Published in final edited form as:

Addict Behav. 2011 March ; 36(3): 244–247. doi:10.1016/j.addbeh.2010.10.008.

Smoking History, Nicotine Dependence, and Changes in Craving and Mood during Short-Term Smoking Abstinence in Alcohol Dependent vs. Control Smokers

Jaimee L. Heffner, Ph.D.^a, Carolyn Mingione, B.A.^a, Thomas J. Blom, M.S.^a, and Robert M. Anthenelli, M.D.^{a,b}

^aTri-State Tobacco and Alcohol Research Center, Addiction Sciences Division, Department of Psychiatry and Behavioral Neuroscience, University of Cincinnati College of Medicine, UC Reading Campus, 2120 E. Galbraith Road, Building A, Cincinnati, OH 45237

^bCincinnati Veterans Affairs Medical Center, 3200 Vine Street, Cincinnati, OH, 45220

Abstract

Objective—The goal of this study was to compare lifetime cigarette smoking, severity of nicotine dependence, and subjective effects of short-term tobacco abstinence in abstinent alcohol dependent (AD) and control smokers.

Method—AD (n=119) and control (n=55) ever smokers were compared on tobacco use history and nicotine dependence. Negative affect and craving to smoke were examined in a subsample of currently smoking AD (N=34) and control (N=19) participants during a six-hour period of tobacco abstinence using the Profile of Mood States (POMS) and the Questionnaire on Smoking Urges-Brief (QSU-B).

Results—Although AD smokers did not differ from controls on heaviness of smoking, they were more likely to meet lifetime criteria for nicotine dependence. AD smokers also reported more withdrawal symptoms and were more likely to endorse withdrawal-related depressed mood during past smoking reduction or abstinence periods. During short-term abstinence, AD smokers were more likely to report high craving to smoke for negative affect relief within the first 150 minutes of tobacco abstinence, but did not differ from controls on overall craving to smoke or withdrawal-related negative affect on the POMS.

Conclusions—Results support previous findings that AD smokers have a greater prevalence of nicotine dependence and more severe nicotine withdrawal, with a greater propensity toward withdrawal-related depressed mood. These results, along with our novel finding that greater craving to smoke in abstaining smokers with AD is specific to negative affect-related craving,

© 2010 Elsevier Ltd. All rights reserved

Contact author: Jaimee L. Heffner, Ph.D. Tri-State Tobacco and Alcohol Research Center University of Cincinnati Reading Campus 2120 E. Galbraith Rd., Bldg. A Cincinnati, OH 45237 Phone: 513-558-7187 Fax: 513-558-7180 Jaimee.Heffner@uc.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Parts of this manuscript were presented as a poster and presentation at the 32nd Annual Meeting of the Research Society on Alcoholism, San Diego, California, June 2009.

Financial disclosures: Dr. Anthenelli provides consultancy and/or advisory services to Pfizer. Dr. Heffner provides consultancy services to Pfizer. Ms. Mingione and Mr. Blom have no competing interests to disclose. The Tri-State Tobacco and Alcohol Research Center receives research support from Lilly, Pfizer, and Nabi Biopharmaceuticals.

suggest that negative reinforcement may be a particularly salient factor in the maintenance of tobacco use among individuals with AD.

Keywords

tobacco; withdrawal; comorbidity

1. Introduction

Among smokers in treatment for alcohol and other substance use disorders, the prevalence of smoking is around 75–80% (Batel, Pessione, Maitre, & Rueff, 1995; Hurt et al., 1996), and quit rates tend to be low, averaging approximately 12% even with the assistance of pharmacotherapy and/or psychosocial interventions (Prochaska, Delucchi, & Hall, 2004). Data from cross-sectional studies suggest that smokers with alcohol dependence (AD) differ from non-AD smokers in several ways that may impede smoking cessation. For example, smokers with AD tend to be heavier smokers with a greater severity of nicotine dependence (Hertling et al., 2005; Hurt et al., 1995; Marks, Hill, Pomerleau, Mudd, & Blow, 1997; Novy, Hughes, & Callas, 2001). They are also more likely to experience negative affect and endorse depression as a nicotine withdrawal symptom, even after controlling for severity of nicotine dependence (Marks et al., 1997). Additionally, smokers with AD report greater expectations of relief from anxiety and depression as a result of smoking and experience more craving to smoke in response to depressed mood/dejection than non-AD smokers (Hertling et al., 2005; Novy et al., 2001).

Results of these prior studies may be limited by factors such as an exclusive focus on current smokers (i.e., those who are unmotivated or have tried unsuccessfully to quit) as opposed to ever smokers (Hughes, 2007); inaccurate or incomplete recall of past experiences; exclusion of women; or failure to account for co-occurring disorders such as depression, which are more concentrated in the AD population and may influence smoking behaviors and outcome expectancies (Currie, Hodgins, el-Guebaly, & Campbell, 2001; Marks et al., 1997). Additionally, we are aware of only one prospective study that has examined differences in nicotine abstinence effects in AD vs. non-AD smokers. In that secondary analysis of a nicotine patch trial, Hurt et. al (1995) found that nicotine withdrawal severity in alcoholic participants (n=43, all of whom were abstinent for at least one year) did not differ from that of the other participants. However, quit status at the time of assessment was not controlled for in these analyses, and the results may not generalize to individuals with AD in early remission, who are at greater risk for failed smoking cessation attempts than individuals with lengthier alcohol abstinence (Kalman et al., 2004; Prochaska et al, 2004).

Further investigation into the nature and implications of differences between AD and non-AD smokers is necessary to guide the development of more effective intervention strategies for AD smokers, especially for those with shorter lengths of abstinence from alcohol. As such, we compared lifetime cigarette smoking and nicotine dependence as well as the subjective effects of short-term tobacco abstinence in AD and non-AD smokers. Based on the available literature, we hypothesized that: 1) on assessments of lifetime tobacco use, the AD ever-smokers would be heavier, more nicotine dependent smokers who would report more severe nicotine withdrawal and withdrawal-related negative affect (i.e., depression, anxiety, irritability) than control ever-smokers; and 2) during short-term smoking abstinence, AD smokers would report greater negative affect and craving to smoke for negative affect relief than control smokers.

2. Materials and methods

2.1. Participants

Participants were AD (n=119) and control (n=55) ever-smokers who were screened for participation in a laboratory study examining the effects of gender and AD on stress responsivity (ClinicalTrials.gov Identifier: NCT00226694; Anthenelli, et al., 2010). All AD participants met Diagnostic and Statistical Manual for Mental Disorders, 4th edition, Text-Revised (DSM-IV-TR; American Psychiatric Association, 2000) criteria for the disorder and were involved in a substance abuse treatment program. Control participants without any history of AD were recruited primarily through newspaper and other print media advertisements. The subsample who completed the laboratory test requiring short-term smoking abstinence were current cigarette smokers (n=53), including 34 smokers in early full remission from AD (M=122.7 days of abstinence, SD=58.5) and 19 control smokers.

In order to be included, participants had to be between the ages of 21 and 55, have no current, independent Axis I psychiatric disorders other than nicotine dependence, and not be taking any psychotropic medications. Co-occurring substance use disorders that were in early or sustained full remission were not exclusionary, nor was a lifetime or current diagnosis of a substance-induced mood disorder or attention-deficit/hyperactivity disorder.

2.2. Assessments

The Semi-Structured Assessment for the Genetics of Alcoholism—Version 2 (SSAGA-II; Bucholz et al., 1994) was used to assess major Axis I disorders as well as antisocial personality disorder according to DSM-IV-TR criteria and to assess tobacco use history. The Family History Assessment Module (FHAM; Rice et al., 1995) was administered to determine family history of alcohol problems in one or more first-degree relatives. To assess severity of nicotine dependence in participants who had smoked within the past 12 months (n=143; 82% of the sample), we used the 6-item Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

Changes in withdrawal-related negative affect were assessed using three Profile of Mood States (POMS; McNair, Lorr, & Droppelman, 1971) subscales most consistent with the negative affect observed as part of nicotine withdrawal (i.e., tension-anxiety, depression-dejection, and anger-hostility). Additionally, the 10-item Questionnaire on Smoking Urges-Brief (QSU-B; Cox, Tiffany, & Christen, 2001) was administered to assess craving to smoke. The QSU-B has two distinct factors that have been replicated in multiple samples: Factor 1 is a desire and intention to smoke with expectation of smoking as a pleasurable experience, and Factor 2 is an urgent desire to smoke with expectation of relief from negative affect as a result of smoking (Cappelleri et al., 2007; Cox et al., 2001; Toll, Katulak, & McKee, 2006).

2.3. Procedures

Following the initial screening process, individuals completed up to three laboratory test sessions in randomized, counterbalanced order, including: 1) a combined dexamethasone/corticotrophin-releasing hormone stimulation test; 2) a citalopram stimulation test; and 3) a placebo test day. During each laboratory session, the POMS was administered at 0 (i.e., at baseline), 60, 180 and 300 minutes, and the QSU was administered at 0, 150, and 300 minutes. A full description of the laboratory tests and procedures for this study can be found elsewhere (Anthenelli et al., 2010). For our analyses, we utilized data only from the placebo test day. There were no differences between AD and control smokers in the timing of placebo test day (i.e., order effects; $p=.669$).

This study was reviewed and approved by the University of Cincinnati Institutional Review Board and the Cincinnati Veterans Affairs Medical Center Research and Development Committee. All participants provided written informed consent to participate.

2.4. Statistical Analyses

Preliminary comparisons of demographic and clinical characteristics were conducted using t-tests and chi-square tests. Comparisons of AD and control smokers on lifetime nicotine dependence and withdrawal symptoms were conducted using ANOVA and logistic regression analyses, controlling for any significant between-group differences in demographic and clinical characteristics. Scores on the QSU-B and POMS were not normally distributed; therefore, a median split was used to dichotomize these variables. Median values for each of the scales were as follows: QSU-B factor 1=5.20, QSU-B factor 2=2.00, QSU-B total=3.90; POMS tension-anxiety=4.00, POMS depression-dysphoria=2.00, and POMS anger-hostility=2.00. Logistic regression analyses were conducted to predict craving and mood at each time point separately, with group (AD vs. control) as the independent variable and FTND score as a covariate. We also conducted an ANOVA to compare the two groups on peak change from baseline in QSU-B Factor 2 scores. All analyses were conducted using SPSS Statistics 17.0.

3. Results

3.1. Comparison of lifetime smoking and nicotine dependence in the full sample (n=174)

Differences in demographic and clinical characteristics of control smokers (n=55) and AD smokers (n=119) are reported in Table 1, and these factors were entered as covariates in subsequent smoking-related comparisons. As illustrated in Table 1, AD and control ever-smokers did not significantly differ on heaviness of smoking or FTND scores. However, AD smokers were more likely to be diagnosed as nicotine dependent, endorsed a greater number of dependence symptoms, and reported more withdrawal symptoms during a past period of smoking reduction or abstinence after controlling for a lifetime diagnosis of nicotine dependence. With respect to the DSM-IV nicotine withdrawal symptoms representing negative affect, AD smokers were significantly more likely to endorse depression, but not irritability or anxiety.

3.2. Comparison of the effects of short-term smoking abstinence in the subsample (n=53)

Within the subsample of current smokers who completed the laboratory test session, AD smokers (n=34) differed from control smokers (n=19) only in terms of a greater likelihood of a lifetime illicit drug use disorder ($p<.001$) and a family history of alcohol problems ($p=.003$). However, we did not include these variables as covariates in the subsequent analyses because of small sample size and multicollinearity.

AD smokers were more likely to report high craving to smoke for negative affect relief (QSU-B Factor 2) at baseline ($p=.011$) and 150 minutes ($p=.001$), but not at 300 minutes ($p=.119$). As portrayed in Figure 1, scores on Factor 2 of the QSU-B increased over time in both the AD and control smokers, and the mean change scores did not differ significantly by group ($p=.830$). Of note, there were no differences between AD and control smokers on QSU-B factor 1 scores or total scores at any of the three time points, indicating that higher craving levels in AD smokers were domain-specific and indicative of a more urgent desire to smoke with expectation of negative affect relief.

On the POMS, we found no differences between the AD and control groups on measures of negative mood during smoking abstinence (data not shown). That is, high scores on the

tension-anxiety, depression-dejection, and anger-hostility subscales were equally likely in the AD and control smokers across all four time points.

4. Discussion

Consistent with our expectations, AD smokers were more likely to meet lifetime criteria for nicotine dependence and endorsed more dependence symptoms than control smokers. Additionally, AD smokers reported more severe nicotine withdrawal and were more likely to endorse depression (but not anxiety or irritability) as part of withdrawal, providing partial support for our hypothesis that AD smokers would report more negative affect-related withdrawal symptoms. This pattern of results fits with prior studies that have documented greater prevalence or severity of nicotine dependence in alcoholic smokers (Marks et al., 1997) and more severe nicotine withdrawal (Xian et al., 2005), including postcessation depressed mood (Marks et al., 1997). However, the finding that the two groups did not differ on heaviness of smoking or severity of nicotine dependence as measured by the FTND was discordant with results of several prior studies (Hertling et al., 2005; Marks et al., 1997; Novy et al., 2001). Although it is difficult to determine the reason for these discrepancies, it is possible that the entry criteria for the present study (e.g., exclusion of individuals with current Axis I disorders) may have eliminated a subset of heavier, more severely dependent smokers.

During short-term smoking abstinence, AD and control smokers did not differ on ratings of negative affect; however, they did report higher levels of negative affect-related craving at two of the three time points. These prospective data are consistent with prior data documenting AD smokers' greater motivation to smoke for negative affect relief (Hertling et al., 2005; Novy et al., 2001). These results suggest that negative reinforcement motives for smoking may be particularly salient for individuals with AD, and that greater craving to smoke to relieve negative affect is not merely due to greater severity of nicotine dependence.

Our study had several limitations. First, AD participants were recruited largely from residential treatment settings and are therefore likely to have more severe dependence along with comorbid drug use disorders, limiting the generalizability of the findings. Second, retrospective reports of smoking history are subject to recall bias, and self-reported nicotine withdrawal symptoms during past smoking abstinence or reduction may have been influenced by factors that were not assessed, such as use of a pharmacotherapy to aid cessation. Finally, our exclusion of currently depressed individuals may have reduced our ability to detect relationships between mood and craving to smoke. Thus, conclusions derived from analyses of the prospective data should be considered preliminary and require replication.

Despite these limitations, the results of this study support and extend previous findings that AD smokers tend to have a greater prevalence and severity of nicotine dependence, which is linked to poorer smoking cessation outcomes (Ferguson et al., 2003). Because negative affect is a strong predictor of relapse (Kenford et al., 2002), our finding that AD smokers reported greater abstinence-induced depressed mood in the retrospective data and greater craving to smoke to relieve negative affect in prospective data implies that smoking cessation interventions incorporating either pharmacological or behavioral methods to reduce negative affect may be beneficial in this population.

Research Highlights

- Alcohol dependent smokers had a higher prevalence of nicotine dependence and a history of more severe nicotine withdrawal than control smokers

- Alcohol dependent smokers were more likely than control smokers to report depressed mood as a symptom of nicotine withdrawal during past smoking abstinence or reduction
- Alcohol dependent smokers endorsed greater craving to smoke for negative affect relief during short-term smoking abstinence than control smokers

Acknowledgments

The authors would like to thank Candace Johnson, Ph.D.; Patricia Shay; Deonna Suggs, B.S.; Rebecca Kramer, B.A.; Kerri Dawson-Earles, B.S.; Lori Buns, N.P.; Show Lin, M.D.; Suzan Winders-Barrett, Ph.D., and Reene Cantwell for their assistance on this project. We are also indebted to the staff and clients of the Cincinnati VA Substance Dependence Program, Talbert House Pathways for Women Program, First Step Home, Transitions Women's Recovery Addiction Program, Center for Chemical Addictions Treatment, and the Crossroads Center for their involvement in the study.

Sources of funding: Drs. Heffner and Anthenelli and Mr. Blom were supported, in part, by NIAAA grants #AA013307, AA013957; NIDA/VA CSP #1022; and by the Department of Veterans Affairs. Dr. Heffner was also supported by NIDA grant #DA026517.

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. text revision. Author; Washington, D.C.: 2000.
- Anthenelli RM, Blom TJ, Johnson CS, Heffner JL, Wand GS. Sex differences in the stress response to the combined dexamethasone – CRH stimulation test in nondepressed, abstinent alcoholics and controls. 2010 Manuscript submitted for publication (copy on file with author).
- Batel P, Pessione F, Maitre C, Rueff B. Relationship between alcohol and tobacco dependencies among alcoholics who smoke. *Addiction* 1995;90:977–980. [PubMed: 7663320]
- Bucholz KK, Cadoret R, Cloninger CR, Dinwiddie SH, Hesselbrock VM, Nurnberger JI, Reich T, Schmidt I, Schuckit MA. A new, semi-structured psychiatric interview for use in genetic linkage studies: a report on the reliability of the SSAGA. *Journal of Studies on Alcohol* 1994;55:149–158. [PubMed: 8189735]
- Burling AS, Burling TA. A comparison of self-report measures of nicotine dependence among male drug/alcohol-dependent cigarette smokers. *Nicotine and Tobacco Research* 2003;5:625–633. [PubMed: 14577979]
- Cappelleri JC, Bushmakin AG, Baker CL, Merikle E, Olufade AO, Gilbert DG. Multivariate framework of the Brief Questionnaire on Smoking Urges. *Drug and Alcohol Dependence* 2007;90:234–242. [PubMed: 17482773]
- Cox LS, Tiffany ST, Christen AG. Evaluation of the brief questionnaire of smoking urges (QSU-brief) in laboratory and clinical settings. *Nicotine & Tobacco Research* 2001;3:7–16. [PubMed: 11260806]
- Currie SR, Hodgins DC, el-Guebaly N, Campbell W. Influence of depression and gender on smoking expectancies and temptations in alcoholics in early recovery. *Journal of Substance Abuse* 2001;13:443–458. [PubMed: 11775075]
- Ferguson JA, Patten CA, Schroeder DR, Offord KP, Eberman KM, Hurt RD. Predictors of 6-month tobacco abstinence among 1224 cigarette smokers treated for nicotine dependence. *Addictive Behaviors* 2003;28:1203–1218. [PubMed: 12915164]
- Grant BF, Hasin DS, Chou SP, Stinson FS, Dawson DA. Nicotine dependence and psychiatric disorders in the United States: results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry* 2004;61:1107–1115. [PubMed: 15520358]
- Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström test for nicotine dependence: A revision of the Fagerström tolerance questionnaire. *British Journal of Addiction* 1991;86:1119–1127. [PubMed: 1932883]

- Hertling I, Ramskogler K, Dvorak A, Klingler A, Saletu-Zyhlarz G, Schoberberger R, Walter H, Kunze M, Lesch OM. Craving and other characteristics of the comorbidity of alcohol and nicotine dependence. *European Psychiatry* 2005;20:442–450. [PubMed: 16095883]
- Hughes JR. Measurement of the effects of abstinence from tobacco: a qualitative review. *Psychology of Addictive Behaviors* 2007;21:127–137. [PubMed: 17563132]
- Hurt RD, Dale LC, Offord KP, Croghan IT, Hays JT, Gomez-Dahl L. Nicotine patch therapy for smoking cessation in recovering alcoholics. *Addiction* 1995;90:1541–1546. [PubMed: 8528039]
- Hurt RD, Offord KP, Croghan IT, Gomez-Dahl L, Kottke TE, Morse RM, Melton LJ. Mortality following inpatient addictions treatment: role of tobacco use in a community-based cohort. *Journal of the American Medical Association* 1996;275:1097–1103. [PubMed: 8601929]
- Kalman D, Kahler CW, Tirsch D, Kaschub C, Penk W, Monti P. Twelve-week outcomes from an investigation of high-dose nicotine patch therapy for heavy smokers with a past history of alcohol dependence. *Psychology of Addictive Behaviors* 2004;18:78–82. [PubMed: 15008689]
- Kenford SL, Smith SS, Wetter DW, Jorenby DE, Fiore MC, Baker TB. Predicting relapse back to smoking: Contrasting affective and physical models of dependence. *Journal of Consulting and Clinical Psychology* 2002;70:216–227. [PubMed: 11860048]
- Marks JL, Hill EM, Pomerleau CS, Mudd SA, Blow FC. Nicotine dependence and withdrawal in alcoholic and nonalcoholic ever-smokers. *Journal of Substance Abuse Treatment* 1997;14:521–527. [PubMed: 9437623]
- McNair, D.; Lorr, M.; Droppelman, L. Profile of mood states. 1st ed.. Educational and Industrial Testing Service; San Diego: 1971.
- Novy P, Hughes JR, Callas P. A comparison of recovering alcoholic and non-alcoholic smokers. *Drug and Alcohol Dependence* 2001;65:17–23. [PubMed: 11714586]
- Prochaska JJ, Delucchi K, Hall SM. A meta-analysis of smoking cessation interventions with individuals in substance abuse treatment or recovery. *Journal of Consulting and Clinical Psychology* 2004;72:1144–1156. [PubMed: 15612860]
- Rice JP, Reich T, Bucholz KK, Neuman RJ, Fishman R, Rochberg N, Hesselbrock VM, Nurnberger JJ, Schuckit MA, Begleiter H. Comparison of direct interview and family history diagnosis of alcohol dependence. *Alcoholism: Clinical and Experimental Research* 1995;19:1018–1023.
- Tiffany ST, Drobes DJ. The development and initial validation of a questionnaire on smoking urges. *British Journal of Addiction* 1991;86:1467–1476. [PubMed: 1777741]
- Toll BA, Katulak NA, McKee SA. Investigating the factor structure of the Questionnaire on Smoking Urges-Brief (QSU-brief). *Addictive Behaviors* 2006;31:1231–1239. [PubMed: 16226843]
- Xian H, Scherrer JF, Madden PA, Lyons MJ, Tsuang M, True WR, Eisen SA. Latent class typology of nicotine withdrawal: genetic contributions and association with failed smoking cessation and psychiatric disorders. *Psychological Medicine* 2005;35:409–419. [PubMed: 15841876]

Figure 1.
Change in Urgent Desire to Smoke for Negative Affect Relief (QSU-B Factor 2 Scores)
During Short-Term Abstinence in Alcohol Dependent and Control Smokers.

Table 1

Demographic, Clinical, and Smoking-Related Characteristics of Alcohol Dependent and Control Smokers

	Alcohol Dependent (N=119)	Control (N=55)	p-value
Age, <i>M (SD)</i>	39.26 (8.37)	38.22 (7.77)	.436
Gender (male), <i>no. (%)</i>	55 (46.22)	26 (47.27)	.897
Race (Caucasian), <i>no. (%)</i>	65 (54.62)	38 (69.09)	.071
Education (yrs.), <i>M (SD)</i>	12.21 (1.84)	13.05 (2.40)	.012
Illicit drug abuse/dependence (lifetime), <i>no. (%)</i>	82 (68.91)	10 (18.18)	<.001
Psychiatric comorbidity (lifetime), <i>no. (%)</i> ^a	49 (41.18)	7 (12.73)	<.001
Cigarettes per day, <i>M (SE)</i>	19.45 (1.21)	17.49 (1.92)	.400
Nicotine dependent, <i>no. (%)</i>	110 (92.44)	37 (67.27)	.002
Number of nicotine dependence criteria met, <i>M (SE)</i>	4.72 (0.17)	3.61 (0.26)	.001
FTND score, <i>M (SE)</i>	5.11 (0.27)	4.14 (0.45)	.071
Number of nicotine withdrawal symptoms endorsed, <i>M (SE)</i> ^{b,c}	4.95 (0.25)	3.51 (0.40)	.003
Negative affect-related withdrawal symptoms, <i>no. (%)</i> ^{b,c}			
Irritability	94 (79.66)	34 (62.96)	.855
Anxiety	84 (71.19)	23 (42.59)	.193
Depressed mood	51 (43.22)	5 (9.26)	.036

Note: All p-values were obtained from ANOVA or logistic regression models that controlled for years of education, lifetime illicit drug use disorders, and lifetime psychiatric comorbidity. For continuous variables, values reported in the table are estimated marginal means and standard errors.

^a Includes posttraumatic stress disorder, social phobia, major depressive disorder, attention-deficit/hyperactivity disorder, conduct disorder, and antisocial personality disorder.

^b Self-reported DSM-IV-TR nicotine withdrawal symptoms during a past period of smoking abstinence or reduction.

^c Analyses controlled for lifetime diagnosis of nicotine dependence.