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## Smoking Cessation and Alcohol Consumption in Individuals in Treatment for Alcohol Use Disorders

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### Abstract

Most individuals with alcohol use disorders are dependent on both alcohol and nicotine, and combined use of both substances is more damaging to health than use of either alone. Although research indicates that alcoholics can quit smoking, discrepant results have been reported regarding whether smoking cessation is associated with increased risk of alcohol relapse. The purpose of this paper was to examine the relationship between smoking cessation and alcohol consumption using data from Project MATCH. Of the 1,307 participants who smoked at any point during the study, 160 (12%) quit. Quitters consumed less alcohol than those who continued smoking. In addition, quitters demonstrated a significant reduction in alcohol consumption at the time of smoking cessation, which was sustained for six months post-cessation. These findings suggest that individuals in treatment for alcohol use disorders who are motivated to stop smoking can safely be encouraged to do so without jeopardizing their sobriety.

### Keywords

Smoking; cessation; alcohol; relapse; abstinence; treatment

## ARE INDIVIDUALS IN TREATMENT FOR ALCOHOL USE DISORDERS WHO QUIT SMOKING MORE LIKELY TO RELAPSE?

### Introduction

Most individuals with alcohol and drug use disorders are also dependent on nicotine, with rates of current smoking ranging from 60-95%.<sup>1-9</sup> They also tend to be heavy smokers.<sup>10,11</sup> High smoking rates are likely to continue after substance abuse treatment,<sup>12,13</sup> and use of both alcohol/drugs and tobacco appears to be more deleterious to health than use of only a single substance.<sup>14-17</sup>

Several studies indicate that tobacco treatment, including pharmacotherapy and behavioral interventions, are efficacious for individuals in treatment for substance use disorders.<sup>12,16, 18-24</sup> One-year post-treatment quit rates, however, are typically lower than those reported for

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the general population, ranging from 1-13%.<sup>12,18,20-26</sup> Despite the dangers of continued smoking and the fact that patients in recovery can stop, substance abuse treatment clinicians are often reluctant to advise their patients to quit smoking.<sup>27,28</sup>

In terms of alcohol-related outcomes, some research has suggested that continued cigarette use during and after treatment may help to facilitate alcohol consumption, and perhaps relapse, for several reasons. For example, use of one substance may trigger use of the other through conditioning mechanisms (i.e., cross-cue reactivity) because of repeated usage of alcohol/drugs when smoking.<sup>29-34</sup> Smoking may have made the shift from moderate to heavy drinking more likely by decreasing the effects of alcohol intoxication, suggesting that smoking may help alcohol consumption continue if relapse occurs.<sup>35</sup> In a laboratory study, Cooney et al.<sup>36</sup> reported that non-nicotine deprived smokers responded to alcohol cues with increased alcohol and cigarette cravings, whereas nicotine-deprived alcoholics exposed to alcohol cues showed only increased smoking urges but no increased urge to drink.

In contrast however, some research suggests that smoking might actually help those in treatment remain abstinent from alcohol use. Prendergast et al.<sup>37,38</sup> found that nicotine decreased the effects of ethanol withdrawal, thereby making at least the initial part of alcoholism treatment more tolerable. Palfai et al.<sup>33</sup> reported opposite findings from those of Cooney et al.,<sup>36</sup> although their study examined hazardous, and not dependent, drinkers. Expectancies regarding the belief that smoking will help to suppress drinking urges might also play a role cigarettes' role in alcohol abstinence. Colby et al.<sup>39</sup> found that alcoholics from a detoxification unit who reported using smoking to cope with urges to drink were less likely to relapse to alcohol use than individuals who rarely or never smoked for this purpose.

Most clinical research studies of patients in treatment for alcohol use disorders in which smoking cessation was a targeted outcome have typically found that smoking cessation enhanced alcohol abstinence, or at least did not hurt sobriety.<sup>9,21,40-45</sup> Some research in which patients' smoking was not a focus of treatment have also reported similar results. Lemon et al.<sup>43</sup> reported that, among 2,316 smokers in the Drug Abuse Treatment Outcome Study, smoking cessation was related to improved drug abstinence rates ( $p = .04$ ).

In contrast, Stotts et al.<sup>46</sup> examined patients in a dual substance dependency treatment program and found that patients with higher motivation to stop drinking and lower motivation to quit smoking were more likely to remain in treatment. In a clinical trial of an anticraving drug for alcoholics in which cigarette use was not a focus of treatment, Schmidt and Smolka<sup>47</sup> reported that smokers showed a trend of maintaining their sobriety longer than continuing nonsmokers (173 vs. 114 days;  $p = .092$ ). Community studies in which there was no substance use intervention have also found that smoking cessation was associated with increased substance use (e.g., Carmelli et al.<sup>48</sup>).

In summary, these inconsistencies in the literature suggest that additional research is warranted to test whether smoking cessation is associated with the maintenance of sobriety or with relapse. The purpose of this paper is to examine associations between smoking cessation and alcohol consumption, using data derived from Project MATCH, the largest multi-site randomized clinical trial on alcoholism to date. Our study offers a unique contribution to the literature for several reasons. The reviewed treatment investigations had sample sizes ranging from 155-749 participants, whereas Project MATCH included a far larger sample ( $N = 1,726$ ). The studies cited above collected follow-up assessments annually or biannually, whereas Project MATCH used prospective data collection methods that assessed participants every 90 days. Moreover, we utilized statistical methods that allow for more accurate conclusions to be drawn from complex, longitudinal data. Developments in statistical methods to study outcome event patterns over time, such as latent growth analysis, have only recently begun to find application

in alcohol treatment studies.<sup>49</sup> This study is the first application in which time-varying covariates are used to examine the association over time between smoking cessation and drinking.

Because the majority of alcohol treatment studies in which smoking is not a targeted intervention link smoking cessation with increased substance use, we hypothesized that participants who quit smoking will show worse alcohol outcomes, as assessed by percent days abstinent from alcohol use and drinks per drinking day, than continuing smokers. Moreover, we also predicted that smokers who quit smoking during the 15-month investigation will show increased alcohol use after they quit than prior to smoking cessation.

## METHODS

Our study was based on Project MATCH, a longitudinal investigation of the effects of three different behavioral interventions for alcohol abuse and dependence that were each delivered over the course of 12 weeks.<sup>50</sup> Patients did not receive treatment for their cigarette use.

One thousand seven hundred and twenty-six patients with alcohol abuse and dependence disorders participated in the study. There were two study arms: outpatient and aftercare. Patients in the former were recruited directly from the community or outpatient centers; in the latter, from intensive inpatient or day-hospital treatments. Inclusion criteria included either current (for the outpatient arm) or three months prior to treatment (for the aftercare arm) DSM-III-R diagnosis of alcohol abuse or dependence. Exclusion criteria included if patients met current DSM-III-R diagnosis of dependence for sedative/hypnotic drugs, stimulants, cocaine, or opiates; had taken these drugs intravenously during the previous six months; were currently dangerous to themselves or others; exhibited symptoms of acute psychosis; and/or had severe organic impairment. Participants provided informed consent and the procedures used were in accordance with the standards of the Committee on Human Experimentation with the Helsinki Declaration of 1975.<sup>51</sup>

For the current investigation, only participants who smoked at some point during the study and who did not have missing smoking data at baseline were included, reducing the final sample to 1,307. Results regarding nonsmokers who initiated smoking during the course of Project MATCH can be found elsewhere.<sup>52</sup> Nicotine and alcohol use measures were administered at baseline and 3-, 6-, 9-, 12-, and 15-month follow-up.

### Measures

**Nicotine use**—Nicotine (cigarette) use was assessed at intake and all follow-ups using the Form I-90, developed specifically for Project MATCH.<sup>53</sup> This instrument measured nicotine use during the “current period,” corresponding to the preceding 90 days, roughly. Questions regarding nicotine (cigarette) use included (a) ever tobacco use (yes/no), (b) number of lifetime weeks of use, and (c) number of cigarettes per day in the preceding 90.<sup>53</sup> Cigarettes per day in the current period was used to determine whether a participant was a current smoker. A participant who reported smoking zero cigarettes per day in a given follow-up period was designated as a nonsmoker, whereas a participant who reported smoking one or more cigarettes was classified as a smoker for that follow-up period.

**Alcohol use**—Alcohol use was assessed utilizing percent of days abstinent from alcohol use and drinks per drinking day, as measured using the Timeline Follow-Back<sup>54</sup> (TLFB), at baseline. The TLFB is a calendar-assisted daily drinking estimation method that provides a comprehensive assessment of a person's drinking over a designated period of time. It has demonstrated adequate psychometric properties in a variety of patient samples.<sup>55</sup> The TLFB

tends to provide greater estimates of drinking frequency than quantity-frequency measures, 56-59 although these differences do not appear to be clinically relevant.<sup>55</sup>

## Data Analysis

Statistical analyses were conducted using SAS version 8(1), using PROC FREQ, PROC ANOVA, and PROC MIXED. To examine differences between quitters and continuing smokers at baseline, nominal data were cross-tabulated and examined for independence by using chi-square tests. Fisher's exact test was used when expected cell frequencies were small. Ordinal data were examined with Wilcoxon tests.

To test the hypothesis that continuing smokers will show greater percent of days abstinent from alcohol use and fewer drinks per drinking day than quitters, we performed random effect regression analyses to examine the relationship between smoking status (smoking vs. quit smoking) and drinking scores during follow-up, with age, education, and baseline percent of days abstinent from alcohol use or drinks per drinking day scores as covariates.

To test the hypothesis that quitters will demonstrate increased alcohol consumption following smoking cessation, we employed latent growth analysis methods to test an interrupted timeseries model for drinking around the time of quitting smoking. Using our prospective methodology, we first identified the month in which a smoker quit smoking, and then examined the drinking scores in the months preceding and following this event. We tested for a step-change in drinking, beginning in the month of quitting smoking and continuing after. Preliminary analyses suggested that a linear timeseries model, allowing for a change in slope and intercept at the time of the event, was adequate. The analysis, relying on the least restrictive assumption available, assumed that the correlations among the time points were unstructured.

**Graphing the course of functioning before and after life event**—To compliment and extend the latent growth analyses, we graphed the time course of drinking six months prior to and following the time of the event of quitting smoking. We designated the beginning month of the follow-up interval during which a smoker reported no longer smoking as month 0. Percent of days abstinent from alcohol use and drinks per drinking day were then calculated and plotted relative to that time point, up to six months prior to the life event and six months after the event.

## RESULTS

### Sample Demographic and Baseline Clinical Characteristics

The majority of the sample was male (76%) and Caucasian (89%; see Table 1). Participants were, on average, 39 years old, with 13 years of education. At baseline, approximately 95% of participants were current smokers ( $N = 1,245$ ), with an average daily consumption of 23.40 cigarettes ( $SD = 15.00$ ). One hundred and sixty participants (12%) quit smoking over the course of the study. Of baseline smokers who quit within the first six months of our study, approximately 46% were still not smoking at least six months after they stopped.

We compared smokers who quit smoking (“quitters”) to smokers who continued smoking (“continuing smokers”) on baseline demographic and substance use characteristics. At baseline, quitters were significantly younger and better educated ( $p < .05$ ), reported greater number of lifetime weeks of tobacco use ( $p < .0001$ ), smoked fewer cigarettes per day in the past 90 days ( $p < .0001$ ), and had more baseline percent of days abstinent from alcohol use than continuing smokers ( $p < .05$ ). There were no significant differences between quitters and continuing smokers on gender, race, or baseline drinks per drinking day.

### Between Group Comparisons: Alcohol Consumption in Quitters vs. Continuing Smokers

Cross-sectional rates of smoking were also generally consistent over the course of the study: 95% of the sample was smoking at 3 months, 94% at 6 months, and 93% at 9 months, and 91% at 12 and 15 months. Although most smokers who quit smoking did so within the first six months of the study (i.e., during or immediately after treatment), quit rates remained relatively stable over the course of the investigation. Of the 160 participants who quit smoking, 39 (24%) quit at 3 months, 44 (28%) at 6 months, 23 (14%) at 9 months, 34 (21%) at 12 months, and 20 (12%) at 15 months.

Random effects analyses showed that quitters had greater percent of days abstinent from alcohol use than continuing smokers ( $p < .001$ ) (see Table 2). On average across all follow-up periods, quitters had 84% days abstinent from alcohol consumption, compared to continuing smokers' 79% days abstinent. Quitters also reported significantly fewer drinks per drinking day than continuing smokers (1.20 vs. 1.47;  $p < .01$ ). A time effect in both models indicated a significant decrease in alcohol consumption patterns from baseline to 3 months, the months in which treatment occurred. There was no significant difference, however, in the rate of decrease in alcohol consumption between quitters and continuing smokers.

### Within Group Comparisons: Alcohol Consumption in Quitters

Controlling for the overall time trend of a reduction in alcohol consumption, latent growth analyses showed a statistically significant increase in mean level of percent of days abstinent from drinking and reduction in drinks per drinking day at the time of smoking cessation. Contrary to our hypothesis, however, quitters reported an average increase of 8% days abstinent from alcohol use ( $p < .05$ ) and an average reduction of 0.5 drinks per drinking day ( $p < .05$ ) when they stopped smoking. Figure 1 shows the time course of drinking scores six months prior to and following the event of quitting smoking. Decreases in alcohol consumption appeared to begin prior to quitting smoking in the initial treatment months of the study. At the time of quitting smoking, even greater reductions in drinks per drinking day were noted. This decline in alcohol consumption was sustained for at least six months post-cessation.

## DISCUSSION

The purpose of this study was to investigate whether alcohol outcomes were negatively impacted by smoking cessation among smokers in treatment for alcohol abuse and dependence. Our data were based on Project MATCH, a 15-month study of the efficacy of three behavioral treatments for alcohol abuse and dependence. Both of our hypotheses were disconfirmed.

Smokers who quit smoking during the 15-month investigation reported, on average, lower rates of alcohol consumption, as assessed by percent of days abstinent from alcohol use and drinks per drinking day, than smokers who continued to smoke throughout the duration of the investigation. Moreover, quitters showed significantly greater percent of days abstinent from alcohol use and reduced drinks per drinking day at the time of smoking cessation, which was sustained six months post-quit.

In our investigation, smoking was not a targeted intervention. Since research in which cigarette use is a focus of treatment has shown that stopping smoking may be associated with better alcohol outcomes than continuing smoking, we might assume that our results could have been even more dramatic had smoking been a targeted intervention.

Among those investigations that did not encourage participants to quit smoking, our results are consistent with those of Lemon et al.,<sup>43</sup> who found better drug outcomes among quitters, but at odds with those of Schmidt and Smolka.<sup>47</sup> These discrepancies suggest that additional

studies are merited to determine under what circumstances and in which populations quitting smoking would not be hazardous to drinking outcomes.

Of smokers who stopped smoking within the first six months of the study, approximately 46% retained their nonsmoking status over six months or longer. This quit rate surpasses not only that of untreated smokers in the general population, but and even that of smokers who use intensive pharmacotherapies and/or behavioral treatments.<sup>60-62</sup> It is possible that the cessation rate in our study was higher because participants may have been motivated to change habits, such as smoking, that they associated with drinking.<sup>63</sup>

Our data suggest that, although the motivation to reduce drinking is likely to precede the motivation to quit smoking, quitting smoking does not stop the momentum for continual improvement in alcohol consumption patterns. It is not clear if some aspect of alcoholism treatment and/or the environment may have provided an opportunity for patients to attempt to quit smoking. Our 12.5% six-month quit rate among smokers not being treated for their tobacco dependence suggests that something about the process of achieving abstinence may have helped motivate participants to stop smoking and stay quit. Future research should examine motivation to address smoking cessation during substance abuse treatment and factors that facilitate or inhibit quit attempts.

This study has several limitations that merit attention. First, inadequate sample size of quitters who were initially nonsmokers prior to treatment did not allow us to examine their patterns of alcohol consumption compared to those who smoked prior to treatment. Second, we used a conservative approach in determining quitter status (no cigarettes vs. one or more cigarettes) in order to identify an event of quitting smoking. Future research might capture changes in smoking consumption patterns, particularly among continuing smokers, by using a continuous measure of cigarette use. Third, our assessments relied only on self-report, without biochemical verification (other than a breathalyzer test for acute alcohol consumption) or collateral corroboration.

These limitations withstanding, our findings suggest that smoking cessation may be related to better drinking outcomes, particularly for less heavy smokers, and provides support for smoking interventions in conjunction with alcohol treatment approaches. Future studies are needed to examine if our results are also applicable for heavy smokers, since the quitters in our study smoked significantly fewer cigarettes per day than continuing smokers. Investigations are needed that examine which individual and environmental factors (e.g., smoking restrictions) were related to the high six-month cessation rate seen in our sample. Research is warranted that attempts to determine whether there is something about the *motivation* to quit smoking, rather than smoking cessation itself, that is associated with better alcohol use outcomes. Studies that determine how best to address smoking within the context of clinical, rather than research, settings are needed to help bridge the gap in translating study findings from research to practice.

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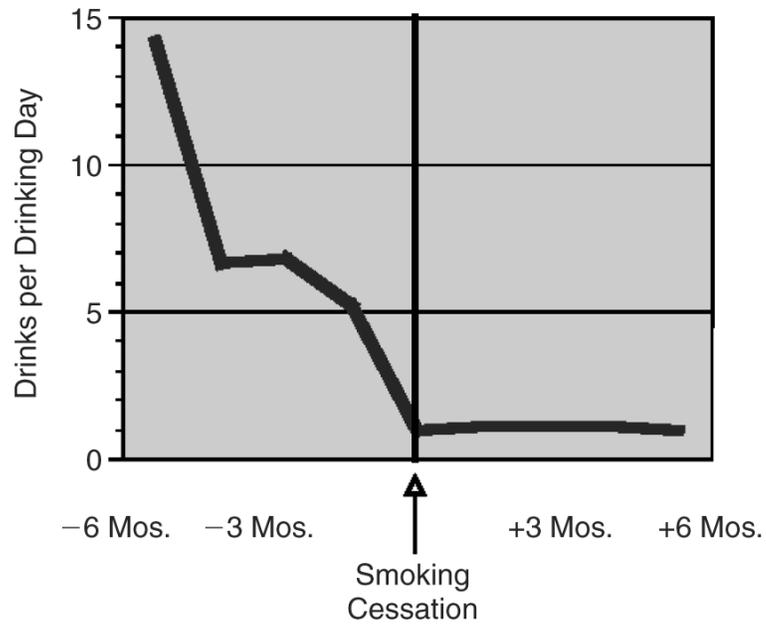
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**FIGURE 1.**  
Drinks per Drinking Day Before and After Smoking Cessation

**Table 1**

## Patient Demographic and Clinical Characteristics

Variable	Chronic Smokers ( <i>N</i> = 1,147) (88%)	Quitters ( <i>N</i> = 160) (12%)	Total ( <i>N</i> = 1,307) (100%)
Gender			
Male	873 (76)	120 (24)	993 (76%)
Female	274 (75)	40 (25)	314 (24%)
Race			
White	932 (87%)	140 (13%)	1,072 (89%)
African-American	119 (91%)	12 (9%)	131 (10%)
Other	96 (92%)	8 (8%)	104 (8%)
Age (M, SD) *	39.4 (10.4)	37.6 (9.5)	39.2 (10.3)
Years of education (M, SD) *	13.0 (2.0)	13.4 (2.0)	13.1 (2.0)
Lifetime weeks of use (M, SD) **	1,118.3 (585.4)	648.3 (600.9)	1,060.8 (606.9)
Baseline % days abstinent (M, SD) *	0.31 (0.30)	0.37 (0.31)	0.32 (0.30)
Baseline drinks per drinking day (M, SD)	17.6 (11.1)	16.2 (10.9)	17.5 (11.1)

\* Significant difference between chronic smokers and quitters;  $p < .05$

\*\* Significant difference between chronic smokers and quitters;  $p < .0001$

**Table 2**

Random Effects by Alcohol Outcome Measure

	Alcohol Outcome Measure			
	F	Percent of days abstinent p	F	Drinks per drinking day p
<b>Smoker status</b>	8.45	.0037	10.80	.0010
<b>Time</b>	14.67	.0001	7.42	.0001
<b>Smoker status × time</b>	0.28	.8887	0.73	.5692