Published in final edited form as:

Addict Behav. 2009 ; 34(6-7): 548–553. doi:10.1016/j.addbeh.2009.03.020.

Depressive Symptoms, Drinking Problems, and Smoking Cessation in Older Smokers

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Abstract

This study modeled the predictive association between depressive symptoms and smoking cessation in a sample of 442 late-middle-aged smokers; assessments occurred at four time-points across a 10-year period. In addition, the study examined the role of baseline drinking problems in moderating the relationship between depressive symptoms and smoking cessation. Findings supported hypotheses. More depressive symptoms prospectively predicted a lower likelihood of smoking cessation. In addition, the presence of baseline drinking problems strengthened the relationship between depressive symptoms and a lower likelihood of smoking cessation. Understanding the mechanisms underlying depression and cigarette smoking among older adults is applicable to secondary prevention and treatment and suggests additional public health benefits from treating depression in older persons.

Keywords

depression; smoking cessation; drinking problems; comorbidity; aging

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1.1

Cigarette smoking is the leading cause of preventable mortality among older persons, and more than two-thirds of the almost half a million smoking-related deaths each year in the U.S. involve persons aged 60 and older (Ossip-Klein, Pearson, McIntosh, & Orleans, 1999). However, because smoking reduction and cessation interventions are targeted overwhelmingly to adolescents and young adults (Morgan et al., 1996; Rimer, Orleans, Keintz, Cristinzio, & Fleisher, 1990), older smokers represent an underserved population. Yet, smoking cessation has health benefits for smokers of all ages (Burns, 2000; Ossip-Klein, Pearson, McIntosh, & Orleans, 1999; Ostbye & Taylor, 2004). Understanding the interplay of emotional and behavioral factors associated with smoking cessation among older adults will facilitate the development of effective smoking cessation interventions with this population. The purpose of this study was to test a model of depressive symptoms in reducing smoking cessation among late-middle-aged smokers and to examine the role of drinking problems in strengthening the link between depressive symptoms and reduced smoking cessation.

1.2 Depressive Symptoms and Cigarette Smoking

Increasing evidence points to a significant positive cross-sectional relationship between depressive symptoms and tobacco smoking in mixed-age samples (Breslau, Novak, & Kessler, 2004; Kenney, Holahan, North, & Holahan, 2006; Lasser et al., 2000). Findings pertaining to depressive symptoms and smoking cessation are more complex, but generally suggest that depressive symptoms are a barrier to smoking reduction and cessation (e.g., Burgess et al., 2002; Cargill, Emmons, Kahler, & Brown, 2001; Curtin, Brown, & Sales, 2000). Based on longitudinal studies of from two weeks to one year, maintaining abstinence is difficult among depressed smokers (Glassman, Covey, Stetner, & Rivelli, 2001; Tsoh et al., 2000). Depressive symptoms during quit attempts have been associated with relapse (Burgess et al., 2002; Kahler et al., 2002), and latency to relapse appears to be significantly shorter for depressed smokers (Niaura et al., 2001; Pomerleau, Namenek-Brouwer, & Pomerleau, 2001).

Although very little research has focused specifically on older smokers, higher levels of depressive symptoms have been associated with cigarette smoking in cross-sectional studies of mixed-aged samples that have included older individuals (Colsher, et al., 1990; Rimer et al., 1990). Longitudinal studies of older samples with analyses across three to five years suggest that, although depressive symptoms are higher among smokers than non-smokers, they are not predictively associated with reduced smoking cessation (Kinnunen et al., 2006; Salive & Blazer, 1993). The failure to find effects for depressive symptoms on smoking cessation among older smokers may reflect the role of underlying moderating factors. One plausible moderator of the depressive symptoms-smoking cessation relationship is drinking problems.

1.3 Drinking Problems as a Moderator of the Depressive Symptoms-Smoking Cessation Relationship

Epidemiological studies document the high lifetime co-occurrence of alcohol abuse and cigarette smoking (Kessler et al., 1997; Merikangas et al., 1998). Research with mixed-aged samples has shown that individuals with drinking problems are less successful at smoking cessation than are those without drinking problems (Batel, Pessione, Maître & Rueff, 1995; DiFranza & Guerrera, 1990). This may be because, among smokers with drinking problems, alcohol-related cues are especially likely to increase the urge to smoke (Drobes, 2002; Gulliver et al., 1995; Rohsenow et al., 1997).

The role of drinking problems in moderating the association between depressive symptoms and smoking cessation is less clear. However, the potential for drinking problems to strengthen the depressive symptoms-smoking cessation relationship warrants investigation because both

alcohol misuse and tobacco smoking share common underlying mechanisms and vulnerabilities. For example, both behaviors often involve similar cognitive expectancies (Currie, Hodgins, el-Guebaly, & Campbell, 2001), coping deficits (Holahan, Moos, Holahan, Cronkite, & Randall, 2001), and underlying personality factors (Dixit & Crum, 2000).

Covey, Glassman, Stetner, and Becker (1993) examined this question in the context of a smoking cessation trial and, among men, found that drinking problems and depression interacted in predicting a lower likelihood of smoking cessation. However, the authors acknowledged that their sample sizes were small for interactional analyses (e.g., only 14 men and 10 women reported both drinking problems and depression). In addition, later studies have implicitly assumed a moderating role for drinking problems in the depression-smoking relationship by examining depression and smoking behavior among individuals with drinking problems. Among individuals being treated for alcohol abuse, depressive symptoms predicted less readiness to consider smoking cessation (Hitsman et al., 2002) and less actual smoking cessation across a 15-month period (Friend & Pagano, 2007). However, because these later studies focused only on individuals with drinking problems, they could not explicitly examine moderation.

1.4 Present Study

The current study is part of a longitudinal project that has examined late-life patterns of alcohol consumption and drinking problems (Moos, Brennan & Moos, 1991; Schutte, Brennan, & Moos, 1994, 1998; Schutte, Byrne, Brennan, & Moos, 2001; Schutte, Moos, & Brennan, 2006) and stress and coping processes (Holahan, Moos, Holahan, & Brennan, 1997; Holahan, Moos, Holahan, Brennan, & Schutte, 2005) among problem and non-problem drinkers age 55 and older. The purpose of the present research was to model the association between depressive symptoms, presence of drinking problems, and smoking cessation in a sample of late-middle-aged smokers, who were assessed at four time-points across a 10-year period. Specifically, the study tested an integrative model of: (a) depressive symptoms in reducing the likelihood of smoking cessation, and (b) the role of drinking problems in strengthening the relationship between depressive symptoms and a lower likelihood of subsequent smoking cessation.

Extending existing research on depressive symptoms and cigarette smoking in older adults (Kinnunen et al., 2006; Salive & Blazer, 1993) and in mixed-aged samples that included older individuals (Colsher, et al., 1990; Rimer et al., 1990), it was hypothesized that, across four assessments spanning 10 years, more depressive symptoms would predict a lower likelihood of smoking cessation. Broadening earlier research examining the interaction between drinking problems and depression in predicting smoking cessation (Covey et al., 1993) and the depression-smoking cessation relationship among individuals with drinking problems (Friend & Pagano, 2007; Hitsman et al., 2002; Patten et al., 1998, 2002), it was hypothesized that the presence of drinking problems would strengthen the association between depressive symptoms and a lower likelihood of smoking cessation. This study adds to previous research on cigarette smoking by examining the role of multiple risk factors in smoking cessation, employing a long-term predictive framework, and focusing specifically on older smokers.

2.1 Method

The larger sample from which the present sample of smokers was selected included 1,884 individuals at baseline who were between the ages of 55 and 65 and had had contact with a health care facility as outpatients within the previous three years for a wide variety of reasons, including minor health concerns. Based on the aims of the parent project, problem drinkers were over-selected and lifetime abstainers were excluded. However, the sample was comparable to similarly aged community samples with respect to health characteristics such as prevalence of chronic illness and hospitalization (for additional information on sample

recruitment, see Brennan & Moos, 1990; Moos et al., 1991). Data were obtained from self-report inventories at baseline and at 1-year, 4-year and 10-year follow-ups. Among participants who were still living, we obtained a 93% to 95% response rate at each of these follow-ups. The study was approved by the Stanford University Medical School Panel on Human Subjects; after the project was fully explained, participants provided signed informed consent.

The overall sample included 476 baseline smokers. Among these baseline smokers, 34 participants (7%) did not provide sufficient data to be included in the hierarchical linear modeling analyses, resulting in 442 participants who were included in the present analyses: 146 women and 296 men. Of the 442 participants included in the present analyses, 161 participants (36%) died or who were too ill to continue participation in the study across the full 10 years. On average, the 442 participants in the present analyses were 61 years of age at baseline ($SD = 3.04$) and had completed 13 years of education ($SD = 2.36$). At baseline, 54% of participants were married, 37% were employed full- or part-time, and 14.5% were members of ethnic/racial minority groups.

2.2 Measures

Descriptive and psychometric information for the depressive symptoms and smoking measures is available in the Health and Daily Living Form (HDL; Moos, Cronkite, & Finney, 1992); information on the Drinking Problems Index (DPI) is available in Finney, Moos, and Brennan (1991).

2.2.1 Depressive symptoms—Depressive symptoms were indexed at each assessment with a measure comprised of 18 symptoms experienced during the previous month ($\alpha = .92$), derived from the Research Diagnostic Criteria (RDC; Spitzer, Endicott, & Robins, 1978). Items tap depressed mood (e.g., feeling guilty, worthless, or down on yourself; feeling negative or pessimistic) and behavioral manifestations of depression (e.g., crying; feeling resentful, irritable, angry). For each item, respondents indicated how often they had experienced the symptom during the past month, from *never* (score = 0) to *often* (score = 4); the overall score can range from 0-72. The measure of depressive symptoms has an average correlation of .90 with the Beck Depression Inventory and has expected associations with treatment outcome and related indices of functioning and well-being (Billings & Moos, 1985; Cronkite, Moos, Twohey, Cohen, & Swindle, 1998; Moos et al., 1992; Moos, Cronkite, & Moos, 1998).

2.2.2 Drinking problems—Following Brennan, Schutte, and Moos (2005), we operationalized baseline drinking problems as the absence vs. presence of one-or-more drinking problems, which were assessed using the Drinking Problems Index (DPI; Finney et al., 1991). The DPI includes 17 alcohol-related problems specifically appropriate for late-middle-aged and older adults experienced during the past month ($\alpha = .94$). Items tap problematic drinking behavior (e.g., being intoxicated or drunk after drinking), adverse drinking consequences (e.g., having a fall or accident as a result of drinking), and alcohol dependence or withdrawal symptoms (e.g., having early morning cravings for a drink). Construct validity is supported by significant associations with prior history of alcohol misuse and treatment for alcohol abuse (Bamberger, Sonnenstuhl, & Vashdi, 2006; Finney et al., 1991; Kopera-Frye, Wiscott, & Sterns, 1999). At baseline, 48% of participants reported no drinking problems (score = 0), and 52% of participants reported one-or-more drinking problems (score = 1).

2.2.3 Smoking cessation—Current smoking was indexed at each assessment and was operationalized as responding yes to smoking tobacco and yes to smoking one or more cigarettes per day. To index smoking cessation, we focused on individuals who were smoking at the start of an interval. Intervals were defined by consecutive time-points (i.e., Times 1-2,

Times 2-3, and Times 3-4). We assigned a score of “0” (no cessation) at the next time point to those who continued smoking at that point or at any subsequent point during the study period. We assigned a score of “1” (cessation) at the next time point to those who were not smoking at that point and who did not resume smoking during the study period. Subsequent observations after permanent smoking cessation were coded as missing; non-responses also were coded as missing. By definition, each individual could receive only one score of “1” for permanent smoking cessation; however, they could receive multiple scores of “0” for continuing smoking.

3.1 Results

Overview of Data Analyses

We used hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002; Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) to examine the covariation within individuals in depressive symptoms and smoking cessation (Bernoulli model for a binary outcome) across the four observations. Specifically, within individuals (level 1), we examined depressive symptoms as a time-varying covariate of smoking cessation over repeated observations. All analyses controlled for time (year of assessment) at level 1; this controls for temporal effects and for the potential effect of unequal intervals between assessments. The intercept and the depressive symptoms slope and time slope varied significantly ($p < .01$) across participants and were examined as random coefficients. Between individuals (level 2), we examined the role of baseline drinking problems in predicting the strength of the depressive symptoms-smoking cessation relationship (level 1 slope). At level 2, we controlled for age, gender, and education.

Following Singer and Willett (2003), we used prospective analyses with depressive symptoms at time x linked to smoking cessation at time $x + 1$. Corresponding to the operationalization of smoking cessation, predictive intervals were defined by consecutive time-points (i.e., Times 1-2, Times 2-3, and Times 3-4). Table 1 shows means and standard deviations for depressive symptoms and smoking cessation lagged across the three assessment intervals. The HLM analyses included individuals in the analysis who had data on both depressive symptoms at the start and smoking cessation at the end of at least one predictive interval and who also had data on all level 2 predictors ($N = 442$).

3.2 Preliminary Attrition Analyses

Among the 476 baseline smokers, we compared participants who provided sufficient data ($n = 442$) with those who did not provide sufficient data ($n = 34$) to be included in the analyses. Compared to excluded participants, those included in the analyses did not differ in age ($F(1, 474) = 0.12, p = .74$), gender ($\chi^2(1) = 0.38, n = 476, p = .54$), or education ($F(1, 474) = 0.57, p = .45$) or on depressive symptoms ($F(1, 474) = 0.56, p = .46$) or drinking problems at baseline ($\chi^2(1) = 0.79, n = 476, p = .37$). In addition, among the 442 participants included in the present analyses, we compared surviving participants ($n = 281$) with those who died or were too ill to continue participation across the full 10 years ($n = 161$). Compared to participants who did not participate across the full 10 years, surviving participants were younger ($F(1, 440) = 4.88, p < .05$) and more likely to be female ($\chi^2(1) = 16.25, n = 442, p < .01$). However, neither of these variables was a significant moderator of the association between depressive symptoms and smoking cessation. Surviving participants were more likely to have reported smoking cessation at either the 1-year or 4-year follow-ups ($F(1, 433) = 4.01, p < .05$). However, survival was not associated with the predictive variables in the model, including depressive symptoms at baseline ($F(1, 440) = 0.01, p = .92$), 1-year ($F(1, 433) = 0.07, p = .79$), or 4 years ($F(1, 372) = 0.66, p = .42$) or baseline drinking problems ($\chi^2(1) = 0.02, n = 442, p = .88$).

3.3 Depression and Smoking Cessation

Within individuals (level 1), we examined the relationship between depressive symptoms and subsequent smoking cessation across the study period. As predicted, controlling for time, depressive symptoms were associated with a lower likelihood of subsequent smoking cessation ($B = -0.013$, $t(441) = -2.17$, $p < .05$). A difference of 1 standard deviation in depressive symptoms was associated with a difference in the relative odds of smoking cessation of 0.82 (95% CI = .69, .98). The time effect also was significant, with the likelihood of smoking cessation increasing over time ($B = 0.17$, $t(441) = 7.42$, $p < .01$).

3.4 The Moderating Role of Drinking Problems

Next, between individuals (level 2), we examined the role of individual differences in the presence or absence of baseline drinking problems in strengthening the association between depressive symptoms and a lower likelihood of subsequent smoking cessation. This analysis controlled for time at level 1 and for age, gender, and education at level 2. As predicted, the presence of baseline drinking problems strengthened the relationship between depressive symptoms and a lower likelihood of smoking cessation ($B = -0.035$, $t(437) = -2.63$, $p < .01$).

¹ The relationship between depressive symptoms and smoking cessation did not vary by age, gender, or education ($p > .05$).

The moderating role of baseline drinking problems on the association between depressive symptoms and smoking cessation is illustrated in Figure 1. Among participants with baseline drinking problems ($n = 230$), depressive symptoms were strongly linked to a lower likelihood of smoking cessation ($B = -0.033$, $t(229) = -3.78$, $p < .01$). For participants with baseline drinking problems, a difference of 1 standard deviation in depressive symptoms was associated with a difference in the relative odds of smoking cessation of 0.61 (95% CI = .47, .78). Across the full range of depressive symptoms, the odds of smoking cessation among participants with baseline drinking problems decreased more than six-fold. In contrast, among participants with no baseline drinking problems ($n = 212$), depressive symptoms were unrelated to the likelihood of smoking cessation ($B = 0.007$, $t(211) = 0.89$, $p = .43$).

4.1 Discussion

Among 442 smokers followed for 10-years, we found that: (a) more depressive symptoms predicted a lower likelihood of smoking cessation, and (b) drinking problems strengthened the relationship between depressive symptoms and a lower likelihood of smoking cessation. These findings extend understanding of emotional and behavioral factors in cigarette smoking by examining the roles of both depressive symptoms and drinking problems in smoking cessation, employing a 10-year predictive framework, and focusing specifically on late-middle-aged smokers.

Extending existing research on depressive symptoms and cigarette smoking in older adults (Kinnunen et al., 2006; Salive & Blazer, 1993) and in mixed-aged samples that included older individuals (Colsher, et al., 1990; Rimer et al., 1990), across four assessments during 10 years, depressive symptoms were associated with a lower likelihood of smoking cessation. In contrast to earlier longitudinal studies of older samples (Kinnunen et al., 2006; Salive & Blazer, 1993), we found a predictive association between depressive symptoms and reduced smoking cessation, which held across gender, as well as across age and education. Analyses of smoking cessation among older adults are conservative, involving a prospective test of change in

¹In addition, the presence of baseline drinking problems was associated with a lower likelihood of smoking cessation across the study period among individuals with high depressive symptoms (i.e., intercept centered at mean of top third in depressive symptoms; $B = -0.63$, $t(437) = -2.09$, $p < .05$).

smoking status among established smokers. Our use of within-subject analyses across multiple time-points may have provided a more powerful test than in earlier studies.

Broadening earlier research examining the interaction between drinking problems and depression in predicting smoking cessation (Covey et al., 1993) and the depression-smoking cessation relationship among individuals with drinking problems (Friend & Pagano, 2007; Hitsman et al., 2002; Patten et al., 1998, 2002), findings showed that the presence of baseline drinking problems strengthened the relationship between depressive symptoms and a lower likelihood of smoking cessation. We found that a one standard deviation increase in depressive symptoms reduced the odds of smoking cessation by more than one-third among older smokers with baseline drinking problems.

The association between depressive symptoms and smoking may involve “self-medication” of negative affect (Breslau, Peterson, Schultz, Chilcoat, & Andreski, 1998; Lerman et al., 1996). Moreover, individuals who experience depressive symptoms and have a history of drinking problems may have a stronger tendency to try to alleviate their negative affect through smoking because both behaviors are often linked to affect regulation. For example, alcohol misuse and tobacco smoking share common cognitive expectancies of reducing negative affect (Currie et al., 2001) and common physiological reinforcing mechanisms involving the mesolimbic dopamine system (Söderpalm, Ericson, Olausson, Blomqvist, & Engel, 2000).

In addition, similar vulnerabilities, such as deficits in coping with negative emotions, may underlie both alcohol misuse and tobacco smoking (Holahan et al., 2001), and common underlying personality factors, such as stimulus seeking and impulsivity (Dixit & Crum, 2000), may promote the co-occurrence of both behaviors. In addition, depressed individuals may not be as concerned about how abusing substances will affect their health or may feel helpless about controlling substance use (Dixit & Crum, 2000). These emotional tendencies may be reinforced at a neurocognitive level by possible deficits in executive functioning associated with frontal lobe dysfunction in depressed individuals (Elliott, 1998), which may be strengthened further by alcohol misuse and tobacco smoking (Glass et al., 2009).

Our results are noteworthy because they demonstrate that even among older smokers, who may be highly addicted to tobacco (Rimer et al., 1990), personal characteristics such as depressive symptoms and drinking problems are linked to smoking behavior. Further, our findings pertain to milder levels of depressive symptoms. Consistent with previous work on depressive symptoms among older adults (see Kasl-Godley, Gatz, & Fiske, 1998), the present sample showed an average level of depressive symptoms comparable to that in a younger community sample (see Holahan, Moos, Holahan, & Cronkite, 1999). Based on three prospective studies of smoking cessation, Niaura et al. (2001) concluded similarly that even very low levels of initial depressive symptoms reduce the length of periods of smoking cessation.

Older smokers comprise an underserved population. Older smokers are as successful as younger smokers in quitting smoking (Burns, 2000; Tait et al., 2006). Yet, although smoking cessation has health benefits for smokers of all ages (Burns, 2000; Ossip-Klein et al., 1999; Ostbye & Taylor, 2004), older smokers are provided fewer smoking reduction resources than are younger smokers (Brown et al., 2004; Cataldo, 2003; Glantz, 1996; Ossip-Klein et al., 2000). Similarly, physicians are less likely to encourage older compared to younger smokers to quit smoking (Jenks et al., 2000).

Some limitations should be noted in interpreting these results. Self-report measures are subject to both social desirability and common method variance. However, several comparisons of self-report with biochemical or cross-informant measures of smoking/substance use have found that self-report measures are accurate in most situations, particularly in studies of adults who are not in smoking interventions (Achenbach, Krukowski, Dumenci, & Ivanova, 2005;

Caraballo, Giovino, Pechacek, & Mowery, 2001; Patrick, Cheadle, Thompson, & Diehr, 1994; Rebagliato, 2002). Nevertheless, future research that includes collateral data on psychological functioning and objective indexes of drinking problems and smoking outcomes would enhance confidence in the present results.

Understanding the mechanisms underlying depression and cigarette smoking among older adults is applicable to secondary prevention and treatment (Dierker, Avenevoli, Stolar, & Merikangas, 2002). Providing smokers with skills for coping with emotional distress might enhance the effectiveness of smoking cessation efforts (Brown et al., 2001; Haas, Muñoz, Humfleet, Reus, & Hall, 2004). Cognitive-behavioral mood management training has been demonstrated to enhance smoking cessation rates among smokers with comorbid depressive symptoms and drinking problems (Patten, Drews, & Myers, 2002; Patten, Martin, Myers, Calfas, & Williams, 1998). Further, our results suggest the potential utility of considering older adults' smoking behavior when addressing their drinking-related problems. Although smoking is more closely associated with mortality among individuals with alcohol use disorders than is alcohol abuse, tobacco use is generally not addressed in alcohol interventions (Friend & Pagano, 2007; Hurt et al., 1996).

Acknowledgments

This work was supported by NIAAA Grant AA15685, the Center for Health Promotion Research at the University of Texas at Austin, and by Department of Veterans Affairs Health Services Research and Development Service funds. We gratefully acknowledge the assistance of Nathan Marti in advising on the HLM analyses.

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Figure 1.

Within individual association between depressive symptoms and odds of smoking cessation at the subsequent time-point across 10 years, contrasting participants with baseline drinking problems ($n = 230$) and participants with no baseline drinking problems ($n = 212$). To facilitate interpretation, time is not controlled and odds are shown; the HLM analysis controlled for time at level 1 and examined a linear function with log odds.

Table 1

Means and Standard Deviations (in Parentheses) for Depressive Symptoms and Smoking Cessation Lagged Across the Three Assessment Intervals.^a

Variable	Assessment			
	<i>Time 1</i>	<i>Time 2</i>	<i>Time 3</i>	<i>Time 4</i>
Depressive Symptoms	24.30 (15.34)	22.36 (14.89)	22.42 (15.01)	—
Smoking Cessation	—	.09 (.29)	.20 (.40)	.34 (.47)

^aDepressive symptoms ranged from 0-69. Mean smoking cessation represents the proportion of individuals who ceased smoking at each time point.