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Cigarette smoking and mood disorders in U.S. adolescents: Sex-specific associations with symptoms, diagnoses, impairment and health services use

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Abstract

Objective—To report sex-specific associations between cigarette smoking and DSM-IV disorders, symptoms, and mental health services use related to depression and anxiety in a nationally representative sample of U.S. adolescents.

Methods—Data on two samples were drawn from the 1999–2004 National Health and Nutrition Examination Surveys to examine the association of ever smoking (versus never smoking) with depression (n=1884 12–15 year-olds) and anxiety (n=6336 12–19 year-olds). Sex-specific associations between smoking and DSM-IV diagnoses, subthreshold and severe disorder, symptoms, impairment and mental health services use were assessed using logistic regression modeling.

Results—Rates of DSM-IV depression and anxiety were increased in adolescent female ever smokers as compared to never smokers (OR=3.9, 95% CI: 1.3–11.3 and OR=10.6, 95% CI: 3.1–37.0, respectively). Females also showed statistically significant increases in severe disorder, subthreshold disorder, all symptoms of major depressive disorder, most symptoms of panic disorder, and increases in severe impairment, especially those related to schoolwork and teachers. Male adolescents showed smaller variations in depression and anxiety by smoking status, but were more likely to seek mental health services.

Conclusions—Smoking prevention efforts may benefit from specifically targeting female youth who show signs of depression or anxiety diagnoses through a school-based program, while greater benefits with males may be evident through programs integrated into mental health services.

Keywords

Adolescents; Anxiety; Depression; Impairment; Services; Smoking

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Conflict of interest

No conflicts of interest or disclosures to report.

Introduction

Despite a sharp decline in smoking prevalence over the past 20 years, rates have stalled in the past few years and until very recently even showed signs of increasing among younger teens [1,2]. Recent data from the Centers for Disease Control estimate that 5.2% of middle school students and 17.2% of high school students smoke cigarettes [3]. Since cigarette smoking is the leading cause of preventable death in the U.S [4], identifying risk factors for initiation is critical. But this has to occur early, as nearly 80% of smokers begin before age 18 and nearly 90% before age 20 [5]. By eighth grade, 20% of students have tried cigarettes [2].

Smoking interventions can be informed by identifying correlates of smoking in youth and using this information to build an evidence-based prevention strategy. One known correlate of smoking in youth is psychiatric disorders, including depression [6–15] and anxiety [7,12,16–18]. The onset of cigarette smoking occurs at a similar time as the onset of these disorders, and although studies on the directionality of the relationship between smoking and depression/anxiety have produced conflicting results [8,9,16–28], there is evidence that depression and anxiety precede smoking initiation or nicotine dependence among at least a subset of adolescents [16,17,19,20,29,30], and that those with mental health problems may initiate smoking at a younger age [31]. This relationship may be reciprocal, as studies have found that smoking also influences the presentation and intensity of psychiatric symptoms [7,11,23,24,32–41]. There are several theories that address reasons why depressed or anxious youth may be predisposed to smoking, including a common genetic etiology, [42–44] a self-medication theory that suggests that smokers use cigarettes as a self-medication to improve mood, cognitive functioning or as stress relief [45–47], as a consequence of low self-esteem [48,49], due to the influence of peer smoking, [50–53] and a recent finding that expectations of smoking reward may promote smoking initiation among depressed adolescents [54].

Despite a well-established literature on the co-occurrence of smoking and depression/anxiety in adults, [55–67] there is less information available addressing this association specifically in adolescents. Several areas need further examination, including: 1) rates of the comorbidity in a sample of adolescents representative of the U.S. population, since much of the research on this comorbidity in youth has been done in clinical, high-risk or other non-generalizable samples; [8,10,19,68–70] 2) further specification of the association in youth, including sex-specific rates of smoking and DSM-IV depression and anxiety, subthreshold and severe disorders and individual symptoms, since much of the previous research on youth uses only measures of symptoms or scales, [6,8,9,11,20,27,32,68,71–73] and; 3) areas of impairment and use of mental health services, since these could inform where to target at-risk youth. Clarifying these elements will further characterize the relationship between depression/anxiety and smoking in youth, inform existing theory on reasons underlying this comorbidity, and maximize how smoking prevention efforts are designed and implemented. This might include tailoring messages preferentially to one gender, targeting youth with specific symptoms, or integrating smoking prevention education into youth mental health counseling programs.

This paper builds upon previous literature by examining the sex-specific associations between ever smoking and DSM-IV diagnoses, subthreshold and severe disorder, and symptoms of depression and anxiety, as well as related impairment and mental health services use in a nationally representative sample of adolescents, 12–19 years of age, from the 1999–2004 National Health and Nutrition Examination Study (NHANES). Data will inform the development of smoking prevention strategies that can be used on a national level to target at-risk youth.

Methods

Sample

This study uses data from the 1999–2004 NHANES, a nationally representative probability sample of non-institutionalized US civilians designed to assess the health and nutritional status of adults and children in the United States. The survey examines a nationally representative sample of about 5000 persons each year and uses a complex, stratified, multistage, probability cluster design that oversampled low-income persons, adolescents 12–19 years of age, persons above 60 years of age, African Americans, and Mexican Americans. Although NHANES data is available on respondents of all ages, this study used data only on adolescents, 12–19 years of age. Two analytical samples were formed due to data availability; the first sample was used to examine the association between ever smoking and depression and uses data collected from 2001 to 2004 and consists of 1884 adolescents, 12–15 years of age, who answered questions on tobacco use and completed the National Institute of Mental Health Diagnostic Interview for Children (NIMH-DISC youth and parent modules for depression). Response rates were 91.2% and 82.3% for those administered the self- and parent-administered depressive disorder interviews. The second sample was used to examine the association between ever smoking and anxiety and uses data collected from 1999 to 2004 and consists of 6355 adolescents, 12–19 years of age, who answered questions on tobacco use and completed the NIMH-DISC youth modules for generalized anxiety disorder and panic disorder. Response rates were 92.3% for those youth administered the anxiety disorder interviews. Additional information on NHANES sampling methodology and survey operations are available on their website [74].

Measures

Adolescents were divided into two groups based on their reported smoking status: never smokers or ever smokers. Respondents who reported at least trying a cigarette once were categorized as ever smokers, while never smokers reported never having taken a puff of a cigarette. Although this is a general measure, it is useful when considering how to inform smoking prevention efforts as the goal in these efforts is to prevent even the first puff of a cigarette.

Information on depression and anxiety disorders was derived from the NIMH-DISC, version IV, a structured diagnostic interview administered by lay interviewers to assess diagnostic criteria for mental disorders in children and adolescents, in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). [75–77] Modules were administered to youth for generalized anxiety disorder (GAD), panic disorder, and

major depressive disorder (MDD)/dysthymic disorder (DD). For adolescents up to 15 years of age, those for MDD/DD were also administered to the primary caretakers, via telephone, within four to 28 days after the youth interviews. Diagnoses of GAD/panic were based on youth reports alone, while those for MDD/DD were based on either youth or caretaker reports. GAD and panic are the only anxiety disorders assessed in the NHANES NIMH-DISC questionnaire. The DSM-IV diagnostic variables developed by the DISC Group in the Division of Child and Adolescent Psychiatry at Columbia University (New York, NY) [78]. Due to low numbers, GAD and panic disorder represent anxiety disorders and MDD or DD represent depressive disorders.

Aside from reporting on DSM-IV diagnoses of anxiety and depression, this study reports on individual symptoms, subthreshold diagnoses and severe disorder. While the definition for subthreshold diagnoses are somewhat arbitrary, the methodology reported in previous studies was used in this paper [79–82]. Subthreshold anxiety was defined as exhibiting at least three of fourteen anxiety symptoms of GAD (six symptoms) and panic disorder (eight symptoms), but not meeting full criteria for anxiety disorder (GAD or Panic). Subthreshold MDD was defined as having at least four of the nine major depression symptoms without a full diagnosis of MDD or dysthymia. The number of symptoms (three for anxiety, four for MDD) was chosen to ensure that only the top 10% of respondents with the presence of the disorder symptoms, but without the full diagnosis, would be classified with sub-threshold disorder.

The designation of severe disorder took into account levels of impairment related to DSM-IV anxiety or depression. Impairment was assessed in six domains, including the respondent's family life, peer relations, relationship with a teacher or boss, school performance, caretakers becoming upset, and the respondent feeling bad or upset. One question in each of the diagnostic surveys addressed impairment in each of the six domains, and response options included: 'a lot of the time', 'some of the time', 'hardly ever'; or 'very bad', 'bad', 'not too bad.' Severe disorder was designated when a DSM-IV diagnosis was met and the respondent endorsed at least one severe rating ('a lot of the time' or 'very bad') in an impairment domain.

Mental health services use within the past 12 months was assessed in each of the diagnostic modules with the following question: "In the past year, have you been to see someone at a hospital or a clinic or at their office [for specific symptoms of disorders]?" Rates of service use for anxiety were calculated among respondents with either a DSM-IV diagnosis or subthreshold anxiety disorder, and rates of service use for depression were calculated among those with either a DSM-IV diagnosis or sub-threshold depression. Subthreshold cases were included in order to have sufficient sample size in sex-specific adjusted logistic regressions.

Control variables assessed in the interview and included in the regression models were: age, gender, race/ethnicity, school attendance (yes/on vacation (e.g. summer) vs. no), living with a smoker, and socioeconomic status as assessed by poverty income ratio (PIR). PIR is based on family size and is the ratio of self-reported family income to the family's poverty threshold level, determined by the Bureau of the Census. PIR is categorized as a three-level variable: less than one, one to two, and greater than two. Values less than one are considered

below the poverty threshold. Perceived health status was used as a covariate but later dropped because it did not alter the outcomes and was only available from 2001 onward.

Data analysis

Sample weights were calculated according to the base probabilities of selection, adjusted for nonresponse, and poststratified to match population control totals, which were provided in each two-year cycle of the NHANES publically released datasets. Analyses for MDD/DD included four-year NHANES data (2001–2004); analyses for anxiety included six-year NHANES data (1999–2004). The four- and six-year sample weights for pooled NHANES datasets were calculated according to the NHANES analytic guidelines, which are available at http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/analytical_guidelines.htm. Data were analyzed using SUDAAN version 10, which uses Taylor series linearization methods to accommodate sampling weights to account for stratification and clustering of the multistage sampling design in the calculation of variances and test statistics. The estimates of prevalence, standard errors, 95% confidence intervals, unadjusted or adjusted odds ratios, and test statistics are presented. Logistic regression models were used to measure the association between smoking and DSM-IV disorders, subthreshold disorders, symptoms, impairment, and mental-health services-seeking in both the total sample and by sex, adjusting for covariates mentioned in the paragraph above.

Results

Of the 1884 respondents in the 2001–2004 sample used to analyze smoking and depression (the four-year sample), 514 (27.6%) were defined as smokers. Of the 6355 respondents in the 1999–2004 sample used to analyze smoking and anxiety (the six-year sample), 2911 (47.1%) were defined as smokers. In both samples, ever smokers were more likely to be older, less likely to be attending school, more likely to fall into the lower socioeconomic strata, and more likely to live with smokers [Table 1]. In the six-year sample, over half (61.2%) of ever smokers reported smoking at least one cigarette within the past month. The mean age of smoking initiation among ever smokers was 13.4 years (SE=0.09), the mean number of days smoked within the past month was 11.6 (SE=0.6), and the mean number of cigarettes per day was 7.2 (SE=0.36);

Sex-specific rates of association between ever smoking and depression and anxiety disorder and symptoms are presented in Table 2. While rates of depression and anxiety were roughly similar in males by smoking status, rates of either a DSM-IV depression or anxiety disorder were far higher in female ever smokers (16.6%) as compared to never smokers (4.0%), as were rates of severe (13.6% vs. 2.3%) and subthreshold anxiety or depression (11.0% vs. 4.0%).

After adjustment for confounders, rates of DSM-IV depression were increased by almost four-fold in female ever smokers as compared to never smokers (OR=3.9, 95% CI: 1.3–11.3) and rates of DSM-IV anxiety were increased roughly 10-fold (OR=10.6, 95% CI: 3.1–37.0). Female ever smokers had statistically significant increases ($p<0.05$) in severe impairment related to depression in all areas (family, peers, schoolwork, relationship with teacher or boss, respondent feeling bad or upset, caretakers becoming upset) as compared to never

smokers, with the highest ORs reported for increases in severe impairment related to school work (OR=18.1, 95% CI: 5.8–56.4) and relationship with their teacher or boss (OR=8.0, 95% CI: 2.7–23.3) (data not shown). Regarding impairment related to anxiety, female ever smokers showed statistically significant increases in severe impairment related to peers (OR=7.4, 95% CI: 1.1–51.6), and relationship to their teacher or boss (OR=8.9, 95% CI: 1.4–55.3).

Smoking status also influenced endorsement of symptoms of MDD. Although rates of DSM-IV depression were similar in male ever and never smokers, adjusted regression analysis showed that male ever smokers were more likely to endorse six of the nine depression symptoms, including feeling worthlessness or guilt (OR=5.6, 95% CI: 1.7–18.7) and anhedonia (OR=4.3, 95% CI: 1.5–12.7). Female ever smokers were more likely to endorse all nine depression symptoms as compared to never smokers, most notably feelings of worthlessness or guilt (OR=7.2, 95% CI: 2.6–20.1) and thinking or concentration problems or indecisiveness (OR=7.7, 95% CI: 3.3–18.1). The only apparent differences in prevalence of dysthymia symptoms were among female ever smokers, who were more likely to endorse low self-esteem (OR=5.8, 95% CI: 1.7–19.3). Regarding anxiety symptoms, male smokers showed no statistically significant differences in endorsement of GAD symptoms, but slight increases in panic symptoms of sudden fear, heart suddenly beating fast and thoughts of going crazy because of attacks. Female smokers showed increases in two of six GAD symptoms and seven of eight panic symptoms, most notably panic attack thought caused by physical problems (OR=7.1, 95% CI: 2.0–24.8) and no longer going places because of fear (OR=10.0, 95% CI: 1.3–78.7).

Rates of past year mental health services among male and female adolescents with anxiety and depression are displayed in Table 3. Male and female never smokers sought treatment for anxiety or depression at approximately the same rates (37.4% vs. 36.6%); however, male ever smokers had much higher rates of seeking treatment (68.1%) and female ever smokers had slightly elevated rates (44.8%). After adjustment, logistic regression showed that male ever smokers had approximately a five-fold increase of seeking treatment for either anxiety or depression as compared to male never smokers (OR=5.3, 95% CI: 1.1–25.8). No statistically significant differences were apparent for females based on smoking status.

Discussion

The results of this study confirm prior literature showing an association between smoking and depression/anxiety disorders in adolescents, and provides additional details on the sex-specific associations of smoking with DSM-IV diagnosed disorder, subthreshold and severe disorder, individual symptoms, severe impairment by domain, and mental health services use in a large sample that is generalizable to the U.S. population of adolescents.

Results suggest that the elevated rates of depression and anxiety previously reported in adolescent smokers are mainly due to large increases among female adolescents, rather than males. This is particularly evident when considering the dramatic 10-fold increase in DSM-IV anxiety evident among female ever vs. never smokers, with no concomitant increase in males. These results are in agreement with two recent community studies that assessed

gender differences in smoking rates among adults with severe mental illness [83,84], and suggest that gender-specific interventions may be beneficial. In this study, the association of smoking and depression/anxiety in female youth is apparent from the symptom-level all the way up to presentation of severe DSM-IV disorder. Furthermore, it is female smokers who show the highest levels of severe impairment due to depression and anxiety, up to eightfold higher in some domains as compared to female never smokers. It is unclear why females might be particularly prone to this comorbidity and its impairment in youth, but it is possible that depressed/anxious females may be particularly vulnerable to the influence of peer smokers, carry more of a genetic load for this comorbidity, be more driven to smoke by low self-esteem, have greater expectations of smoking reward, or be more likely to self-medicate as females appear to react more to triggers involving negative emotions (such as conflict or stress) [85,86]. The only differences evident between male ever and never smokers was the increased rate of specific major depression symptoms as well, as the rate at which male smokers used mental health services treatment. Further research will be necessary to clarify underlying reasons for this sex-specific association between smoking and depression/anxiety in youth so that appropriate prevention programs can be designed.

Smoking is responsible for a significant burden of illness in the U.S. and throughout the world. [87]. In the U.S. alone, cigarette smoking and exposure to tobacco smoke results in at least 443,000 premature deaths annually, and costs more than \$193 billion in lost productivity and health care expenditures [88]. Since approximately 3800 youth aged 12–17 years old try a cigarette for the first time each day, and 1,000 become daily smokers [89], it is essential to identify early risk factors for smoking initiation in order to prevent youth from initiating smoking and beginning down a path toward established smoking and addiction. While the research presented here does not serve as evidence that depression or anxiety precedes smoking initiation, it suggests a strong correlation of smoking and depression/anxiety among female adolescents. Given that depression and anxiety can onset early [90–93], and several prospective studies found that they may precede smoking initiation in adolescents, [16,17,19,20] these data suggest that there may be benefit in developing gender-specific interventions targeted to youth showing early signs of depression or anxiety. Given the high levels of impairment related to schoolwork and relations with teachers, females may benefit most from a school-based intervention, while smoking interventions integrated into mental health counseling may be more optimal for males.

Designing smoking prevention programs to target youth with depression and anxiety is critical given that it is well-established that adults with these disorders smoke at a far higher rate, as much as two-three times more, than the population of individuals without these disorders [63,67,94]. Furthermore, this comorbidity may precipitate poor health outcomes, as a recent study using data from the 1999 Large Health Survey of Veteran Enrollees (n=559,985) found that a great deal of the association reported in prior studies between psychiatric disorders and mortality is mediated, in part, by smoking [95]. Individuals with comorbid psychiatric conditions represent a subgroup in need of specialized intervention, and the Centers for Disease Control *Best Practices for Comprehensive Tobacco Control Programs* highlights the need to eliminate health disparities related to tobacco use [96]. Targeted interventions in youth may help prevent smoking initiation and curb the transition into regular smoking habits among individuals pre-disposed to this comorbidity.

The results of this study must be considered in light of the limitations of the data. It is well known that externalizing disorders [97], alcohol, [98–100] and drug use disorders [19,101,102] are associated with smoking in adolescents. Unfortunately, diagnostic information on these disorders was not available in the adolescent sample. Inclusion of these variables in the regression model would likely impact the point estimate of smoking. However, given the well-established association of smoking with depression and anxiety, it is unlikely that the association would no longer be statistically or clinically significant. A second limitation includes the inability to assess the influence of current, regular or heavy smoking (≥ 20 cigarettes per day) on sex-specific rates of depression and anxiety disorder, symptoms, impairment and mental health services use due to the low sample size. While ‘ever smoking’ might be considered a more vague classification, the data show that over half of the ‘ever smokers’ in the sample had smoked within the past month at an average of 11 days smoked, 7 cigarettes per day. A third limitation is that additional factors known to contribute to this comorbidity, such as peer smoking pressure, were not assessed in the NHANES, and their exclusion in the models may have affected the results. Finally, given the cross-sectional nature of the data, causality could not be determined.

This paper builds on previous literature by providing further detail on the sex-specific associations of smoking with DSM-IV diagnosed depression and anxiety, subthreshold and severe disorder, symptoms, impairment, and mental health services use in a large, nationally representative sample of U.S. adolescents. Integrating smoking prevention programs into school-based programs and mental health services might help to prevent initiation and further progression of smoking in youth, efforts that have the potential to save thousands of lives that could be lost to tobacco-related illness and mortality.

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Table 1

Demographics of adolescent samples by smoking status.

Demographics	Sample I ¹		Sample II ²	
	Never smokers	Ever smokers	Never smokers	Ever smokers
	n=1372	n=512	n=3444	n=2911
	% (SE)	% (SE)	% (SE)	% (SE)
Gender				
Male	49.3 (1.5)	52.0 (2.3)	50.7 (1.1)	51.9 (1.2)
Female	50.7 (1.5)	48.0 (2.3)	49.3 (1.1)	48.1 (1.2)
Wald F [p-value]	1.1 [.310]		0.5 [.504]	
Race				
White	63.8 (2.8)	63.3 (4.3)	60.4 (2.3)	62.2 (2.3)
Black	14.4 (1.6)	13.3 (2.0)	16.2 (1.6)	12.2 (1.3)
Hispanic	11.0 (1.6)	11.5 (2.1)	10.4 (1.2)	11.1 (1.4)
Other	10.7 (1.7)	11.8 (3.0)	13.0 (1.7)	14.6 (1.7)
Wald F [p-value]	0.5 [.715]		6.5 [.001]	
Mean Age (years)	13.4 (0.0)	14.0 (0.05)	14.6 (0.1)	16.4 (.01)
Wald F [p-value]	8.6 [<.0001]		22.1 [<.0001]	
Age Categories (years)				
12–15	100.0 (0.0)	100.0 (0.0)	66.8 (1.5)	32.0 (1.3)
16–19	–	–	33.2 (1.5)	68.0 (1.3)
Wald F [p-value]	–		206.5 [<.0001]	
Attending School				
Yes	99.8 (0.1)	98.0 (0.8)	95.3 (0.6)	80.9 (1.2)
No	0.2 (0.1)	2.0 (0.8)	4.7 (0.6)	19.1 (1.2)
Wald F [p-value]	5.2 [.030]		71.6 [<.0001]	
Poverty Income Ratio (PIR)				
<1 (poor)	18.7 (1.3)	28.0 (3.0)	25.8 (1.4)	31.8 (1.7)
1–2	19.8 (1.0)	23.2 (2.2)	19.9 (1.0)	22.7 (1.5)
>2	61.6 (1.6)	48.8 (3.4)	54.3 (1.7)	45.5 (2.0)
Wald F [p-value]	4.3 [.023]		6.8 [.003]	
Lives with Smokers				
Yes	16.4 (1.2)	34.4 (4.2)	16.9 (1.2)	34.0 (1.9)
No	83.6 (1.2)	65.6 (4.2)	83.1 (1.2)	66.0 (1.9)
Wald F [p-value]	15.3 [.001]		70.3 [<.0001]	

¹Depression sample represents 12–15 year-old adolescents, collected from 2001 to 2004 (n=1884).²Anxiety sample represents 12–19 year-old adolescents, collected from 1999 to 2004 (n=6355).

Table 2

Association of DSM-IV diagnosed depression and anxiety disorders with smoking status in a nationally representative sample of adolescents.

DSM-IV Diagnoses and associated symptoms	Adjusted OR (95% CI) (Ever vs. Never Smokers) ¹		
	Male	Female	Total
Anxiety Disorder (GAD or Panic)²	0.3 (0.0–2.5)	10.6 (3.1–37.0)	4.7 (1.6–13.7)
Severe anxiety disorder ⁴	1.5 (0.1–40.7)	35.0 (3.2–378.4)	12.9 (2.0–82.8)
Subthreshold anxiety	2.3 (0.8–6.5)	2.1 (1.1–4.1)	2.2 (1.3–3.8)
Symptoms of GAD			
Restless or feeling keyed up or on edge	0.5 (0.1–2.9)	2.0 (0.6–7.3)	1.2 (0.4–3.6)
Being easily fatigued	1.5 (0.3–7.3)	2.9 (0.8–10.2)	2.1 (0.7–6.0)
Difficulty concentration or mind going blank	0.6 (0.3–1.5)	1.0 (0.4–2.5)	0.9 (0.5–1.8)
Irritability	3.1 (0.7–13.6)	3.7 (1.4–10.1)	3.4 (1.7–6.8)
Muscle tension	2.5 (0.5–11.7)	0.6 (0.2–2.3)	1.7 (0.5–5.6)
Sleep disturbance	1.7 (0.7–4.4)	4.2 (1.9–9.2)	3.0 (1.7–5.2)
Symptoms of Panic Disorder			
Sudden fear	1.7 (1.0–3.0)	2.0 (1.2–3.3)	1.8 (1.2–2.8)
Breathing problems	1.5 (0.7–3.2)	2.7 (1.4–5.2)	2.0 (1.3–3.3)
Heart sudden fast beat	1.5 (1.0–2.4)	1.3 (0.9–2.1)	1.4 (1.1–1.9)
3 or more attacks of feeling strange	1.0 (0.2–3.9)	5.1 (2.3–11.3)	3.6 (1.8–7.2)
Fear of strangeness attack repetition	1.6 (0.3–8.9)	3.6 (1.5–8.6)	3.1 (1.4–7.0)
Attack thought cause by physical problem	1.1 (0.2–5.6)	7.1 (2.0–24.8)	4.3 (1.4–13.4)
Thought going crazy because of attacks	3.8 (1.5–10.1)	3.3 (1.2–9.4)	2.5 (1.1–5.5)
Stopped going places – attack fear	254.5 (101.1–640.6)	10.0 (1.3–78.7)	10.1 (1.7–59.9)
Depression (MDD or Dysthymia)³	1.6 (0.7–3.8)	3.9 (1.3–11.3)	2.8 (1.1–6.7)
Severe depression disorder ⁴	0.7 (0.1–2.9)	4.9 (1.3–17.9)	2.9 (1.0–8.8)
Subthreshold MDD	2.4 (0.6–9.1)	5.3 (1.1–24.8)	3.6 (1.1–11.1)
Symptoms of MDD			
Depressed mood or irritable mood	3.4 (1.2–9.6)	3.4 (2.2–5.2)	3.1 (1.9–5.1)
Diminished interest or pleasure	4.3 (1.5–12.7)	2.3 (1.2–4.5)	2.7 (1.3–5.6)
Weight loss or weight gain or appetite change	3.6 (1.3–10.1)	2.8 (1.0–7.6)	2.9 (1.4–6.1)
Insomnia or hypersomnia	3.5 (1.4–8.5)	3.3 (1.3–8.4)	3.3 (1.8–6.0)
Psychomotor agitation or retardation	3.3 (1.0–10.9)	3.9 (1.0–15.2)	3.6 (1.4–9.1)
Fatigue or loss of energy	2.3 (0.9–5.7)	5.1 (1.9–13.8)	3.3 (1.7–6.4)
Worthlessness or guilt	5.6 (1.7–18.7)	7.2 (2.6–20.1)	5.4 (2.1–14.0)
Thinking or concentration problems or indecisiveness	2.5 (0.9–7.1)	7.7 (3.3–18.1)	4.8 (2.1–11.2)
Thoughts of death, suicidal ideation, suicide attempt or plan	1.4 (0.3–7.4)	2.7 (1.1–6.4)	2.0 (0.9–4.7)
Symptoms of Dysthymia			
Poor appetite or overeating	0.2 (0.0–2.1)	1.6 (0.2–12.4)	1.0 (0.2–5.3)
Insomnia or hypersomnia	0.3 (0.1–1.5)	2.5 (0.4–14.8)	1.2 (0.3–4.8)
Low energy or fatigue	0.5 (0.1–1.9)	0.6 (0.0–9.3)	0.5 (0.1–3.5)

DSM-IV Diagnoses and associated symptoms	Adjusted OR (95% CI) (Ever vs. Never Smokers) ¹		
	Male	Female	Total
Low self esteem	.5	5.8 (1.7–19.3)	2.0 (0.5–7.9)
Poor concentration, decision difficulty	0.3 (0.1–1.4)	1.9 (0.3–10.5)	1.1 (0.3–4.3)
Feeling of hopelessness	.5	0.9 (0.1–6.0)	0.5 (0.1–2.5)
Either Anxiety or Depression³	1.2 (0.4–3.5)	4.2 (1.6–10.7)	2.7 (1.2–6.2)
Severe anxiety or depression disorder ⁴	0.6 (0.1–2.6)	5.1 (1.4–19.0)	3.0 (1.0–9.2)
Subthreshold Anxiety or MDD	1.9 (0.6–5.9)	3.3 (1.4–7.7)	2.6 (1.3–5.1)

¹The dependent variable is DSM-IV diagnoses; the regression for anxiety adjusts for the covariates in Table 1 (i.e. age, race, attending school, poverty index ratio and lives with smokers) and depression disorder; the regression for depression disorder adjusts for covariates and anxiety; the regression for either disorder only adjusts for Table 1 covariates;

²use sample I;

³use sample II;

⁴severe cases defined as having endorsed at least one severe rating to impairment questions ('very bad', 'a lot of the time'); and

⁵inestimable or unreliable due to small n.

Table 3
Past year mental health service use by smoking status among adolescents with anxiety and depression disorders.

Service Seeking for:	Service rates, % (SE)		Ever Smokers		Adjusted OR (95% CI) (Ever vs. Never Smokers) ¹	
	Never Smokers					
	Male	Female	Male	Female	Male	Female
Anxiety ²	32.3 (12.2)	29.6 (7.7)	27.0 (6.3)	30.2 (4.3)	5.7 (0.8–41.6)	0.1 (0.0–1.3)
Depression ³	39.2 (9.4)	47.3 (10.6)	68.5 (11.5)	51.0 (8.2)	3.5 (0.3–48.0)	0.7 (0.2–3.4)
Either Anxiety or Depression ³	37.4 (10.0)	36.6 (6.8)	68.1 (10.7)	44.8 (7.0)	5.3 (1.1–25.8)	1.2 (0.5–3.0)

¹The dependent variable is reported treatment for anxiety and depression conditions; the regression of treatment for anxiety ran in the subset of anxiety full or subthreshold cases adjusted for the covariates in Table 1 (i.e. age, race, attending school, poverty index ratio and lives with smokers); the regression of treatment for depression disorder ran in the subset of mood disorder full or subthreshold cases adjusted for covariates; the regression of treatment for either disorder ran in the subset of anxiety and depression disorder full or subthreshold cases adjusted for Table 1 covariates.

²Use sample I.

³Use sample II.