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Changes in the prevalence of mood and anxiety disorders among male and female current smokers in the United States: 1990 to 2001

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Abstract

Purpose—The present study investigated whether the prevalence of mood and anxiety disorders has increased over time among current smokers, as well as whether these trends differ by gender and in comparison to non-smokers.

Methods—Data were drawn from the National Comorbidity Survey (NCS; 1990) and the National Comorbidity Survey-Replication (NCS-R; 2001), representative samples of the US adult population. Binomial regression analyses were used to determine differences between mood and anxiety disorders among current smokers in 1990 and 2001 and whether these differed by gender and in comparison to those who were former or never current smokers.

Results—Any anxiety disorder, panic attacks, panic disorder, social anxiety disorder and dysthymia were all significantly more common among current smokers in 2001 compared with 1990 and these increases were significantly greater than any trend found in non-smokers.

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Increases in each of these disorders were more pronounced in female than in male smokers. Major depressive disorder and generalized anxiety disorder were not found to increase over time among smokers.

Conclusions—The prevalence of several anxiety disorders and dysthymia among current smokers appears to have increased from 1990 to 2001. Future studies are needed to determine whether these trends have continued. If so, interventions aimed at moving the prevalence lower may have limited success if mental health problems such as anxiety disorders and certain mood disorders are not considered in the development and dissemination of tobacco control programs.

Keywords

tobacco; depression; anxiety; prevalence

INTRODUCTION

One in five adult deaths in the United States [1] is attributable to cigarette smoking. Even among nonsmokers, smoking presents a substantial health risk; approximately 38,000 nonsmokers die each year from secondhand smoke exposure [2, 3]. Despite the well-known dangers of smoking, it remains common, with a current prevalence of about 21% among U.S. adults [4].

The prevalence of smoking declined substantially in the general US population between 1950–1990 [5]; from 42% in the 1950's–1960's to 25% in the 1990's [6, 7]. The decline in smoking prevalence appears attributable to the effectiveness of public health tobacco control efforts that resulted in increases in smoking cessation [7]. In 2005, the prevalence of smoking was 21.0% [8], suggesting a relatively narrow decline between 1990 and 2005 compared change observed in prior decades. Moreover, quit rates have not increased among adults over this same time period [9]. It is, therefore, possible that the stagnated decline in smoking prevalence is influenced by the stability of quit rates [9]. Accordingly, there is a need to better understand the factors related to quit success among smokers in the general population.

Many smokers with comorbid mental and physical conditions often struggle to quit smoking [10]. There is now broad-based clinical and scholarly recognition that smokers are more likely to have a mental disorder than are nonsmokers and individuals with a mental disorder are significantly more likely to smoke compared to persons without a mental disorder [8, 10–13]. Depression and anxiety disorders are highly prevalent in the general population and highly comorbid with smoking [14–23]. Depression and anxiety disorders have been found in a majority of adults who smoke [24–29]. Moreover, there is robust empirical evidence that depression and anxiety disorders can increase risk of smoking experimentation [30, 31], progression to daily smoking [32], and development of nicotine dependence [33]. Additionally, among current smokers, depression and anxiety disorders often increase risk of smoking cessation failure [34–38].

An increase in the prevalence of depression and anxiety disorders among smokers in the general population could contribute to population-level stagnation of smoking prevalence.

Prior studies have shown strong links between depression and anxiety disorders and persistent smoking in community samples [39–41]. Yet, with the exception of one study in Australia which found no significant difference in the strength of the relation between smoking and mental health problems between 1997 and 2007 [42], past research has not examined whether the proportion of smokers with depression and anxiety disorders has actually increased in more recent years. In addition, the decline in smoking has been much more pronounced among men than women [43], who are much more likely than men to have depression and anxiety disorders [44]. As such, gender could be an important factor to consider in better understanding the proportion of smokers with depression and anxiety disorders.

The current study investigated whether and to what degree the prevalence of depression and anxiety disorders has increased among smokers in the US general population over time. Data were drawn from the National Comorbidity Survey (NCS) [45] and the National Comorbidity Survey-Replication (NCS-R) [46], representative samples of the US adult population approximately ten years apart. First, we investigated the prevalence of mood and anxiety disorders among current smokers in 2001 compared to 1990. Second, we examined whether prevalence differ significantly by gender. We also investigated the prevalence of depression and anxiety disorders among non-smokers in 2001, compared with 1990, in an effort to examine whether such changes were specific to smokers.

METHODS

Sample I

The National Comorbidity Survey (NCS) is based on a national probability sample ($n = 8,098$) of individuals aged 15 to 54 in the non-institutionalized United States population [47]. Fieldwork was carried out between September 1990 and February 1992. There was an 82.4% response rate. The data were weighted for differential probabilities of selection and non-response. A weight was also used to adjust the sample to approximate the cross-classification of the population distribution on a range of sociodemographic characteristics. Weighting and a full description of study methodology are described in detail elsewhere [48, 49]. Only 18–54 year olds were included in the present analyses to ensure consistency with the 2001 survey. Questions about smoking in the NCS were restricted to a random subsample who participated in the in the NCS Tobacco Supplement ($n = 4,411$). Written informed consent was obtained from each participant after the survey had been fully explained. The study was approved by the IRB of the University of Michigan.

Diagnostic Assessment—Psychiatric diagnoses were generated from a modified version of the World Health Organization (WHO) Composite International Diagnostic Interview [50], a structured interview designed for use by trained lay interviewers. WHO field trials [51] and NCS clinical reappraisal studies documented acceptable reliability and validity of all diagnoses [52, 53]. Psychiatric disorders examined in the current analyses included past 12-month panic attacks, panic disorder, post-traumatic stress disorder (PTSD), specific phobia, social anxiety disorder, generalized anxiety disorder (GAD), major depressive disorder, dysthymia, bipolar I and II.

Smoking: All participants in the in the NCS Tobacco Supplement ($n = 4,411$, $n = 4,149$ between 18–54) were asked a series of questions about cigarette smoking, that allowed for the categorization of current, former, and never smokers. The initial question was “Have you ever (smoked/used) for a month or more?” Participants answering “No” to this question were designated as “Never a Smoker.” Those answering “Yes” were asked “When was the last time you (smoked/used) fairly regularly – in the past month, past six months, past year, or more than a year ago?” Participants who answered “More than a year ago” were designated as “Former Smokers.” Those who selected any of the three other answers were considered “Current Smokers.”

Sample II

The National Comorbidity Survey-Replication (NCS-R) is a nationally representative sample ($n = 9,882$) of English-speaking individuals aged 18 and older living in US households between February 2001 and December 2004 [54]. Part I of the NCS-R survey, which comprised of core diagnostic assessment, was administered to all respondents, Part II was administered to only those individuals who met lifetime criteria for a Part I disorder and a probability sample of other respondents [55]. Analyses were carried out on the sample that completed both Parts I and II ($n = 6,706$). The data were weighted to adjust for the sampling scheme of the NCS-R. Only 18–54 year olds were included in the current analyses to be consistent with the 1990 sample. The NCS-R received human subjects consent approval from Harvard Medical School and the University of Michigan.

DSM-IV mental disorders—The WHO Composite International Diagnostic Interview (CIDI) Version 3.0 was used to assess major depression and anxiety disorders. The CIDI is a structured diagnostic interview which is administered by lay interviewers who are specifically trained in CIDI administration [56]. Clinical re-appraisal studies have shown good concordance between CIDI diagnoses and diagnoses made with the research version of the Structured Clinical Interview for DSM-IV (SCID) [57, 58]. These analyses included past 12-month panic attacks, panic disorder, PTSD, specific phobia, social anxiety disorder, and GAD, major depressive disorder, dysthymia, bipolar I and II.

Smoking—Participants were asked “Are you a current smoker, ex-smoker, or have you never smoked?” Those answering current were coded as “Current smokers”, those answering ex-smoker were coded as “Former smokers” and those answering “Only a few times” (an additional response category) or “Never” were considered “Never a Smoker”.

Statistical Analyses—The prevalence of depression and anxiety disorders by each smoking group (current, former, never) were calculated in 1990 and 2001. Binomial regression with a linear link of each disorder as the outcome regressed on year, smoking group, and the interaction of year and group was used to obtain risk differences (RDs) and 95% confidence intervals representing the increase or decrease in the prevalence of the disorder across time within the particular group. Differential time trends across smoking groups were tested by the interaction term. Then using only current smokers, a similar set of binomial regression models tested for differences in time trends across gender. Analyses

incorporated sampling weights available for NCS and NCS-R rescaled to sum to the sample size.

RESULTS

Prevalence of depression and anxiety disorders by smoking status in 1990 vs. 2001

In 1990 the prevalence of all depression and anxiety disorders were significantly higher among current smokers than they were in never smokers. This was also found in 2001.

When examining trends over time, the prevalence of panic attacks, panic disorder, social phobia and dysthymia were statistically significantly higher among current smokers in 2001 compared with 1990 (see Table 1). Furthermore, with the exception of social phobia the increases over time among current smokers were significantly greater than the respective changes over time in the never smokers. The most prominent increase in current smokers was among panic attacks. Post-traumatic stress disorder showed an increase from 1990 to 2001 among former smokers that was significantly greater than the change over time of never smokers (who did not show a significant change in PTSD). There were no significant changes in MDD or GAD over time in current or former smokers.

Prevalence of depression and anxiety disorders by gender in 1990 vs. 2001

In 1990, the prevalence of all depression and anxiety disorders were significantly higher among female current smokers than among male current smokers with the exception of bipolar II. The higher prevalence of these disorders among female, compared to male current smokers, were also found in 2001.

Compared with 1990, the prevalence of panic attacks, panic disorder, social phobia, and dysthymia were higher among female current smokers in 2001 (see Table 2) and with the exception of panic disorder these increases were significantly greater than the respective changes over time in male current smokers. There were no significant changes in the prevalence of PTSD, specific phobia, GAD or MDD in either gender of current smokers.

DISCUSSION

The present study compared the prevalence of depression and anxiety disorders among adults who smoke cigarettes current in the U.S. adult population in 2001 and 1990. There were three main findings. First, the prevalence of any anxiety disorder and dysthymia was higher among current smokers in 2001 compared with 1990. Second, there are specific types of anxiety disorders that appear more common among smokers in 2001 compared with 1990, including panic attacks, panic disorder and social phobia. Third, the increase in anxiety disorders among current smokers appears more pronounced among women compared with men. Overall, the present findings are generally consistent with the perspective that as the smoking prevalence has declined, the prevalence of some mood and anxiety disorders has risen among remaining smokers.

Reasons for the increase in prevalence of anxiety disorders among smokers between 1990 and 2001 remain unclear. It may be that smokers who have anxiety disorders, compared to

those without these disorders, are less likely to quit smoking. Integrative models of smoking-anxiety comorbidity often posit a dynamic interplay between smoking and anxiety. For example, smokers with anxiety disorders tend to be fearful of anxiety-related symptoms and bodily sensations, react with anxiety and fear when confronted with stressors, and cope with emotionally distressing events by trying to escape or avoid them [61]. These affect-relevant characteristics may increase the likelihood that smokers with anxiety disorders will be especially sensitive and emotionally reactive to nicotine withdrawal-related aversive interoceptive cues that routinely occur during smoking cessation [62] and cope with such emotional distress by smoking [63].

Previous studies have shown that depression and anxiety disorders are associated with decreased likelihood of quitting [59] and that nicotine dependence predicts continued smoking over time [60]. We found that dysthymia was significantly increased among current smokers in 2001, compared with 1990, though we did not find the same trend with major depression. As such, it is conceivable that an increase in the prevalence of dysthymia among current smokers could be a contributing factor to the stagnation of smoking rates. Clinically, the present results suggest that addressing depression and anxiety disorders in smoking cessation treatment may help improve the efficacy of tobacco control efforts. Smoking cessation programs that routinely integrate mental health interventions with smoking cessation are likely needed. As such, programs—both community-based and clinical—aimed at moving the prevalence of smoking lower should consider that a substantial proportion of smokers have depression and anxiety disorders.

There are several limitations to the current study. First, we analyzed current smoking and could not compare various levels of smoking prospectively, as this was the one measure of smoking across the two surveys. It is possible that current smokers in the NCS-R differed in their persistence vs those in the NCS. However, data suggest current smoking persists for years on average [66]. Therefore, the extent to which this affects the results should be minimal. Shifts in the proportion of mood and anxiety disorders among other types of smokers (e.g., less frequent, those with and without nicotine dependence) may differ. Second, measurement of depression and anxiety disorders was based on the DSM-III-R criteria in the NCS and DSM-IV in the NCS-R; they are not identical although the likelihood that results are due to definitional differences is likely minimized by lack of consistent findings among non-smokers. Thus, it is possible that definitional changes in mental disorders between DSM-III-R and DSM-IV may impact the observed results. Third, we were only able to look at the time period from 1990 to 2001/2003. Ideally, trends in depression and anxiety in the context of smoking can be examined over additional decades (e.g., from 1950 to the present). This is an important timeframe in the history of smoking, as it includes the beginning of the stagnation in overall decline; still, data that are more proximal to current day are needed next to more fully understand the most recent trends. Finally, it is impossible to draw conclusions about a causal relation between increases in depression and anxiety disorders in the smoking population and stagnation in smoking at the individual level. There are third many variables that may play a role in the observed associations (e.g., physical health status).

In sum, this study provides empirical evidence that the prevalence of certain anxiety disorders and dysthymia among current smokers in the US population appears to be higher in 2001 than it was in 1990. We observed an increase among both men and women, though the increase in anxiety disorders appears stronger among women. This increase was not observed among non-smokers. These results offer one possible plausible contributing factor to the stagnation in smoking prevalence. Namely, the stagnation in smoking prevalence over the past decade may be related to an increase in the proportion of current smokers with certain anxiety disorders and persistent mood disturbance (dysthymia) and that tobacco control and clinical smoking cessation interventions available to most do not yet routinely address these complicating conditions.

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Table 1
Prevalence of depression and anxiety disorders in 1990 vs. 2001^a, by Smoking Status

Past 12-Month Diagnoses	Current Smoker			Former Smoker			Never a daily Smoker			Overall P-Value Comparing Group RDs ^d
	1990 n=1356	2001 n=1872	RD (95% CI)	1990 n=637	2001 n=1277	RD (95% CI)	1990 n=2026	2001 n=3540	RD (95% CI)	
Panic Attack	6.26%	19.01%	12.8 (10.6, 14.9)	4.77%	12.01%	7.3 (4.8, 9.7)	2.92%	10.10%	7.2 (5.9, 8.4)	<.0001 ^{A, B}
Panic Disorder	3.38%	5.59%	2.2 (0.8, 3.6)	2.97%	2.52%	-0.5 (-2.0, 1.1)	1.76%	2.33%	0.6 (-0.2, 1.3)	.0370 ^{A, B}
Post-traumatic Stress Disorder ^b	6.76%	6.34%	-0.4 (-2.4, 1.5)	2.04%	4.72%	2.7 (0.8, 4.6)	3.31%	1.69%	-0.5 (-1.5, 0.5)	.0130 ^{A, C}
Social Phobia	8.16%	10.20%	2.0 (0.0, 4.0)	5.53%	7.94%	2.4 (0.1, 4.7)	6.39%	7.02%	0.6 (-0.7, 2.0)	.3128
Specific Phobia	12.25%	11.89%	-0.4 (-2.7, 1.9)	8.20%	9.95%	1.8 (-1.0, 4.4)	7.12%	8.32%	1.2 (-0.2, 2.7)	.4189
Generalized Anxiety Disorder	5.61%	7.11%	1.5 (-0.2, 3.2)	4.25%	4.67%	0.4 (-1.5, 2.4)	1.65%	3.12%	1.5 (0.7, 2.3)	.5961
Any Anxiety disorder^c	24.62%	32.51%	7.9 (4.8, 11.0)	16.26%	26.26%	10.0 (6.3, 13.8)	14.64%	21.75%	7.1 (5.1, 9.2)	.4203
Major Depressive Disorder	13.32%	14.94%	1.6 (-0.8, 4.0)	8.71%	8.99%	0.3 (-2.4, 3.0)	8.13%	7.20%	-0.9 (-2.4, 0.5)	.1998
Dysthymia	3.25%	4.59%	1.3 (0.0, 2.7)	1.93%	2.65%	0.7 (-0.7, 2.1)	2.37%	1.71%	-0.7 (-1.5, 0.1)	.0221 ^B
Bipolar I	3.15%	2.01%	-1.2 (-2.2, -0.0)	1.02%	0.67%	-0.4 (-1.3, 0.6)	0.45%	0.20%	-0.3 (-0.6, 0.1)	.3120
Bipolar II	3.15%	1.92%	-1.2 (-2.4, -0.1)	1.02%	0.94%	-0.1 (-1.0, 0.9)	0.45%	0.49%	0.0 (-0.3, 0.4)	.0948
Any Mood disorder^c	15.06%	16.42%	1.4 (-1.2, 3.9)	9.48%	9.61%	0.1 (-2.7, 2.9)	8.94%	7.45%	-1.5 (-3.0, 0.0)	.1441

RD = Risk Difference, i.e. difference in prevalence across time; CI = confidence interval

^a All prevalence estimates incorporate sampling weights to represent US population between ages 18–54 years old.

^b The sample assessed for PTSD in 1990 and 2010 is slightly smaller but prevalence estimates incorporate sampling weights still representative of US population between 18–54. Sample includes: Current 1990 N=1310, Current 2001 N=1151, Former 1990 N=622, Former 2001 N=762, Never 1990 N=2059, Never 2001 N=2169.

^c Any Anxiety includes panic attack, panic disorder, PTSD, social phobia, specific phobia, GAD; Any Depression includes MDD, Dysthymia, Bipolar I or II

^d Overall p-value is based on 2 degree of freedom test assessing group by time interaction. Significant (p<.05) post-hoc comparisons of RDs across groups are labeled ^A, ^B, ^C where ^A indicates RD for Current Smokers is different than former Smokers, ^B indicates RD for Current Smokers is different than for Never Smokers, and ^C indicates RD for Former Smokers is different than for Never Smokers.

Prevalence of depression and anxiety disorders among male and female current smokers in 1990 vs. 2001^a

Table 2

Past 12-Month Diagnoses	Current Smokers MALES			Current Smokers FEMALES			p-value comparing Group RDs
	1990 (n=674)	2001 (n=1006)	RD (95% CI)	1991 (n=682)	2001 (n=866)	RD (95% CI)	
Panic Attack	3.53%	13.24%	9.7 (7.1, 12.2)	8.95%	25.71%	16.76 (13.1, 20.4)	.0017
Panic Disorder	2.18%	3.41%	1.2 (-0.3, 2.8)	4.57%	8.13%	3.6 (1.2, 6.0)	.1129
Post-traumatic Stress Disorder ^b	4.95%	3.19%	-1.8 (-4.0, 0.5)	8.44%	9.76%	1.3 (-1.9, 4.6)	.1243
Social Phobia	9.13%	8.82%	-0.3 (-3.1, 2.5)	7.20%	11.81%	4.6 (1.7, 7.5)	.0163
Specific Phobia	6.75%	7.76%	1.0 (-1.5, 3.5)	17.68%	16.68%	-1.0 (-4.8, 2.8)	.3854
Generalized Anxiety Disorder	3.98%	4.93%	1.0 (-1.0, 3.0)	7.22%	9.63%	2.4 (-0.4, 5.2)	.4023
Any Anxiety disorder^c	18.70%	24.55%	5.9 (1.9, 9.8)	30.47%	41.75%	11.3 (6.5, 16.0)	.0867
Major Depressive Disorder	10.87%	11.77%	0.9 (-2.2, 4.0)	15.74%	18.63%	2.9 (-0.9, 6.7)	.4228
Dysthymia	3.15%	2.91%	-0.2 (-1.9, 1.5)	3.35%	6.54%	3.2 (1.1, 5.3)	.0135
Bipolar I	3.04%	1.46%	-1.6 (-3.1, -0.1)	3.29%	2.65%	-0.6 (-2.4, 1.1)	.4178
Bipolar II	3.00%	2.27%	-0.7 (-2.3, 0.9)	3.29%	1.50%	-1.8 (-3.4, -0.2)	.3464
Any Mood disorder^c	12.13%	12.59%	0.5 (-2.8, 3.7)	17.96%	20.87%	2.9 (-1.0, 6.9)	.3447

RD = Risk Difference, i.e. difference in prevalence across time; CI = confidence interval

^a All prevalence estimates incorporate sampling weights to represent US population of current smokers between ages 18–54 years old.^b The sample assessed for PTSD in 1990 and 2010 is slightly smaller: Male 1990 N=631, Female 1990 N=679, Male 2001 N=599, Female 2001 N=552^c Any Anxiety includes panic attack, panic disorder, PTSD, social phobia, specific phobia, GAD; Any Depression includes MDD, Dysthymia, Bipolar I or II^d p-value is for test assessing gender by time interaction indicating difference in RDs