The Relationship Between Anxiety Disorders and Substance Use Among Adolescents in the Community: Specificity and Gender Differences

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Abstract

Using a sample of 781 adolescents (ages 13–17, 52.8% male) from a community survey, this study examined gender differences in the co-occurrence of specific anxiety disorders with substance use in adolescents. The associations between anxiety disorders and substance use differed according to the particular anxiety disorders and forms of substance use being examined, as well as by gender. Social phobia was associated with cigarette smoking among boys only. For girls, social phobia appeared to be negatively associated with drug use. For the other anxiety disorders, the associations with substance use tended to be stronger among girls. These findings highlight the need to improve clinical recognition of the anxiety disorders and to improve treatment access for afflicted adolescents. Future studies based on longitudinal data could further elucidate the relationships among anxiety disorders, gender, and substance use.

Keywords

Anxiety disorders; Substance use; Comorbidity; Adolescence; Gender

Introduction

Substance use disorders comorbid with anxiety disorders are common in the population (Book and Randall 2002; Christie et al. 1988; Compton et al. 2007; Grant et al. 2004a; Hall and Farrell 1997; Hasin et al. 2007; Kessler et al. 1996), and tend to be more difficult to treat than substance use disorders alone (Book and Randall 2002; Grothues et al. 2008; Helzer and Pryzbeck 1988; Zimmermann et al. 2004). Adolescence tends to be the time of life during which substance use and abuse begin to develop (Young et al. 2002). Anxiety disorders, similarly, typically have their onsets during childhood or adolescence (Kessler et al. 2005). Thus, in seeking to better understand the nature of comorbidities between anxiety and substance use disorders, it is crucial to examine patterns of the co-occurrence of anxiety disorders with substance use and abuse, not only among adults, but also among adolescents.

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Studies examining anxiety and substance use disorders among community-dwelling adults generally find the two types of disorders to be positively associated (Christie et al. 1988; Compton et al. 2007; Eisen and Rasmussen 1989; Falk et al. 2008; Grant et al. 2004a; Kolada et al. 1994; Kushner et al. 1999; Suzuki et al. 2002) (Johnson et al. 2000). There have been fewer community studies examining the associations between anxiety disorders and substance use and abuse among adolescents (Brook et al. 1998; Kandel et al. 1997; Rohde et al. 1996). With regard to gender, findings have been highly inconsistent, both among adult studies (Alonso et al. 2004; Bott et al. 2005; Burns and Teesson, 2002; Grant et al. 2004a; Gratzer et al. 2004; Kessler et al. 1997) and among studies of adolescents (Kandel et al. 1997; Rohde et al. 1996; Sung et al. 2004), as to whether associations between anxiety disorders and substance use and abuse differ substantially between males and females. Given these inconsistencies, the current study examines three categories of adolescent substance use (i.e., frequent smoking, frequent/heavy drinking, and illicit drug use) in relation to each of six anxiety disorders (i.e., social phobia, agoraphobia, overanxious disorder/generalized anxiety disorder (OAD/GAD), separation anxiety, and obsessive-compulsive disorder (OCD)), and focuses on gender differences in the patterns of these relationships.

Anxiety Disorders in Relation to Substance Abuse Among Adults

Studies of adults have found that anxiety disorders in general tend to be positively related to abuse of, and dependence on, both alcohol (Book and Randall 2002; Eisen and Rasmussen 1989; Falk et al. 2008; Kolada et al. 1994; Kushner et al. 1990; Merikangas et al. 1998; Suzuki et al. 2002) and illicit drugs (Agrawal et al. 2007; Keyes et al. 2008). With regard to tobacco use, however, findings have been more variable. A nationally representative community study of adults in the United States found that nicotine dependence was positively associated with a wide range of psychiatric disorders, including agoraphobia, social phobia, specific phobia, generalized anxiety disorder, and OCD (Grant et al. 2004a). With regard to OCD, some clinical studies have concluded that patients with this disorder appear to be less likely to smoke compared to the general population (Bejerot and Humble 1999; Himle et al. 1988). However, one community study done in northern Germany found OCD to be positively associated with both nicotine and alcohol dependence among women (Grabe et al. 2001). In a community study conducted in New York State (Johnson et al. 2000) heavy smoking among young adults was found to be associated with generalized anxiety disorder but not with agoraphobia or social phobia. With regard to gender, some adult community studies have found that associations between the two types of disorders tend to be stronger among women than men (Burns and Teesson 2002; Gratzer et al. 2004; Kessler et al. 1997). Other studies of adults, however, have concluded that these associations do not differ by gender (Alonso et al. 2004; Bott et al. 2005; Grant et al. 2004a).

Anxiety Disorders in Relation to Substance Use Among Adolescents

Previous studies examining the relationship between anxiety and substance use in children and adolescents have produced inconsistent, and often unclear, results. One cross-sectional study of adolescents found anxiety disorders to be positively related to the frequent use of tobacco, but not to the use of either alcohol or illicit drugs (Kandel et al. 1997). In a longitudinal study of youth, anxiety was not found to be significantly related to any of the types of substance use assessed (Brook et al. 1998). These studies did not distinguish among the various anxiety disorders, instead employing only a single, general anxiety variable in their analyses. One study of adolescents from the Great Smoky Mountains region of the United States did examine two different childhood anxiety disorders separately in relation to alcohol use, and found that adolescents with a history of one of the disorders (generalized anxiety disorder) were significantly more likely to be alcohol users, whereas a history of the other anxiety disorder (separation anxiety) appeared to indicate a decreased risk of alcohol use (Kaplow et al. 2001). This study was, however, unable to compare these relationships across different

substances, as only alcohol use was examined. With regard to the role of gender, some previous studies have found anxiety to be significantly associated with alcohol abuse (Rohde et al. 1996), or with substance abuse in general (Sung et al. 2004), among girls but not among boys. Kandel et al. (1997) on the other hand, found that anxiety was more strongly related to frequent smoking among boys than among girls (Kandel et al. 1997). The inconsistencies among these findings call for further research to be done in this area.

The Current Study

This study addresses three main questions regarding the relationship between anxiety and substance use, and the role of gender in that relationship. First, we examine the relationships of specific anxiety disorders (social phobia, agoraphobia, OAD/GAD, separation anxiety, and OCD) with substance use behaviors (i.e., frequent smoking, frequent/heavy drinking, or illicit drug use) among adolescents in the community. Second, we examine gender differences in patterns of the co-occurrence of anxiety disorders and substance use among these adolescents. Third, we assess gender differences, both in the relationship between comorbid anxiety/depression and substance use, and in the relationship between anxiety comorbid with disruptive disorders, and substance use.

Researchers who have examined comorbidity among psychiatric disorders have concluded that it is the norm rather than the exception (Grant et al. 2004b; Kessler et al. 1996; Regier et al. 1990). Because depression has been found to be associated both with anxiety (Angst et al. 2002; Hasin et al. 2005; Kessler et al. 1996; Lepine et al. 1993; Wittchen et al. 1991) and with substance use (Armstrong and Costello 2002; Breslau et al. 1993b; Breslau et al. 1998; Grant et al. 2004a; Hasin et al. 2005; Kessler et al. 1996; Regier et al. 1990; Wu et al. 2006), we recognized that any associations we might find between anxiety and substance use could be due to their mutual relationship with depression. Our study was, therefore, designed to take depression into account in the analyses. Disruptive disorders also are known to be highly related to substance use/abuse (Armstrong and Costello 2002; Compton et al. 2007; Costello et al. 1999; Ronald C. Kessler et al. 1996). Therefore, this study also examines the patterns of substance use of adolescents having anxiety disorders only, in comparison with those of adolescents having both anxiety and disruptive disorders. Some important demographic and family factors, such as age, gender, ethnicity, and family structure, as well parental drug/alcohol problems, have also been shown to be associated with both anxiety and substance use/abuse (Armstrong and Costello 2002; Costello et al. 1999; Wu et al. 2006). These factors are also controlled for in all of our analyses.

Methods

Sample

Data are from two surveys done in the United States: The NIMH Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) Study (Lahey et al. 1996) and the Westchester Study (Kovalenko et al. 2001). The full sample of 1,458 children and adolescents (ages 9–17) was randomly selected from four geographic areas: (1) Hamden, East Haven and West Haven, Connecticut ($N = 314$); (2) DeKalb, Rockdale, and Henry Counties, Georgia ($N = 299$); (3) Westchester County, New York ($N = 360$ from the MECA study and $N = 173$ from WS); and (4) San Juan, Puerto Rico ($N = 312$). The overall compliance rate of this combined community sample was 85% (MECA Study 84% and Westchester Study community sample 94%). The study was conducted in 1992. The study protocol was reviewed and approved by the Institutional Review Board of the New York State Psychiatric Institute. Detailed information on the study is available elsewhere (Kovalenko et al. 2001; Lahey et al. 1996). A subsample of these subjects—the adolescents, ages 13–17 ($N = 781$)—is used in this study.

The socio-demographic and family characteristics of the sample are presented for the whole sample, and by gender, in Table 1. Forty-seven percent of the sample were girls, 49% White, 17% African American, and 27% Hispanic. The mean age was 15.

Measures

Trained interviewers interviewed one child and one parent/guardian in each household regarding childhood psychopathology as measured by Version 2.3 of the Diagnostic Interview Schedule for Children (DISC), which assesses psychiatric symptoms and diagnoses in children and adolescents according to DSM-III-R criteria (Shaffer et al. 1996). Mental health service utilization and a wide array of risk factors were also assessed (Goodman et al. 1998). Written consent was obtained from both the parent/guardian and the child prior to the interview. Interview length was ~3 h (Lahey et al. 1996).

Use of Alcohol, Cigarettes and Other Drugs

Information about each adolescent's lifetime and past year use of alcohol, cigarettes and other drugs, as well as frequency of use, was obtained from both the parent and the youth. If either the parent or the child reported use of a substance by the child, the child was considered to be a user. For the purposes of our analyses, binary substance use variables were created using the following criteria: Adolescents who had smoked at least one cigarette per day in the last 6 months were classified as frequent smokers. Those who, over the past 6 months, had had a drink at least once a week, or had been drunk at least once, were classified as having frequent or heavy drinking. Adolescents who had, in the past year, used any illicit drug (such as marijuana, cocaine, heroin, etc.), or had used psychotropic prescription drugs non-medically, were classified as having illicit drug use. The cut-off values for these three substance use variables were selected in order to allow us sufficient statistical power for detecting associations with possible predictors. Our sample was one of community-dwelling adolescents, and, as expected, did not contain many cases of individuals with full-blown substance dependence.

Measures of Anxiety Disorders and Other Mental Disorders

Youth psychopathology in the 6 months prior to the interview was assessed using the DISC. The validity and reliability of its measures have been reported elsewhere (Schwab-Stone et al. 1996; Shaffer et al. 1996). A diagnostic criterion was considered positive if reported by either the parent or the child. A child was considered positive on any disorder when (1) DSM-III-R criteria for that disorder were met, and (2) there was an indication of diagnosis-specific impairment (Shaffer et al. 1996). Anxiety disorders included in this study are social phobia, agoraphobia, OAD/GAD (overanxious disorder or generalized anxiety disorder), separation anxiety, and obsessive-compulsive disorder (OCD). These various anxiety disorders are not mutually exclusive. We also examined the presence of any anxiety disorder, as well as the number of anxiety disorders, in relation to substance use. The depressive disorders assessed include major depression and dysthymia. The disruptive disorders include attention deficit hyperactivity disorder, conduct disorder, and oppositional defiant disorder.

Demographics and Family Factors

Youth demographic information includes gender, age, and ethnicity. Youth were divided into four ethnic groups: non-Hispanic White, African-American, Hispanic, and Other. A dummy-coded variable, White (non-Hispanic Whites), was created for logistic regression analyses. Information about public assistance and family structure (living with both biological parents vs. others) was obtained from parent interviews. The variable "parental drug/alcohol problems" was coded "yes" if it was reported that either of the adolescent's biological parents had stayed overnight or longer, in a hospital or treatment facility, because of a drug or alcohol problem.

Analysis

Univariate analyses were conducted first, to describe the characteristics of the sample, in total and by gender. Then, logistic regression analyses predicting substance use (i.e., frequent smoking, frequent/heavy drinking, or drug use), with the anxiety disorders as the independent variables, were conducted separately for boys and girls in two steps: In step 1 (Model 1), each of the anxiety disorders was entered into the model, with demographic and family factors controlled for; in step 2 (Model 2), depression (i.e., major depressive disorder or dysthymia) was added to the equation to test whether the associations between the anxiety disorders and substance use would still hold. Using gender specific logistic analyses, we obtained covariate-adjusted odds ratios (AORs) for the associations between the anxiety and the substance use variables, for boys and girls. Wald tests were then used to test for gender differences in the AORs.

Finally, similar logistic regression analyses were conducted to examine the relationships between substance use and two types of mental disorder comorbidities, i.e., anxiety comorbid with depression, and anxiety comorbid with disruptive disorder(s), while controlling for sociodemographic and other relevant variables. Here, too, Wald tests were used to test for gender differences.

Results

Among 781 adolescents, 7.8% were smoking at least 1 cigarette per day, 19% were frequent or heavy drinkers and 10.8% had engaged in illicit drug use in the year prior to the interview (Table 2). About 8.6% met criteria for social phobia, 4.4% for agoraphobia, 8.6% for OAD/GAD, 4.7% for separation anxiety, and 3.2% for OCD. Overall, 18.4% met criteria for any of the assessed anxiety disorders. The prevalences of depressive and disruptive disorders were 9.6 and 11.5%, respectively. The prevalences of comorbid anxiety/depression, and of anxiety comorbid with disruptive disorders, were each just under 5%.

The prevalences of frequent smoking and drug use were similar for the two genders. Frequent or heavy drinking was more common among boys than among girls, but this difference was only marginally significant. As expected, anxiety and depressive disorders were, in general, more common among girls than boys. For social phobia and agoraphobia, as well as depression, the gender differences were statistically significant, but they were not statistically significant for the other three anxiety disorders. Comorbid anxiety/depression was more common among girls (7.9%) than among boys (2.2%), while disruptive disorders were more prevalent in boys than in girls.

Cigarette Smoking and Anxiety Disorders

Controlling for demographic and familial factors (Model 1 in Table 3), frequent cigarette smoking was significantly associated with anxiety disorders in general for both boys (AOR = 3.0, $p < .05$) and girls (AOR = 3.3, $p < .05$). However, a significant gender difference was found in the analyses on social phobia, which was significantly associated with smoking among boys (AOR = 4.9, $p < .01$) but not among girls (AOR = .08, not significant). This gender difference was statistically significant ($p = .05$). With regard to OAD/GAD, Separation Anxiety, and OCD, on the other hand, significant associations with smoking were found for girls but not for boys.

In order to take into account the fact that depression may be associated both with anxiety and with substance use, depression was added into the equation in Model 2 (Table 3). After depression was controlled for, the associations between smoking and anxiety disorders for girls became noticeably weaker, indicating that depression may be either a confounder or a mediator

of the relationship between anxiety and smoking in girls. For example, the AORs for OCD and smoking in girls dropped from 13.0 ($p < .001$) in Model 1–7.4 ($p < .05$) in Model 2. It is interesting to note, however, that the AORs for boys were almost the same in Model 2 as in Model 1, indicating that depression may not be a confounding factor for boys. After depression was controlled for, the gender difference for social phobia remained significant.

Alcohol Use and Anxiety Disorders

With regard to alcohol use, no significant associations were found for boys between frequent/heavy drinking and anxiety disorders when controlling for demographic and familial factors (Model 1 in Table 4), while for girls frequent or heavy drinking was significantly associated with any anxiety disorder and with number of anxiety disorders, as well as with two specific anxiety disorders, i.e., agoraphobia and OCD.

After depression was controlled for (Model 2 in Table 4), any anxiety, number of anxiety disorders, and agoraphobia were still significantly associated with frequent/heavy drinking among girls, although the relationships became slightly weaker. The relationships for boys remained non-significant. There was a significant gender difference, here, with regard to any anxiety disorder; it was related to frequent/heavy drinking among girls, but not among boys.

Drug Use and Anxiety Disorders

Table 5 shows that, as with the analyses on frequent smoking and frequent/heavy drinking, more significant associations were found for girls than for boys between illicit drug use and anxiety disorders. The results for Model 1 show that, for boys, OCD was the only anxiety disorder significantly associated with drug use (AOR = 4.1, $p < .05$). For girls, on the other hand, agoraphobia, separation anxiety, and OCD were all significantly associated with drug use. Again, when depression was controlled for the positive associations became somewhat weaker. It is also worth mentioning that a marginally significant negative association between social phobia and drug use in girls emerged here after controlling for depression (AOR = 0.2, $p < .10$), indicating that girls with social phobia are less likely to use drugs than other girls. The difference between girls and boys, with regard to social phobia and drug use, was statistically significant.

Comorbid Anxiety/Depression and Anxiety Comorbid With Disruptive Disorders

The top half of Table 6 displays the results regarding the associations between anxiety disorders, either alone or in combination with depression, and substance use. For boys, having an anxiety disorder without depression was found to be associated with smoking (AOR = 3.2, $p = .013$). Depression in boys was associated with past year drug use; the AORs here were 3.9 ($p = .0234$) for "Depressive Disorder(s) only", and 9.5 ($p = .005$) for "Both", indicating that boys with both anxiety and depression may be at the greatest risk for drug use. Among girls, having both anxiety and depression was predictive of smoking (AOR = 5.4, $p = .006$) and of frequent/heavy drinking (AOR = 3.2, $p = .021$). "Anxiety Disorder(s) only" was predictive of both frequent/heavy drinking (AOR = 2.8, $p = .012$) and of past year drug use (AOR = 3.4, $p = 0.010$). These differences between the genders were not, however, statistically significant.

The bottom half of the table displays the results of similar analyses concerning the associations of anxiety and disruptive disorders with substance use. As expected, the associations between disruptive disorders and substance use were found to be stronger than those between anxiety and substance use, for both genders. The association between "Disruptive Disorder(s) only" and frequent/heavy drinking was significantly stronger among girls than among boys (with AORs of 17.3 and 2.8, respectively), and the same was true for the relationship between anxiety comorbid with disruptive disorders ("Both"), and frequent/heavy drinking (here the AORs were 16.1 for girls, and 1.9 for boys).

Discussion

Using data from a community sample, this study examined patterns of the co-occurrence of anxiety disorders with use of different types of substances among adolescents, and the ways in which these patterns differ by gender. This study's findings, when combined with the findings of studies examining these comorbidities among adults, shed light on the developmental processes involved in changes in the relationships between anxiety disorders and substance use and abuse which may occur over the life cycle. Significant gender differences were found in the associations of social phobia with cigarette smoking and illicit drug use among adolescents. Specifically, among boys, those with social phobia were significantly more likely to be smokers, while among girls, those with social phobia actually appeared to be somewhat less likely to smoke than those without, although this association was non-significant. It may be that boys are more susceptible than girls to engaging in tobacco use in response to the self-presentation concerns that typically accompany social phobia. Among girls, social phobia was found to be marginally negatively related to drug use. This indication that rates of drug use, and of frequent smoking, may be lower among girls with social phobia than among girls without it, is somewhat analogous to Kaplow et al. (2001) finding that symptoms of separation anxiety are negatively related to alcohol use initiation among children and adolescents. As these authors point out, the kinds of anxiety symptoms that tend to inhibit a child or adolescent's ability to form affiliations with his or her peer group may, as a result, exert a protective effect against substance use initiation (Kaplow et al. 2001). Studies of adults, however, have consistently found social phobia and drug use to be positively associated among women (Buckner et al. 2006; Magee et al. 1996). Our findings indicate that the nature of social phobia's relationship with drug use may change during the transition from adolescence to adulthood.

For the other four anxiety disorders assessed here (agoraphobia, OAD/GAD, separation anxiety, and OCD), the associations with substance use among girls were frequently positive and significant, while the associations for boys tended not to be significant. After we controlled for depression along with other potentially confounding variables, significant associations remained, among girls, between each of these four anxiety disorders and at least one category of substance use—either smoking, drinking or illicit drug use. These stronger positive associations for females than males are consistent with gender differences found in some previous studies of both adults (Page and Andrews 1996) and youth (Patton et al. 2002; Patton et al. 1996).

OCD was the specific anxiety disorder that showed the most consistent associations with substance use among girls in our study, although after depression was controlled for its association with alcohol use became marginal. The high rates of habit-based, repetitive, and ritualized behaviors that typically accompany OCD may place girls who are afflicted with OCD at greater risk of converting casual substance use into habit-based substance misuse. To our knowledge, no previous studies have examined the relationship between OCD and tobacco use among adolescents. One study did find OCD to be positively associated with dependence on alcohol and illicit drugs among adolescents in New Zealand, consistently with our study; this study did not, however, test for gender differences in these associations (Douglass et al. 1995). Our finding that OCD and smoking are significantly, and positively, associated among girls, but not among boys, is analogous to the results of a community study done in northern Germany, which found OCD to be positively related to smoking among women but not among men (Grabe et al. 2001). However, it stands in contrast to the findings of clinical studies of adults where both men and women with OCD were found to have very low rates of smoking (Bejerot and Humble 1999; Himle et al. 1988). This difference in findings may have to do with differences between community and clinical samples. Further research is needed to elucidate

the nature of the relationship between OCD and use of different types of substances, among males and females, over time.

Another specific anxiety disorder with relatively strong associations with substance use among the girls in our sample was agoraphobia, which was significantly associated both with alcohol use and with illicit drug use. The finding of a positive relationship between agoraphobia and alcohol use is consistent with Zimmermann and colleagues' study of hazardous use of alcohol in youth (Zimmermann et al. 2003), and Grant and colleagues' findings on substance use disorders in adults (Grant et al. 2004b). Girls may be particularly susceptible to engaging in alcohol and drug use as a means of alleviating the fear of public and unfamiliar places that characterizes agoraphobia.

Our study also examined the role of other mental disorders in the co-existence of anxiety disorders with substance use. Our findings indicate that among adolescents of both genders, those who have anxiety disorder(s) comorbid with other mental disorders (i.e., depressive or disruptive disorders) are relatively likely to be substance users. However, girls may differ from boys with similar mental disorder comorbidities, in terms of the types of substances chosen. For example, among the girls, anxiety comorbid with depression was predictive of frequent smoking, and of frequent/heavy drinking; while among the boys it was significantly predictive of illicit drug use. This gender difference may be a reflection of differences in the general popularity of particular types of substances of abuse, or in levels of involvement in substance use, among boys and girls. A gender difference was also found with regard to anxiety comorbid with disruptive disorders, which was significantly predictive of frequent/heavy drinking among girls, but not among boys. These gender difference findings should be further explored in other community, and preferably longitudinal, studies.

This study is limited by the cross-sectional nature of the data set, and no causal relationship between substance use and anxiety disorders can be established. The low prevalence of substance use disorders in this adolescent community sample precluded examination of relationships between anxiety disorders and full-blown substance use disorders. The relatively low prevalences of the specific anxiety disorders may have similarly limited our power to detect gender differences in the associations between anxiety disorders and substance use. However, the availability of information on these specific anxiety disorders, as measured by the NIMH Diagnostic Interview Schedule for Children (Shaffer et al. 1996), in this probability sample of community-dwelling adolescents, allowed us to offer unique insights into the relationship between anxiety disorders and substance use in adolescence.

Most previous studies of adolescents have not examined gender differences in the associations between specific anxiety disorders and the use of various specific types of substances. Our findings suggest that the associations between substance use and anxiety may be specific to particular anxiety disorders, as well as to particular types of substance use, and that the strengths of these links may also be gender-specific. In general, the associations between anxiety disorders and substance use were stronger among girls than among boys. Anxiety disorders comorbid with disruptive disorders were also more consistently associated with higher rates of heavy drinking and drug use among girls, than among boys. Social phobia was an exception to this rule. The differences between the patterns observed in the current study's adolescent sample, and the findings of adult studies, with regard to social phobia, and to some extent OCD, indicate that the relationship between anxiety disorders and substance use may change from adolescence to adulthood. The findings also indicate the importance of recognizing and treating childhood anxiety disorders, especially among girls, in order to help them avoid developing secondary, comorbid substance use disorders.

Acknowledgments

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Table 1

Sample characteristics ($N = 781$)

	Total ($N = 781$)	Boys ($N = 412$)	Girls ($N = 369$)
Girl (%)	47.3	–	–
Age (Mean)	15.0	15.0	15.0
Ethnicity (%)			
White	48.9	49.0	48.8
African-American	17.4	17.0	17.9
Hispanic	27.1	29.4	24.7
Other	6.5	4.6	8.7
Public assistance (%)	10.9	10.0	12.0
Not living with both Biological parents (%)	40.5	39.8	41.2
Parental drug/alcohol problems (%)	5.1	4.4	6.0

Table 2

Substance use, anxiety and other disorders, by gender[a]

	Total (*N* = 781) (%)	Boys (*N* = 412) (%)	Girls (*N* = 369) (%)
Smoked at least 1 cigarette/day, past 6 months	7.8	7.8	7.9
Frequent or heavy drinking, past 6 months	19.0	21.4	16.3[+]
Illicit drug use, past year	10.8	10.0	11.7
Anxiety disorders			
Social Phobia	8.6	6.6	10.8[*]
Agoraphobia	4.4	2.7	6.2[*]
OAD/GAD[b]	8.6	7.3	10.0
Separation anxiety	4.7	3.9	5.7
OCD[c]	3.2	2.4	4.1
Any anxiety disorder	18.4	14.8	22.5[**]
Number of anxiety disorders (Mean (SD))	0.29 (0.72)	0.23 (0.03)	0.37 (0.80)[**]
Any depressive disorder	9.6	6.8	12.7[**]
Any disruptive disorder	11.5	15.5	7.1[***]
Anxiety disorder with depressive disorder	4.9	2.2	7.9[***]
Anxiety disorder with disruptive disorder	4.9	5.3	4.3

[a] Values are percentages, except where otherwise noted

[b] Overanxious disorder/generalized anxiety disorder

[c] Obsessive-compulsive disorder

[+] $p < 0.10$;

[*] $p < 0.05$;

[**] $p < 0.01$;

[***] $p < 0.001$

Table 3

Results of logistic regression analyses of frequent smoking on anxiety disorders, by gender

	Social phobia AOR[a] (CI)[b]	Agoraphobia AOR (CI)	OAD/GAD AOR (CI)	Separation anxiety AOR (CI)	OCD AOR (CI)	Any anxiety AOR (CI)	No. of anxiety disorders AOR (CI)
Model 1[c]							
Boys	4.9 ** (1.6–15.1)	_d	2.9[+] (1.0–8.8)	1.8 (0.4–9.6)	1.1 (0.1–9.2)	3.0 * (1.3–7.0)	1.7 * (1.0–2.8)
Girls	0.8 (0.2–3.3)	3.2 (0.7–14.1)	6.5 ** (2.1–20.3)	5.4 * (1.4–21.2)	13.0 *** (2.3–73.2)	3.3 * (1.3–8.0)	2.1 * (1.3–3.3)
Gender Difference[e]	p = .0505	NA	NS	NS	NS	NS	NS
Model 2[f]							
Boys	4.8 ** (1.6–14.8)	_d	2.8[+] (0.9–8.5)	1.8 (0.4–9.4)	1.1 (0.1–9.4)	2.9 * (1.2–6.9)	1.7 * (1.0–2.7)
Girls	0.5 (0.1–2.0)	3.0 (0.6–13.7)	4.4 * (1.2–15.8)	3.9[+] (1.0–15.7)	7.4 * (1.1–47.8)	2.4[+] (0.9–6.5)	1.8 * (1.0–3.0)
Gender Difference[e]	p = .0138	NA	NS	NS	NS	NS	NS

[a] AOR = adjusted odds ratio

[b] CI = 95% Confidence interval

[c] Controlling for age, ethnicity, public assistance, not living with both biological parents, parental drug/alcohol problems and site

[d] No estimates available because of empty cells (no boy had co-occurring agoraphobia and smoking)

[e] A p value for gender difference is listed here if the AORs for boys and girls, for the particular anxiety disorder, were found to be significantly different, using the Wald test for equality of coefficients; NS = not significant; NA = not available

[f] In addition to the variables controlled for in model 1, depressive disorders were also controlled for here

[+] p < 0.10;

[*] p < 0.05;

[**] p < 0.01;

[***] p < 0.001

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Table 4

Results of logistic regression analyses of frequent/heavy drinking on anxiety disorders, by gender

	Social phobia AOR[a] (CI)[b]	Agoraphobia AOR (CI)	OAD/GAD AOR (CI)	Separation anxiety AOR (CI)	OCD AOR (CI)	Any anxiety AOR (CI)	No. of anxiety disorders AOR (CI)
Model 1[c]							
Boys	0.9 (0.3–2.7)	1.6 (0.3–8.2)	0.9 (0.3–2.5)	2.4 (0.7–8.3)	1.3 (0.3–5.7)	1.0 (0.5–2.0)	1.1 (0.7–1.7)
Girls	1.4 (0.5–3.4)	3.6* (1.2–10.9)	2.4+ (1.0–6.0)	3.0+ (0.9–9.4)	5.2* (1.3–20.9)	2.9** (1.5–5.7)	1.7** (1.2–2.4)
Gender Difference[d]	NS	NS	NS	NS	NS	p = .0340	NS
Model 2[e]							
Boys	0.9 (0.3–2.6)	1.6 (0.3–8.1)	0.8 (0.3–2.3)	2.3 (0.7–7.8)	1.3 (0.3–5.6)	0.9 (0.5–2.0)	1.1 (0.7–1.6)
Girls	1.1 (0.4–2.9)	3.5* (1.1–10.5)	2.0 (0.7–5.3)	2.5 (0.8–8.2)	4.1+ (0.8–17.2)	2.7** (1.3–5.6)	1.6* (1.1–2.4)
Gender Difference[d]	NS	NS	NS	NS	NS	p = .0479	NS

[a] AOR = adjusted odds ratio

[b] CI = 95% confidence interval

[c] Controlling for age, ethnicity, public assistance, not living with both biological parents, parental drug/alcohol problems and site

[d] A p value for gender difference is listed here if the AORs for boys and girls, for the particular anxiety disorder, were found to be significantly different, using the Wald test for equality of coefficients; NS = not significant

[e] In addition to the variables controlled for in model, depressive disorders were also controlled for here

+ p < 0.10;

* p < 0.05;

** p < 0.01

Table 5

Results of logistic regression analyses of illicit drug use on anxiety disorders, by gender

	Social phobia AOR[a] (CI)[b]	Agoraphobia AOR (CI)	OAD/GAD AOR (CI)	Separation anxiety AOR (CI)	OCD AOR (CI)	Any anxiety AOR (CI)	No. of anxiety disorders AOR (CI)
Model 1[c]							
Boys	2.1 (0.7–6.6)	1.2 (0.1–11.8)	1.9 (0.6–5.6)	1.1 (0.2–5.8)	4.1* (0.9–18.6)	2.3+ (1.0–5.2)	1.5 (0.9–2.3)
Girls	0.3 (0.1–1.4)	4.4* (1.2–16.0)	2.4 (0.8–7.0)	6.1** (1.7–22.5)	7.9* (1.5–40.3)	2.6* (1.2–5.7)	1.6* (1.0–2.5)
Gender Difference[d]	$p = .0455$	NS	NS	NS	NS	NS	NS
Model 2[e]							
Boys	1.8 (0.5–5.5)	1.3 (0.1–12.6)	1.4 (0.4–4.4)	1.0 (0.2–5.1)	4.2+ (1.0–18.8)	2.1 (0.9–4.7)	1.3 (0.8–2.1)
Girls	0.2+ (0.04–1.1)	4.3* (1.2–13.7)	2.1 (0.6–6.6)	5.6* (1.5–21.2)	6.7* (1.2–38.3)	2.5* (1.1–5.8)	1.6+ (1.0–2.6)
Gender Difference	$p = .0349$	NS	NS	NS	NS	NS	NS

[a] AOR = adjusted odds ratio

[b] CI = 95% confidence interval

[c] Age, ethnicity, public assistance, not living with both biological parents, parental drug/alcohol problems and site were controlled for

[d] A p value for gender difference is listed here if the AORs for boys and girls, for the particular anxiety disorder, were found to be significantly different, using the Wald test for equality of coefficients; NS = not significant

[e] In addition to the variables controlled for in Model 1, depressive disorders were also controlled for here

+ $p < 0.10$;

* $p < 0.05$;

** $p < 0.01$

Table 6

Results of logistic regression analyses of substance use behaviors on types of mental disorders, by gender

		Frequent smoking AOR[a] (CI)[b]	Frequent or heavy drinking AOR (CI)	Illicit drug use AOR (CI)
Anxiety and/or depressive disorder(s)[c]				
Boys	Neither anxiety nor depressive disorder[d]	1	1	1
	Anxiety disorder(s) only	3.2 (1.3–7.9)[*]	0.9 (0.4–2.1)	2.0 (0.8–5.0)
	Depressive disorder(s) only	1.9 (0.5–7.9)	1.8 (0.6–.1)	3.9 (1.2–12.6)[*]
	Both	3.0 (0.3–27.1)	1.7 (0.3–9.1)	9.5 (2.0–12.6)[**]
Girls	Neither anxiety nor depressive disorder[d]	1	1	1
	Anxiety disorder(s) only	2.8 (0.9–8.8)	2.8 (1.3–6.4)[*]	3.4 (1.3–8.8)[*]
	Depressive disorder(s) only	3.2 (0.7–15.0)	1.5 (0.4–.5)	2.5 (0.6–10.1)
	Both	5.4 (1.6–18.0)[**]	3.2 (1.2–8.5)[*]	2.1 (0.6–6.7)
Gender	Anxiety disorder(s) only	NS	$p = .0566$	NS
Difference[e]	Depressive disorder(s) only	NS	NS	NS
	Both	NS	NS	NS
Anxiety and/or disruptive disorder(s)[f]				
Boys	Neither anxiety nor disruptive disorder[d]	1	1	1
	Anxiety disorder(s) only	2.1 (0.5–8.3)	0.9 (0.4–2.3)	2.0 (0.6–6.1)
	Disruptive disorder(s) only	10.4 (3.6–30.0)[***]	2.8 (1.3–6.1)[**]	3.7 (1.4–9.7)[**]
	Both	22.8 (6.1–85.9)[***]	1.9 (0.6–5.7)	5.5 (1.6–18.6)[**]
Girls	Neither anxiety nor disruptive disorder[d]	1	1	1
	Anxiety disorder(s) only	1.6 (0.5–5.3)	2.8 (1.2–6.4)	2.7 (1.0–7.2)[*]
	Disruptive disorder(s) only	7.3 (1.0–52.8)[*]	17.3 (3.5–84.9)[***]	25.0 (4.6–136.8)[***]
	Both	26.9 (4.8–150.6)[***]	16.1 (3.9–66.9)[***]	16.2 (3.3–78.4)[***]
Gender	Anxiety disorder(s) only	NS	NS	NS
Difference[e]	Disruptive disorder(s) only	NS	$p = 0443$	$p = .0542$
	Both	NS	$p = .0199$	NS

[a] AOR = adjusted odds ratio

[b] CI = 95% confidence interval

[c] Age, ethnicity, public assistance, not living with both biological parents, parental drug/alcohol problems, and site were controlled for in this set of analyses

[d] Reference group

[e] A p value for gender difference is listed here if the AORs for boys and girls, for the specified type of mental disorder, were found to be significantly different, using the Wald test for equality of coefficients; NS = not significant

^{f}Age, ethnicity, public assistance, not living with both biological parents, parental drug/alcohol problems, site and depressive disorder were controlled for in this set of analyses

$^{+}$$p < 0.10$;

*$p < 0.05$;

**$p < 0.01$,

***$p < 0.001$