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## Mental Disorders and Cigarette Use among Adults in the United States

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### Abstract

**Background**—The goal of this study was to determine the association between mental disorders and cigarette consumption and nicotine dependence.

**Methods**—Data were drawn from the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC), a nationally representative survey of adults (N=43,093) aged 18 and older. Relationships between specific anxiety disorders, mood disorders, non-dependent cigarette use, nicotine dependence among the whole sample, and nicotine dependence among cigarette users were examined.

**Results**—After adjusting for demographics and comorbid mental disorders, generalized anxiety disorder (OR = 1.16 (1.29–1.51)), specific phobia (OR = 1.35 (1.21–1.51)), panic disorder (PD) (OR = 1.90 (1.62–2.23)), major depression (MDD) (OR = 1.31 (1.16–1.48)), and bipolar disorder (OR = 1.30 (1.09–1.54)) were associated with increased likelihood of non-dependent cigarette use. Specific phobia (OR = 1.69 (1.49–1.91)), PD (OR = 1.82 (1.50–2.21)), MDD (OR = 1.59 (1.38–1.84)), and bipolar disorder (OR = 1.71 (1.39–2.09)) were associated with increased odds of nicotine dependence among the whole sample; social phobia (OR = 1.69 (1.19–2.40)), specific phobia (OR = 1.69 (1.43–2.01)), MDD (OR = 1.65 (1.34–2.02)), and bipolar disorder (OR = 2.38 (1.74–3.24)) were associated with increased risk of nicotine dependence among cigarette users.

**Conclusions**—Specific anxiety disorders and mood disorders were uniquely associated with non-dependent cigarette use, nicotine dependence among the whole sample, and the risk of nicotine dependence among cigarette users in the United States. Findings suggest that demographic differences, comorbid mood, anxiety, substance, and personality disorders all contributed to previously observed associations between mental disorders and nicotine dependence, explaining these links in some but not all cases.

### Introduction

There has been growing interest in the relationship between mental disorders and cigarette smoking. Consistent evidence of a link between mental disorders and cigarette smoking comes from three main sources. First, clinical studies have consistently documented high

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#### Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

rates of cigarette smoking and nicotine dependence among patients in treatment for depression, anxiety disorders, and other serious mental disorders, such as schizophrenia.<sup>1</sup> Second, recent epidemiologic studies have shown high rates of daily cigarette smoking<sup>2,3</sup> and nicotine dependence<sup>4</sup> among adults with mental disorders in the community, with the strongest links among those with major depression and specific anxiety disorders.<sup>5</sup> Third, a number of community based longitudinal studies among youth have shown associations between cigarette smoking and increased risk of panic disorder, agoraphobia, and major depression later in development,<sup>6–10</sup> as well as a link between panic attacks and subsequent onset of cigarette smoking.<sup>7,11</sup> In addition, studies from both clinical and community settings have suggested that specific mental disorders (e.g., social phobia) may increase risk of nicotine dependence among cigarette users, though the possibility that a range of other mental disorders may play this type of role has not been examined.

Despite the consistency of results showing an association between smoking and several types of mental disorders, a number of important areas remain unexamined regarding these links. First, while previous studies have examined the relationship between mental disorders and daily smoking, as well as the role of mental disorders in the risk of nicotine dependence among daily smokers, no single study has examined whether, or to what degree, mental disorders are specifically associated with non-dependent cigarette use, potentially the strongest modifiable risk factor for nicotine dependence, though one previous study found increased risk of non-dependent smoking associated with multiple comorbid mental disorders.<sup>2</sup> Yet, past work also has not examined the strength of the association between specific mental disorders and non-dependent cigarette use versus nicotine dependence among the whole sample. As such, current knowledge does not discriminate between these constructs in their relation to mental disorders. This information is important for a number of reasons. First, cigarette use is associated with a range of poor physical health outcomes such as pancreatic cancer, lung cancer, and cerebrovascular disease, even in the absence of nicotine dependence.<sup>12</sup> Second, cigarette use is the single strongest risk factor for nicotine dependence.<sup>13,14</sup> A better understanding of the differential comorbidity of mental disorders with non-dependent cigarette smoking with non-dependent cigarette smoking or nicotine dependence may shed light on the etiology of nicotine dependence by distinguishing whether some mental disorders are more closely linked with addictive cigarette use versus non-addictive cigarette use. This is a reasonable hypothesis to test given previous evidence from family studies showing a familial link between some anxiety disorders and addiction to other substances (eg. Alcohol), which have suggested these disorders may have common genetic underpinnings.<sup>15</sup> In addition, community-based and clinical studies have suggested that other disorders (e.g. Alcohol abuse) may be more strongly associated with infrequent/casual/non-dependent cigarette use.<sup>16</sup>

In addition, while results of epidemiologic studies show marked differences in the prevalence of both cigarette smoking<sup>17–24</sup> and mental disorders<sup>25–30</sup> by demographic segment of the population, there has been no detailed investigation into the role or impact of demographic differences in the links between smoking and mental disorders in a representative sample of adults in the United States. As rates of cigarette use have shifted substantially in recent decades, and these changes are thought to differ by socioeconomic status (e.g., rates of smoking have declined more substantially among those with higher levels of formal education),<sup>31</sup> understanding the role of potential demographic differences in these relationships may be important in developing more effective prevention strategies. Personality disorders are strongly linked with mood, anxiety, and substance use disorders.<sup>32–34</sup> Furthermore, clinical studies indicate that comorbid personality disorders may inhibit success in substance abuse/dependence treatment programs.<sup>35,36</sup> Yet, previous epidemiologic studies have not examined the role of the range of personality disorders in the study axis I mental disorders.

The goal of the current study was to begin to fill some of these gaps in the existing literature. First, the study examined the association between mental disorders and dependent and non-dependent cigarette use among adults in the United States. Second, the study examined whether and to what degree differences in gender, race, income, and educational attainment play a role in the link between mental disorders and dependent and non-dependent cigarette use. Third, the study examined the role of additional Axis I and II comorbidity in the links between specific mental disorders and dependent and non-dependent cigarette use.

## Methods

### Selection and description of participants

The sample was drawn from participants in the 2001–2002 National Epidemiologic Survey of Alcohol and Related Conditions (NESARC), a nationally representative United States survey of 43,093 civilian, non-institutionalized, participants aged 18 and older that have been sampled cross-sectionally. Details of the sampling frame are described elsewhere.<sup>37,38</sup> The National Institute on Alcohol Abuse and Alcoholism (NIAAA) sponsored the study and supervised the fieldwork, conducted by the U.S. Bureau of the Census. Young adults, Hispanics, and African-Americans were oversampled, and the study achieved an overall response rate of 81%. To adjust for non-response and selection probability, the sample was weighted and adjusted to reflect the U.S. population from the 2000 Decennial Census in terms of age, race, sex, and ethnicity. The research protocol, including informed consent procedures, received full ethical review and approval from the U.S. Census Bureau and U.S. Office of Management and Budget.

### Interviewers, training, and field quality control

Interviewing was conducted by 1,800 professional interviewers from the Census Bureau using computer-assisted software with built-in skip, logic, and consistency checks. All interviewers had experience with other national health-related surveys with an average of five years of experience, and were further trained for 10 days under the direction of NIAAA. Verification of the interviewer was conducted by regional supervisors who re-contacted a random 10% of all respondents for quality control purposes. In addition, a randomly selected subset of respondents was re-interviewed with 1 to 3 complete sections of the AUDADIS-IV. This served as a test-retest reliability study of NESARC measures.<sup>39</sup> In the few cases when accuracy was uncertain, the data were discarded and a supervising interviewer repeated the interview.

### Measures

Diagnoses were assessed with the NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV (AUDADIS-IV).<sup>39</sup> All diagnoses were made in the prior 12-months; the time periods for measurement were consistent across all diagnoses included in the present analysis. This instrument was specifically designed for experienced lay interviewers and was developed to advance measurement of substance use and mental disorders in large-scale surveys. Nicotine dependence among the whole sample was assessed in a unique module separate from the assessment of other substance use. Respondents were considered to have ever used cigarettes if they have smoked 100 or more cigarettes during their lifetime. Four other modes of nicotine use were assessed as well: pipe, cigar, snuff, and chewing tobacco use. The test-retest reliability of the nicotine use variables and well as other AUDADIS-IV nicotine use measures (e.g. frequency and duration of use), were excellent, with interclass correlation coefficients of 0.83 to 0.84.<sup>40</sup>

Assessment of cigarette use and nicotine dependence was based on the unique characteristics of nicotine dependence as distinct from other substances. To that end, the

AUDADIS-IV used an extensive list of over 40 questions to assess nicotine dependence, and obtains extensive information on time frames of nicotine use and dependence. Diagnoses were made according to the DSM-IV criteria.<sup>41</sup> Criteria for nicotine dependence include 3/7 of the following: (1) the need for more nicotine to achieve desired effect; (2) that the subject meets the criteria for nicotine withdrawal syndromes; (3) the use of tobacco by the subject more than the subject intended; (4) the persistent desire or unsuccessful efforts to cut down on nicotine use; (5) the great deal of time spent using tobacco (e.g. chain smoking); (6) the necessity to give up activities in favor of nicotine use; (7) and the continued use despite recurrent physical or psychological problems likely to have been caused by nicotine use. Nicotine withdrawal was assessed as a syndrome as described by the DSM-IV based on four symptoms: (1) the use of nicotine upon waking; (2) the use of nicotine after being in a situation in which nicotine was restricted; (3) the use of nicotine to relieve or avoid withdrawal symptoms; (4) the need to wake up in the middle of the night to use nicotine. Time frames for diagnosis included the previous 12-month period and prior to the previous 12-month period.

The reliability and validity of the nicotine dependence diagnosis was assessed via random subsample of 347 respondents who were reinterviewed with the nicotine dependence module up to 10-weeks after initial appraisal.<sup>42</sup> The reliability of the previous 12-month (i.e. current) diagnosis was good ( $k=0.63$ ). Further, a series of linear regression analyses were used to validate the diagnoses by examining the association between nicotine dependence and Short-Form-12v2 (an often used measure of generic quality of life which generates 10 component and profile scores assessing various dimensions of physical and mental disability)<sup>43</sup> physical disability scores. Analyses were controlled for age, personality disorders, current comorbid alcohol and drug use, and mood and anxiety disorders.

### Statistical Analyses

Analyses were conducted using SUDAAN<sup>44</sup> to derive standard errors that account for the complex sampling scheme of the dataset. Weighted percentages were obtained to describe the demographic characteristics of various subpopulations of cigarette users with mood or anxiety disorders, including those that have never used cigarettes, non-dependent cigarette users, and nicotine dependent cigarette users. Statistical associations with demographic characteristics were tested using chi-square. Demographic variables tested included: age (18–29, 30–44, 45–64, 65+), gender, race/ethnicity (White, Non-Hispanic Black, American Indian/Alaska Native, Asian/Hawaiian/Pacific Islander, or Hispanic), education (less than high school, high school graduate, more than high school), and personal income (\$0–19,999, \$20,000–34,999, \$35,000–69,999, \$70,000). Odds ratios (ORs) were derived to establish the association between current (i.e., past 12-month) mental disorders (predictor) and cigarette use status (outcome), controlling for demographic characteristics, as well as any other mood, anxiety, personality, or substance disorder. Ten personality disorders including antisocial, conduct, avoidant, dependent, schizoid, histrionic, narcissistic, paranoid, and obsessive-compulsive were assessed in the AUDADIS-IV; any diagnosis across the ten disorders considered the individual positive for a personality disorder. First, we examined the relationship between any anxiety disorder, generalized anxiety disorder (GAD), social phobia, specific phobia, and panic disorder and level of cigarette use (past 12-months). Next any depressive disorder, major depression, bipolar disorder, and dysthymia were examined in relation to level of cigarette use.

## Results

### Association between anxiety disorders and dependent and non-dependent cigarette use

After controlling for demographic characteristics and any mood disorders, results showed that all anxiety disorders were significantly associated with increased likelihood of non-dependent cigarette use, nicotine dependence among the whole sample, and nicotine dependence among cigarette users with the exception that social phobia was not associated with non-dependent cigarette use (See Table 1). After adjusting for demographics, mood, substance use, and personality disorders, all of these associations remained significant although somewhat weaker with the exception of the link between social phobia and nicotine dependence among the whole sample, which lost statistical significance. After further adjustment for any other anxiety disorders, we found that GAD, specific phobia, and panic disorder remained associated with non-dependent cigarette use. We found also that specific phobia and panic disorder were associated with nicotine dependence among the whole sample and that social phobia and specific phobia were associated with nicotine dependence among cigarette users. The strongest associations after adjustment were between panic disorder and both non-dependent cigarette use and nicotine dependence among the whole sample.

### Association between mood disorders and dependent and non-dependent cigarette use

After adjusting for demographics and any anxiety disorders, results showed that all mood disorders were significantly associated with non-dependent cigarette use, nicotine dependence among the whole sample, and nicotine dependence among cigarette users (See Table 2). After adjusting for demographics, anxiety, substance use disorders, and personality disorders, associations persisted except for the link between dysthymia and nicotine dependence among cigarette users. After additionally adjusting for demographics, anxiety, substance use disorders, any personality disorders, and any other mood disorders simultaneously, all the associations remained significant, albeit, attenuated. The strongest link after adjustment was between bipolar disorder and nicotine dependence among cigarette users.

## Discussion

Our results are consistent with previous epidemiologic data showing a strong and significant link between anxiety/mood disorders and cigarette use.<sup>45–48</sup> Importantly, the findings extend previous knowledge in three major ways. First, we found that both anxiety disorders and depression are independently associated with non-dependent cigarette use and dependent cigarette use (nicotine dependence) among adults in the United States. Second, we found that while demographic differences played a role in these linkages, they do not fully explain these relationships. Third, after adjusting for demographics, anxiety, substance use disorders, any personality disorders, and any other mood disorders simultaneously, we found that the strength and significance of the links between specific anxiety and mood disorders and specific levels of cigarette use were attenuated, but still quite substantial and significant for a number of disorders. These data provided new information on the importance of specifying the role and type of cigarette use/nicotine dependence in the investigation of the relationships between anxiety/mood disorder and nicotine use.

At the broadest level, the present data indicate that there may be different mechanisms linking dependent and non-dependent smoking to specific mental disorders and that psychopathology is thus not uniformly associated with any pattern of cigarette use. Indeed, these data illustrate that both mood disorders and anxiety disorders were significantly associated with dependent and non-dependent cigarette use, and that despite high rates of



comorbidity, the associations between mood disorders and cigarette use was independent of comorbid anxiety disorders, as well as the reverse. Second, these data also show that there are differences in the strength of the associations between specific forms of depression and anxiety, and different types of non-dependent cigarette use. Specifically, different mental disorders were variably related to non-dependent cigarette use, dependent cigarette use, and the nicotine dependence among cigarette users. Third, the data showed that the association between depression, anxiety disorders, non-dependent cigarette use, and dependent cigarette use is related to comorbid mental disorders, substance use, personality disorders, as well as differences in demographic characteristics; however, these characteristics do not entirely explain these associations.

The current results extend previous findings in a novel fashion pertaining to the link between the range of mental disorders and cigarette smoking by showing that both specific anxiety disorders and mood disorders are associated with dependent and non-dependent cigarette use and nicotine dependence among the whole sample, with each contributing independently to these problems. While numerous clinical and epidemiologic investigations have examined the relationships between mood disorders and smoking,<sup>49–52</sup> and anxiety disorders and smoking,<sup>45,48</sup> these studies have not examined whether and to what degrees these relationships are independent of each other. Specifically, as mood and anxiety disorders are highly comorbid,<sup>53,54</sup> analyses of mood disorders that fail to adjust for the potential impact of anxiety disorders (and vice versa) may not illuminate the strength of these distinct relationships. For instance, previous studies separately identified strong relationships between panic and cigarette use<sup>8</sup> and nicotine dependence.<sup>37</sup> However, the studies did not adjust for depression, so whether or to what degree depression influenced the observed findings was left unclear.

Our analyses are the first to examine the role of demographic differences, comorbid Axis I mood and anxiety disorders, substance use disorders, and personality disorders, in the link between depression and anxiety with various level of smoking among adults in the community. Adjusting for these factors provides new information on the degree to which each disorder of interest is independently associated with severity of smoking (i.e., cigarette use vs. dependence). In terms of anxiety disorders, the links between specific phobia and panic disorder and cigarette use and dependent cigarette use were strongest and most consistent. These links remained statistically significant across all levels of adjustment, with the exception of the risk of nicotine dependence among the whole sample associated with panic disorder among non-dependent cigarette users. In contrast, GAD was strongly associated with dependent and non-dependent cigarette use, and nicotine dependence among users only when demographics and mood disorders were controlled, but after adjustment for all other factors, only the relationship between GAD and non-dependent cigarette use remained significant. This observation suggests that the observed link between GAD and nicotine dependence among the whole sample appears to be largely accounted for by comorbidity with other anxiety disorders. Presumably, this comorbidity is linked to specific phobia and panic disorder, since these are the only anxiety disorders that remained significantly linked with nicotine dependence among the whole sample after adjustment.

Of interest, the relationship between social phobia and levels of cigarette use differed from those observed with other anxiety disorders. Before adjustment, social phobia was not significantly associated with non-dependent cigarette use and was associated with an increased likelihood of dependent cigarette use. After adjustment for all factors, social phobia was associated with a significantly reduced likelihood of dependent and non-dependent cigarette use but was strongly associated with increased risk of nicotine dependence among cigarette users. Adjusting for these factors illustrates that, in isolation, social phobia seems to be protective against initiating cigarette use. This effect may be

related to the strong peer effect on smoking initiation among youth, for youths with social phobia may be less exposed to peer pressure to smoke, as they are less likely to be in social situations. This hypothesized 'protective' effect of social isolation does not appear to persist once cigarette use is initiated among those with social phobia, as those with social phobia who use cigarettes appear extremely vulnerable to dependence. This finding is consistent with Sontag et al.<sup>55</sup> and Johnson et al.,<sup>8</sup> who similarly found that the onset of cigarette use was delayed among youth in the community with social phobia. The consistency of results on the relationship between social phobia and various levels of smoking with previous studies, and the notable difference in the strength and specificity with which social phobia appears to be associated with various levels of smoking compared with other anxiety disorders (e.g., panic disorder is strongly associated with all levels of smoking) highlights the importance of investigating each of these specific linkages. In that, this specificity indicates that any discussion of the relationship between anxiety disorders and smoking would be potentially misleading unless specific anxiety disorders are examined separately.

Similarly, the relationship between bipolar disorder and nicotine dependence among the whole sample appeared to be the strongest among all mood and anxiety disorders. In contrast, adjusted analyses revealed that while dysthymia is significantly associated with dependent and non-dependent cigarette use prior to adjustment, after adjusting for other mood disorders the relationship between dysthymia and dependent cigarette use was no longer evident. Similarly, after adjusting for other substance use problems and personality disorders, the association between dysthymia and the risk of dependent cigarette use among users disappeared. As such, it appears that comorbid major depression and bipolar disorder may explain the observed link between dysthymia and nicotine addiction. Similar to anxiety disorders, these results emphasize the impact specific mood diagnoses have on results of analyses between mental disorders and cigarette smoking.

Limitations of this study should be considered when interpreting our results. First, the study was cross-sectional; therefore we cannot draw conclusions about the potential causal mechanisms between the disorders, although the size and generalizability of this study did allow for an in-depth examination of specificity. Future longitudinal studies with large sample sizes will be useful in understanding the temporal nature of these relationships. Second, we could not explore associations between PTSD and levels of cigarette use because such data were not available from the data set. Future work could extend the present findings by examining such analyses to PTSD and perhaps other trauma-related disorders (e.g., acute stress disorder). The second wave of the NESARC will include PTSD and allow investigation of these links over two waves.

In sum, our findings provided important new information on the strength and specificity of the links between specific anxiety and mood disorders, and dependent and non-dependent cigarette use in the United States. While our results were generally consistent with previous cross-sectional and longitudinal findings, the above findings provide new insight into these relationships through the examination of the role of comorbid mood, anxiety, substance use, and personality disorders. These results also provided new data on the relationship between specific mood and anxiety disorders and non-dependent cigarette use among adults in the US, as well as in the role of mood and anxiety disorders and the risk of nicotine dependence among individuals who used cigarettes. Previously, Grant et al. 2004<sup>4</sup> addressed the relationship of mental disorders to nicotine dependence, and the current study builds on and extends this work by examining these relationships in greater detail. Our findings highlight the importance of specifying the type of anxiety/mood disorder, as well as the level of frequency and dependence when drawing clinical implications or directions for future research on the relationship between mental disorders and cigarette use in the community. Future studies that take a multidisciplinary approach toward understanding the potential

social, environmental, genetic and/or biological mechanisms that might explain the relationships between specific anxiety and mood disorders and various types of cigarette use are needed. For example, there may be common biochemical underpinnings or neural pathways underlying addiction and severe anxiety disorders which lead to comorbidity of social phobia and nicotine dependence while social/environmental/triggers may contribute to non-dependent use among adults with dysthymia. Such information may help to develop more effective prevention programs for high risk groups before initiation of cigarette use, or toward improving smoking cessation treatment strategies for those dependent on nicotine.

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## References

1. Steinberg ML, Williams JM, Ziedonis DM. Financial implications of cigarette smoking among individuals with schizophrenia. *Tob Control*. 2004 Jun;13(2):206. [PubMed: 15175544]
2. Breslau N, Novak SP, Kessler RC. Daily smoking and the subsequent onset of psychiatric disorders. *Psychol Med*. 2004 Feb; 34(2):323–333. [PubMed: 14982138]
3. Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: A population-based prevalence study. *JAMA*. 2000 Nov 22–29; 284(20):2606–2610. [PubMed: 11086367]
4. 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. *Arch Gen Psychiatry*. 2004 Nov; 61(11):1107–1115. [PubMed: 15520358]
5. McCabe RE, Chudzik SM, Antony MM, Young L, Swinson RP, Zvolensky MJ. Smoking behaviors across anxiety disorders. *J Anxiety Disord*. 2004; 18(1):7–18. [PubMed: 14725865]
6. Goodwin RD, Lewinsohn PM, Seeley JR. Cigarette smoking and panic attacks among young adults in the community: the role of parental smoking and anxiety disorders. *Biol Psychiatry*. 2005 Nov 1;58(9):686–693. [PubMed: 16018987]
7. Isensee B, Wittchen HU, Stein MB, Hofler M, Lieb R. Smoking increases the risk of panic: findings from a prospective community study. *Arch Gen Psychiatry*. 2003 Jul; 60(7):692–700. [PubMed: 12860773]
8. Johnson JG, Cohen P, Pine DS, Klein DF, Kasen S, Brook JS. Association between cigarette smoking and anxiety disorders during adolescence and early adulthood. *JAMA*. 2000 Nov 8; 284(18):2348–2351. [PubMed: 11066185]
9. McLeish AC, Zvolensky MJ, Bonn-Miller MO, Bernstein A. Perceived health moderates the association between smoking rate and panic vulnerability variables among daily smokers. *Depress Anxiety*. 2006; 23(5):257–265. [PubMed: 16688733]
10. McLeish AC, Zvolensky MJ, Bucossi MM. Interaction between smoking rate and anxiety sensitivity: relation to anticipatory anxiety and panic-relevant avoidance among daily smokers. *J Anxiety Disord*. 2007; 21(6):849–859. [PubMed: 17166696]
11. Bernstein A, Zvolensky MJ, Schmidt NB, Sachs-Ericsson N. Developmental course(s) of lifetime cigarette use and panic attack comorbidity: an equifinal phenomenon? *Behav Modif*. 2007 Jan; 31(1):117–135. [PubMed: 17179533]
12. The health consequences of smoking: A report of the surgeon general. Washington, DC: United States Department of Health and Human Services; 2004.
13. Horn K, Fernandes A, Dino G, Massey CJ, Kalsekar I. Adolescent nicotine dependence and smoking cessation outcomes. *Addict Behav*. 2003 Jun; 28(4):769–776. [PubMed: 12726789]
14. Karp I, O'Loughlin J, Hanley J, Tyndale RF, Paradis G. Risk factors for tobacco dependence in adolescent smokers. *Tob Control*. 2006 Jun; 15(3):199–204. [PubMed: 16728750]
15. Merikangas KR, Stevens DE, Fenton B, et al. Co-morbidity and familial aggregation of alcoholism and anxiety disorders. *Psychol Med*. 1998 Jul; 28(4):773–788. [PubMed: 9723135]



16. Schumann A, Hapke U, Meyer C, Rumpf HJ, John U. Prevalence, characteristics, associated mental disorders and predictors of DSM-IV nicotine dependence. *Eur Addict Res.* 2004; 10(1):29–34. [PubMed: 14665803]
17. Barbeau EM, Krieger N, Soobader MJ. Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health.* 2004 Feb; 94(2):269–278. [PubMed: 14759942]
18. Conwell LS, O'Callaghan MJ, Andersen MJ, Bor W, Najman JM, Williams GM. Early adolescent smoking and a web of personal and social disadvantage. *J Paediatr Child Health.* 2003 Nov; 39(8):580–585. [PubMed: 14629522]
19. Eaton WW, Keyl PM. Risk factors for the onset of Diagnostic Interview Schedule/DSM-III agoraphobia in a prospective, population-based study. *Arch Gen Psychiatry.* 1990 Sep; 47(9):819–824. [PubMed: 2393340]
20. Ellickson PL, McGuigan KA, Klein DJ. Predictors of late-onset smoking and cessation over 10 years. *J Adolesc Health.* 2001 Aug; 29(2):101–108. [PubMed: 11472868]
21. Juon HS, Ensminger ME, Sydnor KD. A longitudinal study of developmental trajectories to young adult cigarette smoking. *Drug Alcohol Depend.* 2002 May 1; 66(3):303–314. [PubMed: 12062465]
22. Lorant V, Deliege D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic inequalities in depression: a meta-analysis. *Am J Epidemiol.* 2003 Jan 15; 157(2):98–112. [PubMed: 12522017]
23. Rouse BA. Epidemiology of smokeless tobacco use: a national study. *NCI Monogr.* 1989; (8):29–33. [PubMed: 2785648]
24. Wells JC, Tien AY, Garrison R, Eaton WW. Risk factors for the incidence of social phobia as determined by the Diagnostic Interview Schedule in a population-based study. *Acta Psychiatr Scand.* 1994 Aug; 90(2):84–90. [PubMed: 7976463]
25. Bijl RV, Ravelli A, van Zessen G. Prevalence of psychiatric disorder in the general population: results of The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Soc Psychiatry Psychiatr Epidemiol.* 1998 Dec; 33(12):587–595. [PubMed: 9857791]
26. Davey Smith G, Hart C, Hole D, et al. Education and occupational social class: which is the more important indicator of mortality risk? *J Epidemiol Community Health.* 1998 Mar; 52(3):153–160. [PubMed: 9616419]
27. Lewis G, Bebbington P, Brugha T, et al. Socioeconomic status, standard of living, and neurotic disorder. *Lancet.* 1998 Aug 22; 352(9128):605–609. [PubMed: 9746021]
28. Muntaner C, Eaton WW, Diala C, Kessler RC, Sorlie PD. Social class, assets, organizational control and the prevalence of common groups of psychiatric disorders. *Soc Sci Med.* 1998 Dec; 47(12):2043–2053. [PubMed: 10075245]
29. Weich S, Lewis G. Material standard of living, social class, and the prevalence of the common mental disorders in Great Britain. *J Epidemiol Community Health.* 1998 Jan; 52(1):8–14. [PubMed: 9604035]
30. Holzer CE, Shea BM, Swanson JW, et al. The increased risk for specific psychiatric disorders among persons of low socioeconomic status: Evidence from the Epidemiologic Catchment Area Surveys. *American Journal of Social Psychiatry.* 1986; 6(4):259–271.
31. Breslau N, Johnson EO, Hiripi E, Kessler R. Nicotine dependence in the United States: prevalence, trends, and smoking persistence. *Arch Gen Psychiatry.* 2001 Sep; 58(9):810–816. [PubMed: 11545662]
32. Brieger P, Ehrt U, Marneros A. Frequency of comorbid personality disorders in bipolar and unipolar affective disorders. *Compr Psychiatry.* 2003 Jan-Feb; 44(1):28–34. [PubMed: 12524633]
33. Reich J, Perry JC, Shera D, et al. Comparison of personality disorders in different anxiety disorder diagnoses: panic, agoraphobia, generalized anxiety, and social phobia. *Ann Clin Psychiatry.* 1994 Jun; 6(2):125–134. [PubMed: 7804388]
34. Tragesser SL, Sher KJ, Trull TJ, Park A. Personality disorder symptoms, drinking motives, and alcohol use and consequences: cross-sectional and prospective mediation. *Exp Clin Psychopharmacol.* 2007 Jun; 15(3):282–292. [PubMed: 17563215]
35. Kranzler HR, Del Boca FK, Rounsaville BJ. Comorbid psychiatric diagnosis predicts three-year outcomes in alcoholics: a posttreatment natural history study. *J Stud Alcohol.* 1996 Nov; 57(6):619–626. [PubMed: 8913993]

36. Verheul R, van den Brink W, Hartgers C. Personality disorders predict relapse in alcoholic patients. *Addict Behav.* 1998 Nov-Dec;23(6):869–882. [PubMed: 9801722]
37. Compton WM, Grant BF, Colliver JD, Glantz MD, Stinson FS. Prevalence of marijuana use disorders in the United States: 1991–1992 and 2001–2002. *JAMA.* 2004 May 5; 291(17):2114–2121. [PubMed: 15126440]
38. Grant BF, Stinson FS, Dawson DA, Chou SP, Ruan WJ, Pickering RP. Co-occurrence of 12-month alcohol and drug use disorders and personality disorders in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry.* 2004 Apr; 61(4):361–368. [PubMed: 15066894]
39. Grant, BF.; Dawson, DA.; Hasin, DS. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV version (AUDADIS-IV). Bethesda: National Institute on Alcohol Abuse and Alcoholism; 2001.
40. Grant BF, Dawson DA, Stinson FS, Chou PS, Kay W, Pickering R. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug Alcohol Depend.* 2003 Jul 20; 71(1):7–16. [PubMed: 12821201]
41. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Washington, DC: American Psychiatric Association; 1994.
42. Grant, BF.; Moore, TC.; Kaplan, K. Source and Accuracy Statement: Wave 1 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). Bethesda: National Institute on Alcohol Abuse and Alcoholism; 2003.
43. Ware, JE.; Kosinski, M.; Turner-Bowker, DM.; Gandek, B. How to Score Version 2 of the SF-12 Health Survey. Lincoln: Quality Metrics; 2002.
44. Software for Survey Data Analysis (SUDAAN), (Ver. 9.01) [computer program]. Research Triangle Park: Research Triangle Institute; 2002.
45. Breslau N, Kilbey M, Andreski P. Nicotine dependence, major depression, and anxiety in young adults. *Arch Gen Psychiatry.* 1991 Dec; 48(12):1069–1074. [PubMed: 1845224]
46. Glassman AH, Helzer JE, Covey LS, et al. Smoking, smoking cessation, and major depression. *JAMA.* 1990 Sep 26; 264(12):1546–1549. [PubMed: 2395194]
47. Kendler KS, Neale MC, MacLean CJ, Heath AC, Eaves LJ, Kessler RC. Smoking and major depression. A causal analysis. *Arch Gen Psychiatry.* 1993 Jan; 50(1):36–43. [PubMed: 8422220]
48. Schneider NG, Houston JP. Smoking and anxiety. *Psychol Rep.* 1970 Jun; 26(3):941–942. [PubMed: 5433811]
49. Glassman AH. Cigarette smoking: implications for psychiatric illness. *Am J Psychiatry.* 1993 Apr; 150(4):546–553. [PubMed: 8465868]
50. Glassman AH, Covey LS. Smoking and affective disorder. *Am J Health Behav.* 1996; 20:279–285.
51. Hall SM, Munoz RF, Reus VI, Sees KL. Nicotine, negative affect, and depression. *J Consult Clin Psychol.* 1993 Oct; 61(5):761–767. [PubMed: 7902368]
52. Lekka NP, Lee KH, Argyriou AA, Beratis S, Parks RW. Association of cigarette smoking and depressive symptoms in a forensic population. *Depress Anxiety.* 2007; 24(5):325–330. [PubMed: 17041915]
53. Hasin DS, Goodwin RD, Stinson FS, Grant BF. Epidemiology of major depressive disorder: results from the National Epidemiologic Survey on Alcoholism and Related Conditions. *Arch Gen Psychiatry.* 2005 Oct; 62(10):1097–1106. [PubMed: 16203955]
54. Kessler RC, Nelson CB, McGonagle KA, Liu J, Swartz M, Blazer DG. Comorbidity of DSM-III-R major depressive disorder in the general population: results from the US National Comorbidity Survey. *Br J Psychiatry Suppl.* 1996 Jun.(30):17–30. [PubMed: 8864145]
55. Sonntag H, Wittchen HU, Hofler M, Kessler RC, Stein MB. Are social fears and DSM-IV social anxiety disorder associated with smoking and nicotine dependence in adolescents and young adults? *Eur Psychiatry.* 2000 Feb; 15(1):67–74. [PubMed: 10713804]

**Table 1**

Association between past 12-month anxiety disorders and past 12-month nicotine status

Predictor	Outcome	OR* (95% CI)	OR <sup>†</sup> (95% CI)	OR <sup>‡</sup> (95% CI)
Any anxiety disorder (N=4,880)	Use cigarettes	<b>1.44 (1.32–1.57)</b>	<b>1.26 (1.15–1.39)</b>	--
	Nicotine dep	<b>2.04 (1.84–2.27)</b>	<b>1.62 (1.45–1.81)</b>	--
	Nic dep among use cig	<b>2.24 (1.93–2.59)</b>	<b>1.80 (1.54–2.10)</b>	--
Gen Anx (N=894)	Use cigarettes	<b>1.50 (1.23–1.81)</b>	<b>1.30 (1.06–1.59)</b>	<b>1.16 (1.29–1.51)</b>
	Nicotine dep	<b>1.76 (1.41–2.19)</b>	<b>1.35 (1.07–1.70)</b>	1.11 (0.88–1.42)
	Nic dep among use cig	<b>1.84 (1.36–2.51)</b>	<b>1.39 (1.01–1.90)</b>	1.11 (0.81–1.54)
Soc Phob (N=1,140)	Use cigarettes	<b>1.07 (0.90–1.29)</b>	0.89 (0.74–1.07)	0.76 (0.62–0.92)
	Nicotine dep	<b>1.66 (1.35–2.03)</b>	1.19 (0.96–1.48)	0.96 (0.77–1.20)
	Nic dep among use cig	<b>2.90 (2.09–4.03)</b>	<b>2.07 (1.47–2.91)</b>	<b>1.69 (1.19–2.40)</b>
Spec Phob (N=3,073)	Use cigarettes	<b>1.54 (1.39–1.70)</b>	<b>1.38 (1.24–1.54)</b>	<b>1.35 (1.21–1.51)</b>
	Nicotine dep	<b>2.15 (1.92–2.41)</b>	<b>1.77 (1.57–1.99)</b>	<b>1.69 (1.49–1.91)</b>
	Nic dep among use cig	<b>2.23 (1.89–2.64)</b>	<b>1.83 (1.54–2.17)</b>	<b>1.69 (1.43–2.01)</b>
Panic disorder (N=907)	Use cigarettes	<b>2.22 (1.90–2.59)</b>	<b>1.99 (1.70–2.32)</b>	<b>1.90 (1.62–2.23)</b>
	Nicotine dep	<b>2.49 (2.08–2.98)</b>	<b>2.03 (1.69–2.45)</b>	<b>1.82 (1.50–2.21)</b>
	Nic dep among use cig	<b>1.83 (1.40–2.40)</b>	<b>1.44 (1.09–1.90)</b>	1.21 (0.90–1.62)

Bold=p&lt;.05

\* controlled for demographics, any mood disorder

<sup>†</sup> controlled for demographics, any mood, any SUD, any personality disorder<sup>‡</sup> controlled for demographics, any mood, any SUD, any personality disorder, other anxiety disorders

**Table 2**

Association between past 12-month mood disorders and past 12-month nicotine status

Predictor	Outcome	OR <sup>*</sup> (95% CI)	OR <sup>†</sup> (95% CI)	OR <sup>‡</sup> (95% CI)
Any depressive disorder (N=4,455)	Use cigarettes	<b>1.68 (1.53–1.85)</b>	<b>1.40 (1.27–1.56)</b>	--
	Nicotine dep	<b>2.28 (2.05–2.55)</b>	<b>1.71 (1.52–1.93)</b>	--
	Nic dep among use cig	<b>2.37 (2.03–2.77)</b>	<b>1.83 (1.56–2.15)</b>	--
Major depression (N=2422)	Use cigarettes	<b>1.49 (1.34–1.66)</b>	<b>1.33 (1.19–1.49)</b>	<b>1.31 (1.16–1.48)</b>
	Nicotine dep	<b>1.84 (1.62–2.09)</b>	<b>1.55 (1.35–1.77)</b>	<b>1.59 (1.38–1.84)</b>
	Nic dep among use cig	<b>1.80 (1.49–2.18)</b>	<b>1.56 (1.28–1.89)</b>	<b>1.65 (1.34–2.02)</b>
Bipolar (N=897)	Use cigarettes	<b>1.65 (1.41–1.94)</b>	<b>1.27 (1.08–1.51)</b>	<b>1.30 (1.09–1.54)</b>
	Nicotine dep	<b>2.37 (1.98–2.84)</b>	<b>1.60 (1.32–1.95)</b>	<b>1.71 (1.39–2.09)</b>
	Nic dep among use cig	<b>3.17 (2.35–4.27)</b>	<b>2.23 (1.65–3.03)</b>	<b>2.38 (1.74–3.24)</b>
Dysthymia (N=843)	Use cigarettes	<b>1.81 (1.50–2.17)</b>	<b>1.52 (1.27–1.82)</b>	<b>1.34 (1.11–1.62)</b>
	Nicotine dep	<b>2.07 (1.68–2.55)</b>	<b>1.53 (1.24–1.89)</b>	1.22 (0.97–1.53)
	Nic dep among use cig	<b>1.87 (1.39–2.52)</b>	1.34 (0.98–1.84)	1.02 (0.73–1.43)

Bold=p&lt;.05

\* controlled for demographics, any anxiety disorder

† controlled for demographics, any anxiety, any SUD, any personality disorder

‡ controlled for demographics, any anxiety, any SUD, any personality disorder, other mood disorders