Published in final edited form as:

Addict Behav. 2010 January ; 35(1): 30–34. doi:10.1016/j.addbeh.2009.08.005.

Substance Use among Late Adolescent Urban Youths: Mental Health and Gender Influences

Traci M. Schwinn^{a,*}, Steven P. Schinke^a, and Danielle N. Trent^a

^aColumbia University School of Social Work, 1255 Amsterdam Ave, New York, NY 10027, USA

Abstract

This paper explores gender and mental health influences on alcohol, tobacco, and illicit drug use among late adolescent urban youths. Specifically, we examine whether rates of substance use differ by gender, whether mental health indices differ by gender and are predictive of substance use, and whether gender moderates the relationship between mental health and substance use. Data from our non-clinical sample of 400 youths were collected primarily online. Analysis of cross-sectional data revealed no differences in substance use by gender. Indices of mental health differed by gender, with girls reporting greater symptoms of depression and anxiety. Ratings of hostility were similar for boys and girls. Alcohol, tobacco, and drug use were associated with greater symptoms of depression, anxiety, and hostility; this relationship, however, was not moderated by gender. Study findings provide evidence that among late adolescent youths living in urban areas, poorer mental health status is associated with increased substance use. Evidence of a moderating effect of gender on the relationship between mental health and substance use was not significant.

Keywords

Adolescent; drug use; gender; mental health; urban; moderate

1. Introduction

Alcohol and drug use among America's youth are associated with unintentional injuries, violent behavior, school failure, adulthood substance use disorders, chronic disease, unemployment, and incarceration (Bachman et al., 2008; Grant et al., 2004; Hingson, Heeren, Zakocs, Winter, & Wechsler, 2003; U.S. Department of Justice, 2006). The progression through adolescence into young adulthood is marked by increased substance use. By 12th grade, 44% of students report past-month alcohol consumption, a nearly threefold increase from 8th grade (Johnston, O'Malley, Bachman, & Schulenberg, 2008a). Monthly cigarette use increases from 7% to 21% during high school; nearly one in five 12th-graders report monthly marijuana use (Johnston et al., 2008a). Ethnic-racial differences are apparent in substance use rates (Simantov, Schoen, & Klein, 2000), with Black youths reporting lower rates of alcohol, cigarette, and illicit drug use than White and Latino youths (Johnston, O'Malley, Bachman, & Schulenberg, 2008b).

© 2009 Elsevier Ltd. All rights reserved.

*Corresponding author. Columbia University School of Social Work, 1255 Amsterdam Ave, New York, NY 10027, USA. Tel: +1 212 851 2280; fax +1 212 851 2283. tms40@columbia.edu (T. M. Schwinn).

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

Trends in gender differences in alcohol and substance use are mixed. In early and mid-adolescence, female substance use matches and in some instances exceeds substance use by males. By 12th grade, however, several gender differences emerge. Males outpace their female counterparts with respect to annual prevalence rates of certain illicit drug use (e.g., heroin, steroids, hallucinogens), daily marijuana and alcohol use, and frequency of binge drinking (Johnston et al., 2008b, 2008c). Past month alcohol use and annual rates of amphetamine use and illicit drugs other than marijuana are comparable between 12th grade males and females (Johnston et al., 2008b). Despite similar rates of substance use among males and females, the risk factors for using likely differ by gender (Fisher, Miles, Austin, Camargo, & Colditz, 2007; Silberg, Rutter, D'Onofrio, & Eaves, 2003). Mental health disorders comprise one such constellation of risk factors that may differentially affect substance use among boys and girls (Simantov et al., 2000). Accordingly, the influences of mental health and gender on adolescent substance use warrant additional consideration.

1.1. Mental health and substance use

The association between mental health problems and substance use is well established (Harris, & Edlund, 2005; Kessler et al., 1996). Adolescence, in particular, is a high risk period for the onset of mental health and substance use disorders (Rao, Daley, & Hammen, 2000). Consequently, teenage alcohol and drug use in these years are associated with depression (Brook, Brook, Zhang, Cohen, & Whiteman, 2002). Anxiety disorders, such as post-traumatic stress disorder, are also associated with increased use of marijuana and other illicit drugs among adolescents (Rey, Sawyer, Raphael, Patton, & Lynskey, 2001). Similarly, behavioral problems during adolescence, such as conduct disorder, are a leading risk factor for alcohol use and are predictive of drug use (Armstrong & Costello, 2002; Moss & Lynch, 2001).

Though evidence exists to support the association between mental health problems and substance use among adolescents, some research has failed to find such an association. For example several studies found no evidence to support the comorbidity of depression and marijuana use (Degenhardt, Hall Lynskey, 2003; Green & Ritter, 2000). Additional studies failed to find a relationship between increased internalizing symptoms (e.g., depression and anxiety) and increased drug (Curran, White, & Hansell, 2000) or alcohol use (Hussong, Curran, & Chassin, 1998). Measelle and colleagues (2006) contend that the relatively small relationship between substance use and such disorders as depression and anxiety is rendered non-significant when examined within the context of other risk factors.

Gender differences in psychiatric symptoms and diagnoses among adolescents are well documented (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). By age 14 years, females experience depression at two and three times the rate of males (Brooks, Harris, Thrall, & Woods, 2002; Wade, Cairney & Pevalin, 2002). One study found that nearly two-thirds of adolescents with an anxiety disorder were female (Lewinsohn, Gotlib, Lewinsohn, Seeley & Allen, 1998). During late adolescence and young adulthood, the gender gap in such externalizing behaviors as conduct disorder, delinquency, and aggression widens, with a male-to-female ratio greater than two to one (Moffitt, Caspi, Rutter, & Silva, 2001).

1.2. Mental health, substance use, and gender

The few studies that have examined whether gender moderates the relationship between mental health and substance use among adolescents show mixed results. Supporting the role of gender as a moderator are data linking depression and anxiety disorders to heavy smoking among adolescent girls, but not among adolescent boys (Acierno et al., 2000). Similarly, frequent marijuana use is associated with depression among adolescent girls but not among adolescent boys (Patton et al., 2002). In other data, elevated depression was related to increased marijuana

use for adolescent boys and girls, though depressed girls were additionally at risk for increased alcohol and cigarette consumption (Poulin, Hand, Boudreau, & Santor, 2005).

But, disruptive disorders have been linked to equivalent increases in substance use for both genders (Shrier, Harris, Kurland, & Knight, 2003). Other data with adolescents found no differences in the association between depression and cigarette smoking among adolescent boys and girls (Galambos, Leadbeater, & Barker, 2004). These data echo a longitudinal study finding no gender effect on the relationship between mental health and adolescent alcohol, marijuana, cigarette, or other illicit drug use (Brook, Cohen, & Brook, 1998). Finnish study data found that whereas girls experience more depression than boys, the strength of the association between depression and substance use did not differ by gender (Torikka, Kaltiala-Heino, Rimpelä, Rimpelä, & Rantanen, 2001). Finally, recent data indicated that anxiety, hostility, and depressive symptoms were similarly associated with increased smoking for boys and girls (Weiss, Palmer, Chuo, Mouttapa, & Johnson, 2008). With some exceptions, most studies on mental health, gender, and substance use focus principally on majority-culture early adolescents. In light of lower rates of alcohol and drug use by Black youths (Johnston et al., 2008b) and the inconcinnity of racial disparities for mental health indicators (Williams & Earl, 2007), study findings from majority culture samples may be limited in their generalizability.

Consequently, the present study engaged a sample of late adolescent minority youths to examine the relationship between mental health and substance use. Gender differences in mental health and substance use were examined, as were the potential moderating effects of gender on the mental health and substance use relationship. We hypothesized that substance use would not differ by gender, but that mental health would differ by gender. Further, in our urban minority sample we predicted that mental health and substance use would be related and that mental health would function as a correlate of substance use differentially for males and females.

2. Method

2.1. Participants

The sample consisted of 400 youths involved in an ongoing clinical trial of an alcohol abuse prevention program (Schinke, Schwinn, & Cole, 2006; Schinke, Schwinn, Di Noia, & Cole, 2004; Schinke, Schwinn, & Ozanian, 2005). Youths were recruited from 43 community-based agencies serving economically disadvantaged youth in greater New York City, Delaware, and New Jersey. These urban agencies were principally Police Athletic Leagues, Boys and Girls Clubs, and centers affiliated with and on the premises of public housing supported by the New York City Housing Authority. Census tract data, identified by agency street address and zip code, indicated that 30% – 100% of immediate neighborhood families were at or below the Federal poverty line (U.S. Census Bureau, 2000). Less than one-half (42%) of youths resided in two-parent homes. The majority of youths attended public school (90%) and 10% attended private school.

At recruitment, youths had a mean age of 11.5 years; the ethnic-racial composition of the initial sample was 54% Black, 30% Latino, 11% White, and 5% Other. Youths were eligible for study participation following receipt of their signed assent forms and their parents' signed consent forms. The research protocol was approved by the Columbia University Institutional Review Board. Following assent and consent procedures, youths were randomly assigned to control and intervention arms. Data reported in this paper are from the sixth-annual measure following initial intervention delivery.

Data from the sixth-annual measure include 400 (78%) of the initial sample of 513 youths. Of the 113 youths lost to follow-up, 35 failed to complete the sixth-annual measure during the

data collection window, 33 were unavailable due to nonworking contact information (telephone, e-mail, mailing address), 23 were removed from the sample due to contradictory response patterns, 19 requested to discontinue study participation, and 3 died.

2.2. Procedures

Annual survey data were collected primarily online. By mail, youths received the web address to a secure, password-protected site. After entering the website, youths were directed to the online survey. Participants without Internet access completed the survey online at our research facilities (10%) or by telephone (35%). To ensure their privacy, telephone respondents received a booklet containing only the answer choices to survey questions. Research assistants read aloud the questions and asked youths to respond with the letter corresponding to their answer.

2.3. Measures

2.3.1. Demographics—Youths reported their age, gender, ethnic-racial group, average letter grade during their most recent school attendance, living arrangement (with parents, roommate(s), spouse, other relative, alone), and whether they were currently enrolled in school (high school, college, General Educational Development program [GED], vocational training).

2.3.2. Alcohol and other substance use—Youths responded to questions adapted from the Youth Risk Behavior Survey (YRBS; Centers for Disease Control and Prevention, 2006) and Monitoring the Future (MTF; MTF Remote Access Service, 2007) on their use of alcohol, binge drinking (five or more drinks in a row), cigarettes, and marijuana. A summative variable, “other illicit drugs” was created to account for the low reported use of ecstasy, inhalants, methamphetamines, Rohypnol, steroids, and prescription drugs used recreationally. Drop-down menus allowed youths to specify the frequency of past 30-day use for each substance. Test-retest reliabilities for YRBS and MTF items are, respectively, 0.82 to 0.95 and 0.77 to 0.91 (Centers for Disease Control and Prevention, 2004; MTF Remote Access Service, 2007).

2.3.3. Mental health—Depression, anxiety, and hostility were measured with subscales from the Brief Symptom Inventory (BSI; Derogatis, 1993; Derogatis & Spencer, 1982). Indicative of the depression scale is, “In the past month, how often have you felt like you had little interest in things?” Indicative of the anxiety scale is, “In the past month, how often have you felt nervous or shaky on the inside?” Indicative of the hostility scale is, “In the past month, how often have you felt like you had the urge to beat, injure, or harm someone?” Response options for each 5-item subscale ranged from “Not at all” (0) “All the time” (4). Internal consistency scores for the depression, anxiety, and hostility subscales are $\alpha = 0.85, 0.81, \text{ and } 0.78$, respectively (Derogatis & Melisaratos, 1983).

2.4. Data analysis

Because reported rates of substance use from the sixth-annual measure were positively skewed (46% of youths reported no past-month substance use), analyses were conducted with natural-log transformations of past-month use. Initial analyses involving one-way ANOVA assessed gender differences in mental health (depression, anxiety, and hostility) and substance use (30-day use of alcohol, cigarettes, marijuana, and other illicit drugs, and binge drinking); Pearson correlations tested the association between mental health and substance use. Multiple regression models provided 1) additional tests of gender differences in mental health and substance use controlling for age, ethnic-racial group, assignment to study arm, academic performance, living arrangement, and enrollment in school; and 2) tests of the association between mental health and substance use in the presence of the aforementioned controls and including gender. To determine whether gender moderated the relationship between mental

health and substance use, interaction terms between gender and each of depression, anxiety, and hostility were included in multivariate regression models for each dependent substance use variable.

To further assess the relationship between mental health and substance use, multivariate logistic regression models compared monthly *users* to *non-users* (none = 0; and 1 or more = 1) and monthly *non/light users* to *regular users* (none or 1 = 0; and 2 or more = 1). Additional multivariate regression models also assessed the relationship between mental health and past-month substance use as a categorical variable (*none* = 0; and *1, 2, 3* = 1; and *4 or more* = 2). Findings from binary and categorical treatment of the dependent variables were similar to those yielded by the treatment of the dependent variables in its original and continuous form. Therefore, results presented are from analyses of the continuous dependent variables.

3. Results

3.1. Demographics

The participant sample of 400 urban youths included 216 females (54%) and 184 males (Table 1). The average age was 17.3 years ($SD = 1.11$) with a range of 15 to 20 years. Most youths were Black (52%), 28% were Latino, 9% were White, and 11% were from other ethnic-racial groups. Most youths (69%) were enrolled in high school, 18% were in college, and 13% were out of school. The majority of participants lived at home with their parents; approximately 20% of the sample lived alone, with a roommate, spouse, or other relative.

3.2. Gender differences in mental health and substance use

Initial ANOVA analyses of gender differences in mental health and substance use are seen in Table 2. For past-month use of alcohol, marijuana, cigarettes, and other illicit drugs, males and females in the sample reported similar rates. Depression and anxiety scores were higher for females than for males. Hostility scores were similar for both genders. Controlling for age, ethnic-racial group, academic performance, assignment to study arm, living arrangement, and enrollment in school, symptoms of depression ($\beta = 1.68, p < .001$) and anxiety ($\beta = 1.98, p < .001$) remained higher for females than males.

3.3. Mental health and substance use

Across the sample, simple Pearson correlations revealed that hostility was positively associated with the five measured substance use variables (alcohol, cigarettes, marijuana, other illicit drug use, and binge drinking). Anxiety and depression were positively correlated with alcohol and cigarette use; depression was also correlated with marijuana use. By gender, however, the pattern of correlation differs (Table 3). Among males, hostility correlated to alcohol and other illicit drug use and binge drinking; among females, hostility was only associated with marijuana use. Depression scores correlated to males' alcohol use and binge drinking but were not correlated to any female substance use. Anxiety scores did not correlate to male or female substance use.

Controlling for age, ethnic-racial group, academic performance, assignment to study arm, living arrangement, enrollment in school, and gender, higher levels of depression predicted past-month drinking ($\beta = .029, p < .01$), binge drinking ($\beta = .014, p < .05$), and marijuana use ($\beta = .029, p < .05$; Table 4). Greater levels of anxiety predicted past-month drinking ($\beta = .023, p < .05$) and cigarette use ($\beta = 0.028, p < .05$). Higher levels of hostility predicted past-month drinking ($\beta = .026, p < .01$), binge drinking ($\beta = .018, p < .01$), cigarette use ($\beta = .025, p < .05$), marijuana use ($\beta = .032, p < .01$), and other illicit drug use ($\beta = .007, p < .05$).

3.4. Moderating effects of gender

Using the aforementioned controls, three regression models for each dependent substance use variable respectively included a gender $\times$ depression, gender $\times$ anxiety, and gender $\times$ hostility term. These models failed to reveal moderating effects of gender on the relationship between mental health and past-month drinking, binge drinking, cigarette smoking, marijuana use, or other past-month illicit substance use.

4. Discussion

Among our sample of late adolescent urban youths, and as hypothesized, rates of alcohol, cigarette, marijuana, and other illicit drug use did not differ by gender. This finding is consistent with recent data suggesting that gender differences in use are disappearing (Johnston et al., 2008b). Gender differences, however, were evident in two of the three measured mental health variables in our data. Compared to males, females reported higher levels of depression and anxiety. Surprisingly, and contrary to our hypothesis, females reported levels of hostility similar to boys' levels of hostility. Across genders, increased levels of depression, anxiety, and hostility predicted increased substance use as hypothesized. Each 1 point increase in depression, anxiety, and hostility scores, ranging from 0 – 20, was associated with approximately a 1% to 3% increase in past-month substance use. Though all three mental health indices (depression, anxiety, and hostility) predicted use of more than one substance, hostility scores were associated with all measured substances (alcohol, binge drinking, cigarettes, marijuana, other illicit drugs). In light of the relatedness of our mental health indices, however, these data likely suggest that mental distress, depressive, anxious, or hostile in nature, may be associated with increased substance use. Finally, and also contrary to our hypothesis, the data failed to provide evidence that gender moderated the relationship between the mental health indices and past-month substance use.

Our findings support and add to the literature on mental health and substance use among late adolescents. That mental health and substance use were related is consistent with previous studies using various populations, settings, and methods (Brook et al., 2002; Harris & Edlund, 2005; Rey et al., 2001). Much of that existing literature, however, draws conclusions from majority-culture youths in academic settings (middle school, high school, or college). Our non-clinical sample of urban youths included not only those in high school, vocational training, and college, but also youths no longer attending school. Controlling for school attendance is important in studies examining adolescent substance use because out-of-school youths have higher rates of use than youths attending school (Wallace et al., 2003). Studies lacking this control may poorly estimate substance use, yield confounded findings on the relationship between predictors and substance use, and be limited in their representativeness to the general population of adolescents.

Few studies have examined the moderating role of gender when assessing the associations between mental health and substance use (Poulin et al., 2005). Among the nine studies reviewed earlier that examine gender differences between mental health and substance use, only two performed moderational analyses (Galambos et al., 2004; Patton et al., 2002). Unlike study analyses that stratify by gender and determine whether mental health variables are associated with substance use for males and females separately, we included gender by mental health interaction terms to determine whether the relationship of poorer mental health and increased substance use operated differently for males and females.

Several limitations of the study deserve attention. All data were self-report. Notwithstanding our analytic controls of age, ethnic-racial group, assignment to study arm, academic achievement, living arrangement, and enrollment in school, the cross-sectional study design precludes any causal inference. We cannot infer whether poorer mental health leads to

substance use or vice versa. Furthermore, the absence of a moderating effect of gender on the relationship between mental health and substance use should be cautiously viewed as our inability to reject the null hypothesis, perhaps due to lack of power, rather than as conclusive evidence that no such moderating effect exists.

Additional research, with larger samples of late adolescent urban youth and more sensitive measures of mental health disorders, is warranted in three areas to determine: 1) whether gender moderates the relationship between mental health and substance use among adolescents, 2) which shared risk factors explain the relationship between mental health and substance abuse, 3) and whether certain mental health disorders uniquely predispose adolescents to choose certain drugs. Perhaps the data reported here will stimulate this future work.

References

- Acierno R, Kilpatrick DG, Resnick H, Saunders B, De Arellano M, Best C. Assault, PTSD, family substance use, and depression as risk factors for cigarette use in youth: Findings from the National Survey of Adolescents. *Journal of Traumatic Stress* 2000;13:381–396. [PubMed: 10948480]
- Armstrong TD, Costello EJ. Community studies on adolescent substance use, abuse, or dependence and psychiatric comorbidity. *Journal of Consulting and Clinical Psychology* 2002;70:1224–1239. [PubMed: 12472299]
- Bachman, JG.; O'Malley, PM.; Schulenberg, JE.; Johnston, LD.; Freedman-Doan, P.; Messersmith, EE. The education-drug use connection: How successes and failures in school relate to adolescent smoking, drinking, drug use, and delinquency. New York: Lawrence Erlbaum Associates/Taylor & Francis; 2008.
- Brook DW, Brook JS, Zhang C, Cohen P, Whiteman M. Drug use and the risk of major depressive disorder, alcohol dependence, and substance use disorders. *Archives of General Psychiatry* 2002;59:1039–1044. [PubMed: 12418937]
- Brook JS, Cohen P, Brook DW. Longitudinal study of co-occurring psychiatric disorders and substance use. *Journal of the American Academy of Child and Adolescent Psychiatry* 1998;37:322–330. [PubMed: 9519638]
- Brooks TL, Harris SK, Thrall JS, Woods ER. Association of adolescent risk behaviors with mental health symptoms in high school students. *Journal of Adolescent Health* 2002;31:240–246. [PubMed: 12225736]
- Centers for Disease Control and Prevention. YRBSS: Youth Risk Behavior Surveillance System. 2006 [Retrieved November 20, 2008]. from <http://www.cdc.gov/nccdphp/dash/yrbs/index.htm>
- Centers for Disease Control and Prevention. Methodology of the Youth Risk Behavior Surveillance System. *Morbidity and Mortality Weekly Report*. 2004 53(RR12):1–13. from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5312a1.htm>
- Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry* 2003;60:837–844. [PubMed: 12912767]
- Curran GM, White HR, Hansell S. Personality, environment, and problem drug use. *Journal of Drug Issues* 2000;30:375–406.
- Degenhardt L, Hall W, Lynskey. Exploring the association between cannabis use and depression. *Addiction* 2003;98:1493–1504. [PubMed: 14616175]
- Derogatis, LR. Brief Symptom Inventory: Administration, scoring, and procedures manual—II. Minneapolis, MN: National Computer Systems; 1993.
- Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychological Medicine* 1983;13:595–605. [PubMed: 6622612]
- Derogatis, LR.; Spencer, PM. Brief Symptom Inventory: Administration, scoring, and procedures manual—I. Baltimore: Clinical Psychometric Research; 1982.
- Fisher LB, Miles IW, Austin B, Camargo CA, Colditz GA. Predictors of initiation of alcohol use among US adolescents. *Archives of Pediatrics and Adolescent Medicine* 2007;161:959–966. [PubMed: 17909139]

- Galambos NL, Leadbeater BJ, Barker ET. Gender differences in and risk factors for depression in adolescence: A 4-year longitudinal study. *International Journal of Behavioral Development* 2004;28:16–25.
- Gelman, A.; Hill, J. Data analysis using regression and multilevel/hierarchical models. Cambridge: Cambridge University Press; 2006.
- Green BE, Ritter C. Marijuana use and depression. *Journal of Health Social Behavior* 2000;41:40–49.
- Grant BF, Dawson DA, Stinson FS, Chou SP, Dufour MC, Pickering RP. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991–1992 and 2001–2002. *Drug and Alcohol Dependence* 2004;74:223–234. [PubMed: 15194200]
- Harris KM, Edlund MJ. Self-medication of mental health problems: New evidence from a national survey. *Health Services Research* 2005;40:117–134. [PubMed: 15663705]
- Hingson R, Heeren T, Zakocs R, Winter M, Wechsler H. Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. *Journal of Studies on Alcohol* 2003;64:23–31. [PubMed: 12608480]
- Hussong A, Curran P, Chassin L. Pathways of risk for accelerated heavy alcohol use among adolescent children of alcoholic parents. *Journal of Abnormal Child Psychology* 1998;26:453–466. [PubMed: 9915652]
- Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national results on adolescent drug use: Overview of key findings, 2007. Bethesda, MD: National Institute on Drug Abuse; 2008a. p. 70(NIH Publication No. 08-6418)
- Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Demographic subgroup trends for various licit and illicit drugs, 1975–2007. Ann Arbor, MI: Institute for Social Research; 2008b. p. 416 (Monitoring the Future Occasional Paper No. 69).
- Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975–2007. Volume II: College students and adults ages 19–45. Bethesda, MD: National Institute on Drug Abuse; 2008c. p. 319(NIH Publication No. 08-6418B)
- Kessler RC, Nelson CB, McGonagle KA, Edlund MJ, Frank RG, Leaf PJ. The epidemiology of co-occurring addictive and mental disorders: Implications for prevention and service utilization. *American Journal of Orthopsychiatry* 1996;50:36–43.
- Lewinsohn PM, Gotlib IH, Lewinsohn M, Seeley JR, Allen NB. Gender differences in anxiety disorders and anxiety symptoms in adolescents. *Journal of Abnormal Psychology* 1998;107:109–117. [PubMed: 9505043]
- Measelle J, Stice E, Springer D. A prospective test of the negative affect model of substance use and abuse: Moderating effects of social support. *Psychology of Addictive Behaviors* 2006;20:225–233. [PubMed: 16938060]
- Moffitt, TE.; Caspi, A.; Rutter, M.; Silva, PA. Sex differences in antisocial behavior: Conduct disorder, delinquency, and violence in the Dunedin Longitudinal Study. Cambridge, England: Cambridge University Press; 2001.
- Monitoring the Future Remote Access Service. RAS dataset documentation. 2007 [Retrieved November 20, 2008]. from <http://www.src.isr.umich.edu/src/mtfrs/>
- Moss HB, Lynch KG. Comorbid disruptive behavior disorder symptoms and their relationship to adolescent alcohol use disorders. *Drug and Alcohol Dependence* 2001;64:75–83. [PubMed: 11470343]
- Patton GC, Coffey C, Carlin JB, Degenhardt L, Lynskey M, Hall W. Cannabis use and mental health in young people: Cohort study. *British Medical Journal* 2002;325:1195–1198. [PubMed: 12446533]
- Poulin C, Hand D, Boudreau B, Santor D. Gender differences in the association between substance use and elevated depressive symptoms in a general adolescent population. *Addiction* 2005;100:525–535. [PubMed: 15784067]
- Rao U, Daley SE, Hammen C. Relationship between depression and substance use disorders in adolescent women during transition to adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry* 2000;39:215–222. [PubMed: 10673833]
- Rey JM, Sawyer MG, Raphael B, Patton GC, Lynskey M. The mental health of teenagers who use marijuana. *British Journal of Psychiatry* 2001;180:216–221. [PubMed: 11872513]

- Schinke SP, Schwinn TM, Cole KC. Preventing alcohol abuse among early adolescents through family and computer-based interventions: Four-year outcomes and mediating variables. *Journal of Developmental and Physical Disabilities* 2006;18:149–161. [PubMed: 17215960]
- Schinke SP, Schwinn TM, Di Noia J, Cole KC. Reducing the risks of alcohol use among urban youth: 3-year effects of computer-based and parent involvement interventions. *Journal of Alcohol Studies* 2004;65:443–449.
- Schinke SP, Schwinn TM, Ozanian AJ. Alcohol abuse prevention among high-risk youth via computer-based intervention. *Journal of Prevention and Intervention in the Community* 2005;29:117–130. [PubMed: 16804562]
- Shrier LA, Harris SK, Kurland M, Knight JR. Substance use problems and associated psychiatric symptoms among adolescents in primary care. *Pediatrics* 2003;111:699–705.
- Silberg J, Rutter M, D'Onofrio B, Eaves L. Genetic and environmental risk factors in adolescent substance use. *Journal of Child Psychology and Psychiatry* 2003;44:664–676. [PubMed: 12831111]
- Simantov ES, Schoen C, Klein JD. Health-compromising behaviors: Why do adolescents smoke or drink? *Archives of Pediatric Medicine* 2000;154:1025–1033.
- Torikka A, Kaltiala-Heino R, Rimpelä A, Rimpelä M, Rantanen P. Depression, drinking, and substance abuse among 14- to 16-year-old Finnish adolescents. *Nordic Journal of Psychiatry* 2001;55:351–357. [PubMed: 11839127]
- U.S. Census Bureau. American FactFinder. 2000 [Retrieved May 29, 2009]. from, http://factfinder.census.gov/servlet/AGSGeoAddressServlet?_lang=en&_programYear=50&_treeId=420
- U.S. Department of Justice. National drug threat assessment 2006. McLean, VA: National Drug Intelligence Center; 2006 [Retrieved October 21, 2008]. (Publication No. 2006-Q0317-001). from <http://www.usdoj.gov/ndic/pubs11/18862/18862p.pdf>
- Wade TJ, Cairney J, Pevalin DJ. Emergence of gender differences in depression during adolescence: National panel results from three countries. *Journal of the American Academy of Child and Adolescent Psychiatry* 2002;41:190–198. [PubMed: 11837409]
- Wallace JM, Bachman JG, O'Malley PM, Schulenberg JE, Cooper SM, Johnston LD. Gender and ethnic differences in smoking, drinking, and illicit drug use among 8th, 10th, and 12th grade students, 1976–2000. *Addiction* 2003;98:225–234. [PubMed: 12534428]
- Weiss JW, Palmer PH, Chuo C, Mouttapa M, Johnson CA. Association between psychological factors and adolescent smoking in seven cities in China. *International Journal of Behavioral Medicine* 2008;15:149–156. [PubMed: 18569133]
- Williams DR, Earl TR. Commentary: Race and mental health – more questions than answers. *International Journal of Epidemiology* 2007;36:758–760. [PubMed: 17566003]

Table 1Sample Characteristics ($N = 400$)

Variable	%	<i>M</i>	(<i>SD</i>)
Age		17.30	(1.11)
Gender			
Female	54%		
Ethnic-racial group			
Black	52%		
Latino	28%		
White	9%		
Other	11%		
Education status			
High school (includes vocational and GED)	69%		
College (Junior and four-year)	18%		
Not in school	13%		
Average letter grade (1 = A; 5 = F)		2.40	(0.75)
Living arrangement			
With parents	82%		
Alone, roommate, spouse, or relative	18%		

Note. GED = General Educational Development.

Table 2
Mean Gender Differences in Mental Health and Substance Use ($N = 400$)

Variable	Female		Male		Sample	
	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)
30-day substance use [†]						
Alcohol	1.97	(3.26)	2.02	(4.26)	1.99	(3.75)
Binge drinking	0.53	(1.37)	0.87	(3.19)	0.69	(2.39)
Cigarettes	4.54	(15.29)	3.11	(13.35)	3.88	(14.43)
Marijuana	3.50	(13.14)	3.67	(12.86)	3.58	(13.00)
Other illicit drugs	0.29	(2.35)	0.07	(0.79)	0.19	(1.81)
Mental Health Indices [‡]						
Depression	5.27 _a	(3.97)	3.69 _a	(3.77)	4.56	(3.95)
Anxiety	5.55 _a	(4.26)	3.71 _a	(3.63)	4.72	(4.08)
Hostility	6.15	(4.26)	5.48	(4.33)	5.85	(4.30)

[†]Note: Number of "times" in the last 30 days a substance was used.

[‡]Measured with Brief Symptom Inventory (Derogatis, 1993), scores ranged from 0 – 20; lower scores correspond to lower symptomatology.

Means within rows that share the same subscript differ at $p < .001$.

Table 3
Pearson Correlations between Mental Health Indices and Past-Month Substance Use by Gender

	Depression		Anxiety		Hostility	
	Male	Female	Male	Female	Male	Female
Alcohol	.20*	.00	.12	.02	.20*	.07
Binge drinking	.15*	.01	.10	-.02	.19*	.09
Cigarettes	.02	.01	.07	.03	.12	-.02
Marijuana	.09	.03	-.01	.08	.09	.15*
Other illicit use	.04	.04	.15	-.07	.16*	.02

* $p < .05$.

Table 4
Logarithmic Regression Models Predicting Past-Month Substance Use from Mental Health Indices

Variable	Drinking		Binge Drinking		Cigarettes		Marijuana		Other Illicit Drugs	
	β	(SE)	β	(SE)	β	(SE)	β	(SE)	β	(SE)
Model 1 Depression	.029**	(.010)	.014*	(.007)	.020	(.012)	.029*	(.013)	.006	(.004)
Model 2 Anxiety	.023*	(.010)	.009	(.007)	.028*	(.012)	.015	(.013)	.002	(.004)
Model 3 Hostility	.026**	(.009)	.018**	(.006)	.025*	(.011)	.032**	(.012)	.007*	(.003)

Note. N = 400.
^a Adjusted for age, ethnic-racial group, academic performance, assignment to study arm, living arrangement, enrollment in school, and gender.
* p < .05.
** p < .01.