcohol and drug abstinence rates than those who continued to smoke. These findings contribute

to the understanding of long-term relationships between smoking and substance abuse outcomes, and support further investigation of smoking cessation for programs to improve patient care.

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**TABLE 1. Demographic, clinical and treatment characteristics based on smoking status five years following chemical dependency treatment (N = 598).**

	Smoking Status		<i>X</i> <sup>2</sup> or <i>t</i>
	Smokers ( <i>n</i> = 315)	Non-Smokers ( <i>n</i> = 283)	
Age at baseline, mean (SD)	35.5 (9.4)	39.7 (11.1)	5.0***
Gender (%)			NS
Male	56.5	57.6	
Female	43.5	42.4	
Ethnicity (%)			NS
White	77.5	70.6	
Black	10.1	9.3	
Hispanic	6.5	12.2	
Other	5.9	7.9	
Education (%)			9.9**
Less than HS	13.7	11.0	
High School	40.1	30.0	
Some College	46.2	59.0	
Dependence diagnosis (%)			9.4*
Alcohol only	35.9	44.2	
Drug only	34.9	25.8	
Alcohol and drug	19.7	16.6	
Substance abuse	9.5	13.4	
ASI Score, mean (SD)			
Alcohol	0.358 (0.31)	0.369 (0.28)	NS
Drug	0.141 (0.13)	0.117 (0.13)	2.2*
Medical	0.198 (0.32)	0.228 (0.33)	NS
Employment	0.405 (0.23)	0.373 (0.21)	NS
Legal	0.099 (0.19)	0.073 (0.17)	NS
Psychiatric	0.406 (0.27)	0.366 (0.27)	NS
Family/social	0.379 (0.26)	0.304 (0.27)	3.4**
Days in treatment, mean (SD)	71.8 (95.2)	94.4 (116.5)	2.6**

Notes: N varies between 586 and 598. Characteristics of patients are based on data collected at baseline, with the exception of length of stay in treatment.

\*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ .

**TABLE 2. Five-year chemical dependency treatment outcomes based on smoking status at time of follow up (N = 598).**

	Smoking Status		<i>X</i> <sup>2</sup> or <i>t</i>
	Smokers ( <i>n</i> = 315)	Non-Smokers ( <i>n</i> = 283)	
30-day abstinence from alcohol and drugs (%)	48.3	64.0	14.9***
12-month abstinence from alcohol and drugs (%)	35.2	51.9	17.0***
ASI Score, mean (SD)			
Alcohol	0.095 (0.17)	0.060 (0.12)	2.9**
Drug	0.029 (0.07)	0.015 (0.04)	2.7**
Medical	0.238 (0.35)	0.209 (0.34)	NS
Employment	0.324 (0.24)	0.288 (0.20)	2.0*
Legal	0.015 (0.07)	0.009 (0.03)	NS
Psychiatric	0.195 (0.22)	0.137 (0.20)	3.4**
Family/social	0.123 (0.19)	0.079 (0.16)	3.0**
Self-reported health (% excellent or very good)	43.8	50.9	3.0*
Self-reported depression	28.6	18.7	9.3**

Notes: N varies between 586 and 598. ASI = Addiction Severity Index.

\*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ .