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BRIEF REPORT

Expectancies Regarding the Interaction Between Smoking and Substance Use in Alcohol-Dependent Smokers in Early Recovery

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The purpose of this study was to investigate expectancies regarding the interaction between cigarette smoking and use of alcohol among alcohol-dependent smokers in early recovery, using the Nicotine and Other Substances Interaction Expectancies Questionnaire (NOSIE). Participants were 162 veterans, 97% male, with a mean age of 50 years, enrolled in a clinical trial aimed at determining the efficacy of an intensive smoking cessation intervention versus usual care. At baseline, participants were assessed on measures of smoking behavior, abstinence thoughts about alcohol and tobacco use, symptoms of depression, and smoking-substance use interaction expectancies. In addition, biologically verified abstinence from tobacco and alcohol was assessed at 26 weeks. Participants reported that they expected smoking to have less of an impact on substance use than substance use has on smoking ($p < .001$). Severity of depressive symptoms was significantly associated with the expectancy that smoking provides a way of coping with the urge to use other substances ($p < .01$). The expectation that smoking increases substance urges/use was predictive of prospectively measured and biologically verified abstinence from smoking at 26 weeks ($p < .03$). The results add to our knowledge of smoking-substance use interaction expectancies among alcohol-dependent smokers in early recovery and will inform the development of more effective counseling interventions for concurrent alcohol and tobacco use disorders.

Keywords: smoking cessation, tobacco use, nicotine dependence, alcohol dependence, expectancies

More than one half of individuals receiving treatment for alcohol use disorders (AUDs) die from tobacco-related diseases (Hurt et al., 1996). The prevalence and intensity of tobacco use are much

higher among individuals with current AUDs compared with the general population (Lasser et al., 2000; Sobell, Sobell, & Agrawal, 2002). Although the overall prevalence of cigarette smoking has declined in the United States, it has changed little among individuals with AUDs (Fertig, 2002; National Institute of Alcohol Abuse and Alcoholism [NIAAA], 1998; Sobell et al., 2002).

There is increasing interest in encouraging and assisting smokers with AUDs to quit smoking while they are receiving substance abuse treatment (Baca & Yahne, 2009). Efforts to develop more effective cessation interventions for smokers in substance abuse treatment settings can be facilitated by a more comprehensive understanding of the bidirectional effects of tobacco and alcohol use as well as the impact of the cessation of one of these substances on the use of the other. For example, studies of the relationship between history of AUD, current alcohol use, and smoking cessation indicate that history of AUD may be less predictive of successful cessation failure than current heavy alcohol use (Hughes & Kalman, 2006; Leeman et al., 2008).

From a social-cognitive perspective, the study of expectancies regarding interactions between smoking and substance use may help identify perceived barriers to quitting smoking among individuals with AUDs and strategies for overcoming these barriers (Rohsenow,

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Colby, Martin, & Monti, 2005). In a survey of alcohol-dependent smokers (Asher et al., 2003), concerns about the effects of quitting smoking on sobriety and the perceived need for cigarettes to cope with negative mood associated with depression were endorsed by almost half of the participants. Further investigations of expectancies regarding the interaction of smoking and drug use are needed to improve our understanding of barriers to quitting smoking in individuals with AUDs. Given the high prevalence of depressive symptoms and mood disorders in alcohol-dependent smokers and their association with drug use behavior (Hall, Degenhardt, & Teesson, 2009; Kodl et al., 2008; Patten, 2002), it makes sense to examine the influence of depressive symptoms in the investigation of expectancies in these complex patients.

To measure expectancies regarding the interaction between use of tobacco and other substances, Rohsenow et al. (2005) developed the Nicotine and Other Substances Interaction Expectancies Questionnaire (NOSIE). The NOSIE assesses expectancies regarding the effects of smoking on substance use/urges, the effects of substance use on smoking, smoking to cope with urges to use other substances, and receptivity to smoking cessation during substance abuse treatment. In the NOSIE development study (Rohsenow et al., 2005), 160 patients enrolled in an inner-city residential substance abuse treatment program reported that substance use almost always increased their smoking or urges to smoke, but that smoking increased their substance use or urges much less frequently. Despite the promising utility of the NOSIE, subsequent studies of expectancies regarding the interaction of smoking and substance use have been lacking.

In the present study, smoking-substance use interaction expectancies were investigated in alcohol-dependent smokers in early recovery who were enrolled in a clinical trial aimed at examining the efficacy of an intensive intervention for smoking cessation. The primary objective of the present study was to replicate the findings of Rohsenow et al. (2005) regarding relationships between smoking-substance use interaction expectancies and use/cessation of tobacco, alcohol, and other drugs and to build upon this work by investigating the influence of symptoms of depression on these expectancies. Specifically, we sought to investigate relationships between smoking-substance use interaction expectancies and 1) various indices of concurrently measured smoking behavior; 2) abstinence thoughts about smoking and alcohol use; 3) symptoms of depression; and 4) prospectively measured abstinence from tobacco, alcohol, and other substances. We hypothesized that severity of depressive symptoms would be associated with a greater reliance on smoking to cope with the urge to drink. Symptoms of depression and presence of depressive disorders have been shown to influence addictive behavior, cessation attempts, and vulnerability to relapse (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Hall et al., 2009; Kodl et al., 2008; Patten, 2002). We also hypothesized that receptivity to quitting smoking during substance abuse treatment would be associated with desire to quit smoking and prospectively measured abstinence from smoking, replicating one of the findings of the Rohsenow et al. (2005) study.

Methods

Participants

Participants for the present study were 162 veterans (157 males and 5 females) recruited from the Drug and Alcohol

Treatment (DAT) programs at the San Francisco VA Medical Center (SFVAMC) and VA Martinez Outpatient Clinic.

Eligibility criteria. DAT patients were considered eligible to participate if they were ≥ 18 years old, reported alcohol as their primary drug of abuse, were currently smoking ≥ 5 cigarettes daily, were abstinent from alcohol for at least seven days and not more than 6 months, and reported an interest in quitting smoking. Exclusion criteria included: any contraindications for nicotine patches or adjuvant nicotine medications (e.g., unstable angina or recent myocardial infarction, skin allergy to the nicotine patch, severe cardiovascular disease, lactation, pregnancy by self-report or by positive serum pregnancy test in premenopausal women), unstable psychiatric disorder, and severe cognitive impairment.

Parent study smoking cessation interventions. Participants were randomly assigned to intensive intervention or usual care. The intensive smoking cessation intervention included 16 sessions of cognitive behavior therapy (CBT) for smoking cessation, including mood management, 4 months of nicotine patches, and 6 months of nicotine lozenges or gum. The mood management component was implemented during Sessions 6 through 16 and included cognitive restructuring and behavioral activation. Usual care involved referral to the medical center's smoking cessation clinic. The smoking cessation intervention period lasted 6 months. Of the 162 participants enrolled in the parent study, 117 (72%) were available for the follow-up assessment at 26 weeks.

Measures

Smoking and substance use interaction expectancies. The NOSIE Questionnaire (Rohsenow et al., 2005) consists of 20 items and four reliable and valid expectancy scales measuring: 1) the effects of substance use on smoking; 2) the effects of smoking on substance use; 3) smoking to cope with the urge to use substances; and 4) receptivity to smoking cessation during substance abuse treatment. Results of the principal components analysis (PCA) and Cronbach's alpha supported the validity and internal consistency reliability of the four NOSIE scales in the Rohsenow et al. (2005) study. In the present study, the NOSIE was administered at baseline. Cronbach's alphas for the four NOSIE subscales in the present study ranged from .64 for subscale 4 (receptivity to smoking cessation during substance abuse treatment) to .90 for subscale 1 (effects of substance use on smoking).

Use of tobacco, alcohol, and other drugs. To assess cigarette smoking status at baseline and point-prevalence abstinence at 26 weeks, participants were asked: 1) "Have you smoked cigarettes in the past seven days?" and 2) "On average, how many cigarettes do you currently smoke per day?" The Alcohol/Drugs subsection from the ASI (McLellan et al., 1992; McLellan et al., 1985; McLellan, Luborsky, Woody, & O'Brien, 1980) was used to characterize substance use patterns and other substance- and treatment-related variables. Expired-air carbon monoxide ($\text{CO} < 10$ ppm) was used to validate self-reported point-prevalence abstinence from smoking at 6 months. The ASI was also used to assess 30-day alcohol use/abstinence at 26 weeks. Breathalyzer was used to validate self-report of abstinence from alcohol use at 26 weeks.

Nicotine dependence. Nicotine dependence was measured on the Fagerström Test for Nicotine Dependence at baseline (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The FTND

has good internal consistency and construct validity (Payne, Smith, McCracken, McSherry, & Antony, 1994).

Abstinence thoughts. The Thoughts about Abstinence Form (Hall, Havassy, & Wasserman, 1990; Hall, Havassy, & Wasserman, 1991; Wasserman, Stewart, & Delucchi, 2001) was used at baseline to assess desire to quit using tobacco and alcohol and expected success in quitting these substances.

Depressive symptoms. Level of depressive symptoms was assessed on the Beck Depression Inventory at baseline (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961). The BDI was used rather than the BDI-II because the BDI was used as a "core battery" assessment across multiple studies by our group of investigators.

Analysis

Correlational analyses and multiple regressions were calculated to examine bivariate and multivariate relationships between each of the four smoking-substance use interaction expectancies and baseline measures of tobacco and alcohol use, abstinence thoughts, and depressive symptoms. In the correlational analyses, the dependent variables, measured at baseline, included: number of cigarettes per day, number of days of alcohol use, total score on the BDI, desire to quit smoking, desire to quit drinking, expected success in quitting smoking, and expected success in quitting drinking. Four multiple regression models were estimated and tested to examine predictors of the four NOSIE expectancies. In these analyses, independent variables (measured at baseline) included number of cigarettes per day, number of days of alcohol use, total score on the BDI, desire to quit smoking, desire to quit drinking, expected success in quitting smoking, and expected success in quitting drinking. Two additional multiple regression analyses were used to determine the association between smoking-substance use interaction expectancies and prospectively measured and biologically verified abstinence from tobacco and alcohol at 26 weeks. In both of these models, independent variables, measured at baseline, included duration of recovery at the time of enrollment in the study, number of cigarettes per day, number of days of alcohol use, total score on the BDI, desire to quit smoking/drinking, expected success in quitting smoking/drinking, and all four NOSIE expectancy variables.

Results

Study Sample Baseline Characteristics

The study sample consisted of all military Veterans, 97% male, with 48% identifying as Caucasian and 37% identifying as African American. Participants were on average 50 years old, unmarried (91% single), with a high school education or less (69%). A total of 81% of participants were unemployed, 83% had an annual income less than \$21,000, 43% reported that they lived in half way houses/therapeutic communities, and 26% were homeless. As shown in Table 1, the baseline mean score on the FTND was 4.1 ($SD = 2.37$) and average smoking rate was 17 cigarettes per day ($SD = 10.48$). The baseline mean score on the ASI Psychiatric Status Index was 0.25 ($SD = 0.25$), exceeding the mean score of 0.10 for the general population (McLellan et al., 1992; McLellan et al., 1985).

Smoking-Substance Use Interaction Expectancies

The mean scores on NOSIE-assessed expectancies for the present study sample were compared with mean scores in the earlier study (Rohsenow et al., 2005). Participants in the present study reported significantly greater impact of substance use on cigarette smoking than participants in the earlier study, $t = 4.04$, $ES = 0.45$, $df = 160$, $p < .001$; similar impact of smoking on substance use/urges, $t = 1.27$, $ES = 0.14$, ns , less use of smoking to remain abstinent from alcohol and other drugs, $t = 2.10$, $ES = 0.24$, $df = 160$, $p < .04$; and more receptivity to quitting smoking during their substance abuse treatment, $t = 5.68$, $ES = 0.64$, $df = 160$, $p < .001$. In addition, participants expected smoking to have less of an impact on the urge to use substances than the impact of substance use has on the urge to smoke, $t = 17.46$, $df = 160$, $ES = 1.38$, $p < .001$.

Association of NOSIE Expectancies With Use of Tobacco and Alcohol, Abstinence Thoughts, and Mood

As shown in Table 2, receptivity to quit smoking during substance abuse treatment was positively associated with the desire to quit both alcohol and smoking and expected success in quitting both. Most of the significant correlations in Table 2 represented small effects with the exception of the larger correlation between desire to quit smoking and receptivity to quitting smoking during substance abuse treatment.

The results of the multiple regression models indicated that desire to quit smoking ($PE = 0.117$) was associated with the expectancy that smoking increases the urge to use other substances ($R^2 = 0.08$, $F = 2.70$, $p < .02$). The BDI total score was predictive of the expectancy that smoking provides a way of coping with the urge to use substances ($R^2 = 0.05$, $PE = 0.021$, $t = 2.61$, $p < .01$). Desire to quit smoking ($PE = 0.17$) and the FTND total score ($PE = -0.057$) were significant predictors of receptivity to quit smoking during substance abuse treatment ($R^2 = 0.20$, $F = 7.62$, $p < .0001$). Desire to quit smoking was positively associated with receptivity to quit smoking during substance abuse treatment and

Table 1
Smoking, Mood, and NOSIE Variables

Variable	Mean	<i>SD</i>
Smoking		
Cigarettes usually smoked in 24 hours	16.8	10.48
Years of smoking	31.8	10.52
Age first tried cigarettes	13.6	4.15
Age began smoking regularly	18.2	6.47
Times quit smoking at least one week	5.1	12.97
FTND total score	4.1	2.37
Psychological distress		
ASI Psychiatric Status Index	0.25	0.25
BDI Total Score	14.1	10.55
POMS Total Mood Disturbance score	44.8	47.20
NOSIE Scales		
Substances increase tobacco use/urges	4.28	0.99
Smoking increases substance use/urges	2.62	1.15
Smoking to cope with substance urges	2.23	1.02
Receptive to quitting during treatment	4.02	0.72

Table 2
Zero-Order Correlations Between the NOSIE Subscales and Smoking, Substance Use, Mood, and Abstinence Thoughts Variables

Variables	NOSIE subscales			
	1	2	3	4
Cigarettes per day	.17	.22*	.01	.07
Years of smoking	.09	.02	.01	.01
Times quit smoking ≥ 24 hours	-.07	-.12	-.08	.04
FTND Total Score	.18	.21*	-.03	-.03
Days using alcohol in past 30 days	.10	.10	.05	.25**
BDI Total Score	.06	.07	.21*	-.18
Desire to quit smoking	.10	.16	-.06	.40**
Expected success quitting smoking	-.07	-.02	.03	.30**
Desire to quit alcohol	.08	.04	-.07	.23*
Expected success quitting alcohol	.03	-.01	-.07	.28**

Note. NOSIE Subscales: 1 = Substances increase tobacco use/urges, 2 = Smoking increases substance use/urges, 3 = Smoking to cope with substance urges, 4 = Receptive to quitting smoking during substance abuse treatment; FTND = Fagerström Test of Nicotine Dependence; BDI = Beck Depression Inventory.

* $p < .01$. ** $p < .001$.

the FTND total score was inversely related to this NOSIE expectancy variable.

Association of NOSIE Expectancies With Prospectively Measured Abstinence From Cigarettes and Alcohol

As shown in Table 3, the expectation that smoking increases substance urges/use was significantly predictive of prospectively measured and CO-verified abstinence from cigarettes at 26 weeks ($p = .03$). None of the four NOSIE expectancies were found to be associated with verified abstinence from alcohol at 26 weeks (all $ps > .05$).

Discussion

Participants in the present study who expected smoking to have an impact on the urge to use substances reported a greater desire to quit smoking and demonstrated a higher verified quit rate from smoking at 26 weeks. This expectancy may have served as a

source of motivation for quitting smoking and remaining abstinent. That is, concern about the impact of smoking on substance use may have motivated smokers to quit and stay quit as a way of safeguarding their sobriety. The potential benefit of assessing and addressing expectancies regarding the interaction of smoking and substance use needs to be further explored in future studies of tobacco use cessation interventions with alcohol-dependent smokers in early recovery.

Participants who reported being more receptive to quitting smoking during substance abuse treatment also reported being more motivated to quit smoking and anticipated being more successful in quitting smoking. Since these variables were assessed concurrently and the relationships were cross-sectional, it is not possible to make causal inferences. In addition, none of these motivational and expectancy factors were found to be predictive of prospectively measured verified abstinence from smoking. In contrast, Rohsenow et al. (2005) found that receptivity to quitting smoking during substance abuse treatment was predictive of prospectively measured quitting behavior at 1 month. Differences in the characteristics of the two study samples must be taken into account in the interpretation of this finding. Although the two study samples were similar in terms of demographics, substance abuse backgrounds, and current enrollment in treatment, participants in the present study were predominately male, all military Veterans, and varied more in their duration of sobriety. Future studies are warranted to investigate relationships between these motivational and expectancy variables and prospectively measured response to smoking cessation interventions aimed at increasing receptivity to cessation, intentions to quit, and actual quit attempts, and reducing attitudinal barriers to cessation.

It has been suggested that alcohol-dependent smokers in early recovery may require more counseling designed to increase their receptivity and self-efficacy for quitting smoking during alcohol/drug treatment (Burling, Ramsey, Seidner, & Kondo, 1997). The belief that quitting smoking may interfere with their recovery from substance abuse may reduce enthusiasm for concurrent (i.e., within first 6 months of recovery) smoking cessation. Providing information that counters this mistaken belief may enhance motivation for quitting. Additional assessment of the belief that quitting smoking may interfere with recovery from substance use may find that some alcohol-dependent smokers do not endorse this belief. On average, the participants in the Rohsenow et al. (2005) study did

Table 3
Multiple Regression Model: Predictors of Prospectively Measured and CO-Verified Abstinence From Cigarettes at 26 Weeks

Covariates	Parameter estimate	SE	Wald Chi-Square	P value
Duration of recovery	-0.022	0.110	0.042	0.837
Average cigarettes per day	0.02	0.040	0.374	0.541
FTND	-0.278	0.187	2.212	0.137
BDI	0.001	0.033	0.002	0.961
Desire to quit smoking	-0.066	0.217	0.093	0.760
Substances increase smoking urges/use	-0.557	0.306	3.306	0.069
Smoking increases substance use/urges	0.779	0.358	4.729	0.030
Smoking to cope with substance urges	-0.021	0.317	0.004	0.947
Receptive to quitting during treatment	0.131	0.493	0.071	0.790

Note. FTND = Fagerström Test of Nicotine Dependence; BDI = Beck Depression Inventory.

not endorse the belief that smoking cessation during substance abuse treatment would interfere with recovery. Some, but not all alcohol-dependent smokers in early recovery believe that quitting smoking will interfere with their sobriety. The efficacy of counseling and educational approaches that include the assessment and discussion of expectancies regarding smoking-substance use interactions needs to be further investigated with this population of smokers.

The present study extended the work of Rohsenow et al. (2005) by investigating the relationship between severity of depressive symptoms and expectancies regarding smoking-substance use interactions. Participants in the present study who reported more severe depressive symptoms had stronger expectations regarding the role of smoking to cope with the substance use/urges and were less receptive to quitting smoking during their substance abuse treatment. Kodl et al. (2008) examined the effects of depressive symptoms on abstinence from tobacco and alcohol after treatment for alcohol and nicotine dependence and found that depressive symptoms were prospectively related to alcohol use, but were not related to subsequent tobacco use. Different and more intensive treatment strategies focusing on mood management may be needed for alcohol-dependent smokers with higher levels of depressive symptoms (Patten, 2002).

Several studies have investigated the role of smoking as a strategy to cope with the urge to drink. Compared with the participants in the Rohsenow et al. (2005) study, the present study sample reported a significantly lower expectancy that smoking provides a way of coping with substance use/urges. The participants in the Rohsenow et al. (2005) study reported using smoking to cope with urges to use substances about half of the time. According to the cross-substance coping response hypothesis (Monti, Rohsenow, Colby, & Abrams, 1995), smoking is viewed as a means of coping with cravings for alcohol. Similarly, drinking may be used to cope with cravings for cigarettes. However, research on cross-substance coping has yielded inconsistent results (Carter & Tiffany, 1999). A majority of smokers in alcohol treatment have not reported any benefit from using such a coping strategy (Asher et al., 2003; Kalman et al., 2001; Monti et al., 1995).

There were limitations in the present study that need to be considered in interpreting the results. The NOSIE measures expectancies regarding the interaction between smoking and substance use and is not specific to expectancies regarding the interaction between smoking and alcohol use. Second, the present study sample was predominantly male and entirely military Veterans. Since the earlier study (Rohsenow et al., 2005) did not find gender differences on any of the NOSIE variables, the fact that the current sample was mostly male is less of a concern. Third, the associations between smoking-substance use interaction expectancies and measures of depressive symptoms and abstinence thoughts were cross-sectional, limiting inferences about causal relationships. Fourth, the large number of analyses introduced the risk of Type I error and most of the significant correlations represented small effects.

There is growing evidence to support the encouragement of smoking cessation among alcohol-dependent smokers in early recovery, that is, concurrent cessation of cigarettes, alcohol, and other drugs (Gulliver, Kamholz, & Helstrom, 2006; Kalman, 1998; Prochaska, Delucchi, & Hall, 2004; Sobell et al., 2002). Still,

tobacco use cessation outcomes in this group of smokers have been less than optimal due to a number of factors. For instance, alcohol-dependent tobacco smokers are more likely to come from a background of socioeconomic disadvantage (Daeppen et al., 2000) and lack effective coping skills for managing dysphoric mood states and substance-related urges (Burling et al., 1997; Steinberg, Hall, & Rustin, 2004). Therefore, tobacco and alcohol cessation outcomes may be enhanced by interventions that minimize the impact of depressive symptoms, cognitive deficits, low self-efficacy, and lack of desire to quit (Gordon, Kennedy, & McPeake, 1988).

There are an increasing number of empirical studies aimed at developing more effective smoking cessation treatments for smokers with AUD and successfully integrating such interventions within the substance abuse treatment and primary care settings (Drake, Mercer-McFadden, Mueser, McHugo, & Bond, 1998; Thompson et al., 1988). As research on treatment efficacy moves more in the direction of considering interactions between specific intervention components, process factors, and patient attributes (Imel, Wampold, Miller, & Fleming, 2008), the investigation of expectancies regarding interactions between smoking and drug use will be useful in designing more effective interventions for cigarette smokers with alcohol and other substance use disorders.

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