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Adolescent Emotional Pathology and Lifetime History of Alcohol or Drug Use with and without Comorbid Tobacco Use

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Abstract

OBJECTIVE—Use of drugs and alcohol, including tobacco, is linked to adolescent emotional psychopathology. Given that tobacco use is becoming less common over recent years, its co-use with drugs/alcohol may mark a more severe profile of emotional symptomatology. However, it is unclear whether teens with a lifetime history of using drugs/alcohol and tobacco exhibit additional elevations in emotional psychopathology and/or multiple forms of emotional psychopathology compared to teens with lifetime drugs/alcohol use without comorbid tobacco use. This cross-sectional study compared emotional disorder symptoms and emotional vulnerability traits among adolescents with varying histories of substance use.

METHODS—Ninth-grade students enrolled at two schools in Los Angeles, CA were recruited; 575 met eligibility criteria and provided both student assent and parental consent. Students completed self-report measures of emotional pathology, trans-diagnostic, and lifetime substance use. Participants were classified into three groupings: (1) no history of substance use (n=294); (2) lifetime history of drug/alcohol use without tobacco use (n=166); and (3) lifetime history of drug/alcohol use with concomitant tobacco use (n=115).

RESULTS—Of those with a history of substance use, teens with lifetime alcohol/drug use with (vs. without) comorbid tobacco use were more likely to have used substances. Compared to students with no history of substance use, those with any history of use (alcohol/drugs with and without tobacco use) had higher major depression symptoms and negative affect; those with lifetime alcohol/drug use *with* comorbid tobacco use had higher generalized anxiety symptoms and distress; those with lifetime alcohol/drug use *without* comorbid tobacco use had higher panic

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disorder symptoms and anhedonia. There were no significant differences between adolescents with lifetime drug/alcohol use with comorbid tobacco use versus those without tobacco use.

CONCLUSIONS—Adolescents with (vs. without) a lifetime history of drug/alcohol use endorse greater emotional symptomatology and trait vulnerabilities, regardless of comorbid lifetime tobacco use. Thus, the extent to which tobacco serves as a gateway, correlate, consequence of other substance use may have little bearing on adolescent emotional health. This study's findings further suggest that emotional vulnerability (in addition to manifest psychopathology) should be considered in adolescent substance use and mental illness prevention.

Keywords

Adolescents; Comorbidity; Tobacco; alcohol; drugs; Psychopathology; Trans-diagnostic

Epidemiologic and clinical studies have shown associations between various forms of substance use and emotional (i.e., mood and/or anxiety) psychopathology that begins in adolescence (Frojd, Ranta, Kaltiala-Heino, & Marttunen, 2011). There is also evidence that trans-diagnostic emotional vulnerability factors (outside of manifest psychopathologic symptoms per se) that may give rise to several emotional syndromes spanning multiple mood and anxiety disorders (Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014) may also play a role in substance use (Leventhal & Zvolensky, 2015). Given the pervasive comorbidity of multiple depressive and anxiety syndromes with substance use (Wolitzky-Taylor, Bobova, Zinbarg, Mineka, & Craske, 2012), it is possible that adolescent substance use may relate with these trans-diagnostic vulnerability traits (Audrain-McGovern et al., 2012; Daughters et al., 2009).

Three trans-diagnostic factors may be particularly pertinent to both emotional pathology and substance use (Leventhal & Zvolensky, 2015). Distress tolerance—the ability to tolerate affective and physical distress (Leyro, Zvolensky, & Bernstein, 2010)—is inversely associated with both depressive and anxiety disorder as well as higher levels of substance use, putatively due to distress intolerant individuals' propensity to terminate distress via mood-altering effects of substances (Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007). Anhedonia—the tendency to experience reduced pleasure in response to rewards (Leventhal, Chasson, Tapia, Miller, & Pettit, 2006)—is implicated in the development of depression (Stein, 2008) and anxiety (Wolitzky-Taylor, et al., 2012), and is positively related to substance dependence (Janiri et al., 2005), potentially because individuals with anhedonia may seek out substances as a means of counteracting deficient pleasure. Anxiety sensitivity —the fear that anxiety symptoms lead to harmful consequences (Reiss, Peterson, Gursky, & McNally, 1986)—is a robust risk factor for anxiety disorders (Barlow, et al., 2014) and has been associated with substance use (Novak, Burgess, Clark, Zvolensky, & Brown, 2003), perhaps due to the motivation to use substances to offset the experiences of anxiety-related sensations. In addition to these three vulnerabilities, general positive and negative affectivity are associated with substance use among adolescents (Wills, Sandy, Shinar, & Yaeger, 1999).

A few extant studies in the substance use literature have looked at these vulnerability factors in adolescents. Evidence is mixed, with some data suggesting poorer distress tolerance,

anhedonia, and anxiety sensitivity relate to some forms of substance use in adolescents (Audrain-McGovern, et al., 2012; Daughters, et al., 2009; Wolitzky-Taylor et al., 2015), and others not showing this association (Lammers, Kuntsche, Engels, Wiers, & Kleinjan, 2013). Most of these studies generally focused on a single substance (e.g., alcohol; Lammers, et al., 2013; Wolitzky-Taylor, et al., 2015), leaving unclear whether these vulnerabilities implicate use of any type of the broad array of harmful licit and illicit substances of abuse. Furthermore, there has yet to be a study that examines all three factors along with multiple emotional psychopathology domains within the same sample to permit comparison across these vulnerabilities and pathologies in terms of their relative association with adolescent substance use. The dearth of data on the role of these factors in adolescent substance use may reflect a barrier toward developing prevention programs that target these underlying vulnerabilities and perhaps prevent both mental illness and substance use disorder.

Another gap in the adolescent emotion-substance comorbidity literature is the limited attention to the role of comorbid tobacco use among alcohol and drug users with regards to emotional psychopathology. Sometimes referred to as the “gateway hypothesis,” initiation of tobacco use may increase risk of alcohol and drug use (Brook, Brook, Zhang, Cohen, & Whiteman, 2002). However, tobacco may no longer be a principal gateway to other substance use. Indeed, over the past twenty years, the prevalence of tobacco use among teens has reduced considerably (Johnston, O'Malley, Bachman, & Schulenberg, 2015) and the proportion of U.S. 10^{th} graders in 2014 who reported perceived harm from regular/heavy cigarette smoking (72%) was greater than perceived harm for alcohol (54%) and marijuana (45%; Johnston, et al., 2015), which diverges from data collected 23 years ago (perceived harm for cigarettes was 60% vs. 82% for marijuana). Given that today's adolescents who use combustible tobacco do not cohere with norms that tobacco smoking is harmful, and that deviant behavior is associated with emotional problems (Albers & Biener, 2002), one might expect substance using teens with comorbid tobacco and other substance use to have greater emotional pathology than substance-using teens who do not use tobacco. However, this prediction has received little empirical attention in the current context in which combustible tobacco is becoming denormalized and marijuana and other drugs are becoming normalized in teens (Haines-Saah, 2014). Thus, an important question is whether adolescents who use drugs or alcohol differ with regards to emotional psychopathology depending on whether they might have also used tobacco (either as a tobacco-related “gateway” to their alcohol/drug use, or perhaps concurrent or after alcohol/drug use). Given that the larger population of low-risk teens with fewer emotional problems may be less apt to experiment with tobacco because of perceived harm, teens with more severe emotional pathology may be more likely to initiate tobacco use, even in the population of teens who have used other substances, some of which may be perceived to be less risky than tobacco (e.g., marijuana, alcohol).

The current cross-sectional study is an analysis of data from a survey on emotion and health behavior, which compared emotional disorder symptoms and trans-diagnostic vulnerabilities among 14 to 16 year-old adolescents with: (1) no history of any substance use; (2) a lifetime history of drug/alcohol use without lifetime tobacco use; and (3) a lifetime history of drug/alcohol use with concomitant tobacco use. We hypothesized that adolescents with a lifetime history of alcohol/drug use would report more emotional pathology and vulnerability across

all outcomes than those who had never used and alcohol/drug users with a lifetime history of comorbid tobacco use.

Methods

Participants and Procedure

All 9th graders not enrolled in English as a second language or special education program (e.g., severe learning/developmental disorder) at two partnering schools in the Los Angeles Area were invited to participate in a study of emotion and health (*N*=807). The schools were selected based on convenience sampling due to their proximity to the institution and adequate representation of diverse demographic characteristics (see Table 1), with 14% and 29% of students in each respective school being eligible for free lunch (i.e., parents' income is 185% of the national poverty level). After a full explanation of the nature of the study, risk and benefits, and that responses were confidential and would not be shared with school administration, students were offered the opportunity to assent to participate. Assenting students were given an informed consent form detailing the nature of the study, risk and benefits, and confidentiality to take home to their parents to review and provide written consent or decline consent for their child to participate. The parents of students who did not return signed consent forms within two weeks were called via phone, informed about the study nature, risk, benefits, and confidential and then given the option to provide verbal consent. Data collectors administered paper-and-pencil surveys, including the measures described below, in compulsory classes and stressed the confidentiality of student responses.

Of the 689 students who provided written assent to participate (85% of those approached), 585 (82%) provided active written or verbal parental consent and completed the study surveys. Students who reported a history of tobacco use but no history of alcohol or other drug use were excluded (n=10) from the final sample in this report (final sample *N*=575);. The University of Southern California Institutional Review Board approved the study, which was conducted in accordance with the Declaration of Helsinki.

Measures

Revised Children's Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000)—The RCADS provides symptom composite indices for separate emotional disorders based on the respondent's report of the frequency of Diagnostic Statistical Manual of Mental Disorders-IV (DSM) based symptoms for that particular emotional disorder on a four-point scale (range: 0-3). Within each subscale, the average symptom frequency score per item was calculated with higher scores indicating greater symptomatology. The subscales administered in this study showed acceptable internal consistency in this sample (α for generalized anxiety disorder, major depression, panic disorder, and social phobia = 0.87, 0.91, 0.87, and 0.90, respectively) and adequate convergent validity with clinician DSM-based diagnoses (Chorpita, Moffitt, & Gray, 2005).

Mood Questionnaire (MQ; Diener & Emmons, 1984)—Participants rated 9 affect adjectives (e.g., "happy," "frustrated," "worried/anxious") based on how they were currently feeling using a seven-point scale (range: 1-7). Responses load onto either positive (α=.90)

and negative (α=.84) affect subscales based on the average score per item and have shown adequate psychometric properties in a prior study with adolescents (Frank, Bose, & Schrobenhauser-Clonan, 2014).

Distress Tolerance Scale (DTS; Simons & Gaher, 2005)—The DTS is a 14-item scale that measures an individual's ability to tolerate affective and physical distress (e.g., “I'll do anything to avoid feeling distressed or upset”). Participants responded to statements regarding distress response using a five-point scale (range: 1-5). Average score per item was calculated with higher scores being indicative of higher levels of distress tolerance (α=0.88). The DTS has demonstrated acceptable psychometric properties in prior work with adolescents (Wolitzky-Taylor, et al., 2015).

Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991)

The CASI is an 18-item measure of subjective fear of anxiety-related sensations and consequences (e.g., “It scares me when my heart beats fast”) based on a three-point scale (1-3) and average score per item per item was calculated (α=0.85). The CASI has demonstrated adequate convergent validity in prior work (Muris, Schmidt, Merckelbach, & Schouten, 2001).

Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995)—Participants responded to 14 self-statements regarding pleasure response to common pleasant experiences that span the areas of food, sensory, hobbies, and social events (e.g., “I would enjoy seeing others’ smiling faces”) on a four point scale (range: 1-4). Average score per item per item was calculated with higher scores being indicative of higher levels of anhedonia (α=0.87). The SHAPS has demonstrated good convergent validity with depressive symptoms in adolescents (Audrain-McGovern, et al., 2012).

Substance Use (Eaton et al., 2010)—Lifetime use was measured with items derived from the Youth Behavior Risk Surveillance Survey (Eaton, et al., 2010) that assessed individual substances separately. Three tobacco items were surveyed, including cigarettes described as a “A whole cigarette (Marlboro, Newport, Camel, etc),” “Smokeless tobacco (dip chew or snuff such as Redman, Skoal, Beechnut, or dissolvables),” and “Other forms of tobacco (cigars, cigarillos, e-cigarettes, or flavored tobacco). An affirmative response to any of the three items was classified as lifetime tobacco use. We also included items measuring alcohol described as “one full drink of alcohol, such as a can of beer, glass of wine, wine cooler, or shot of liquor,” and 16 other drugs (e.g., “marijuana [pot, weed, grass, hash, bud, reefer]”). An affirmative response to any of the 17 non-tobacco substance items was classified as other lifetime substance use.

Data Analysis

The following groups were formed based on responses to the substance use questions: no lifetime use of any substance (n=294), lifetime use of alcohol or drugs but no tobacco use (n=116), lifetime use of alcohol or drugs as well as tobacco (n=115). The primary analyses involved ANOVA for unbalanced cell size based on the general linear model in which substance use group was the independent variable, and a single emotional characteristic was

the outcome variable. We also ran ANCOVAs that adjusted for self-reported ethnicity, gender, age, and highest parental education between the two parents. Post-hoc pairwise tests were then used to test pairwise differences in outcomes. Significance was set to .05 and all tests were two-tailed. Sample sizes vary across analyses due to sporadic missing data on certain outcomes because some students were unable to complete all measures within the time allotted (see table notes).

Results

Participants were 51% male (n = 293) and 49% female (n = 282), with a mean age of 14.5 years (SD = 0.5 years). Over 50% of the participants were Hispanic or Latino (n=289) and the majority of the students had parents with at least a high school education or the equivalent (n=459). More details regarding sociodemographic and other characteristics, by group, are reported in Table 1.

Lifetime use of specific substances within each of the two substance using groups is reported in Table 2, and shows that teens with lifetime alcohol/drug use with (vs. without) comorbid tobacco use were more likely to have used 10 of the substances assessed (out of a total of 16). This included alcohol (90.4% vs. 80.7%, $\chi^2(1) = 4.94$, $p < .05$), marijuana(76.5% vs. 34.3%, $\chi^2(1) = 48.41$, $p < .001$), and heroin (4.3% vs. 0.0%, $\chi^2(1) = 7.35$, $p < .01$), as well as a variety of other licit and illicit drugs.

Results from ANVOAs showed significant omnibus group differences in generalized anxiety ($p < .01$), major depression ($p < .001$), and panic disorder symptoms ($p < .05$), as well as negative affect ($p < .001$), distress tolerance ($p < .05$), and anhedonia ($p < .05$). Pairwise analyses showed that in comparison to non-users, lifetime substance users without comorbid tobacco use reported higher levels of major depression (Cohen's $d = 0.32$, $p < .01$), panic disorder ($d = 0.27$, $p < .05$), negative affect ($d = 0.30$, $p < .01$), and anhedonia ($d = 0.28$, $p < .05$). Adolescent lifetime drug/alcohol users who also had used tobacco, compared to those with no lifetime substance use, reported higher generalized anxiety ($d = 0.31$, $p < .05$), major depression ($d = 0.44$, $p < .001$), negative affect ($d = 0.34$, $p < .01$), and distress tolerance ($d = 0.28$, $p < .05$). There were no significant pairwise differences between lifetime alcohol/drug use with (vs. without) comorbid lifetime tobacco use for any of the outcomes. Most of the above effects remained statistically significant in ANCOVAs that adjusted for demographics. The omnibus and/or pairwise comparisons for generalized anxiety and panic disorder were reduced to trends, not significant effects (ps .05 to .07; results not shown).

Discussion

This study provides a comprehensive analysis of multiple emotional psychopathologies and trans-diagnostic vulnerability factors in a sample of early adolescents. Teens with a history of alcohol or drug use reported a qualitatively unique pattern of emotional disturbance elevations whereby some, but not all, factors were elevated. In our sample, consistent with prior research, lifetime alcohol/drug use was associated with depression (Brook, et al., 2002), panic disorder (Zimmermann et al., 2003), generalized anxiety (Frojd, et al., 2011), negative affect (Wills, et al., 1999), poorer distress tolerance (Daughters, et al., 2009), and

anhedonia (Janiri, et al., 2005); although after adjusting for demographics, associations with panic disorder and generalized anxiety were reduced to tends (*p*s=.05-.07).

By contrast, positive affect, anxiety sensitivity, and social phobia were not associated with drug/alcohol use history in this sample. Prior research examining the association between anxiety sensitivity and adolescent alcohol use has produced results that were inconsistent with our study's findings (Lammers, et al., 2013). Here, anxiety sensitivity was not associated with a broad index of substance use status that amalgamated any use of a variety of licit or illicit substances, suggesting future work exploring substance-specificity in anxiety sensitivity's role in teen substance use may be warranted. Furthermore, although social phobia is positively associated with substance use in adults (Buckner, Eggleston, & Schmidt, 2006), some prior work has not found positive relations between alcohol/drug use and social phobia diagnoses in adolescents (Frojd, et al., 2011), which is consistent with the current null result using a continuous measure of social phobia symptoms.

Even though combustible tobacco use is becoming increasingly deviant and perceived as a substance of greater harm (Johnston, et al., 2015), this study showed that within the group of teens with an alcohol/drug use history, lifetime comorbid tobacco use did not significantly differentiate emotional psychopathology characteristics. The lack of differences between these groups is unlikely to reflect poor representativeness of the sample to tobacco use trends nationally, as US National data indicated that 15% and 26% of US 8th and 10th graders reported ever smoking in 2013; our rate of 20% of 9th graders reporting ever smoking appears to be in line with this trend (Johnston, et al., 2015). One possible explanation for the lack of differences may be that teens with lifetime alcohol/drug use without (vs. with) comorbid tobacco use may have been more extensive drug users, leading to more emotional pathology in that group than expected. However, the opposite pattern was found; teens with comorbid tobacco use were *more* likely to have used a greater diversity of substances (see Table 2). It is also possible that the failure to detect differences was due to a lack of power. A post-hoc power analysis showed that this study had 0.8 power to detect effect sizes that were at least of medium magnitude (Cohen's $d = 0.34$). It is possible that this study might have missed detecting smaller differences between the two groups; however, the clinical significance of differences of effects of such small magnitudes is unclear.

Existing evidence indicates that nicotine administration acutely enhances one's subjective mood state, particularly among those with emotional pathology (Spring et al., 2008), and research in adults indicates smoking is associated with psychiatric comorbidity after statistically controlling for comorbid alcohol/drug use (Bakhshaie, Zvolensky, & Goodwin, 2015). We expected that adolescents with a lifetime alcohol/drug use history and comorbid tobacco use would have more emotional pathology than those without comorbid tobacco use, and were surprised to not find this result. In interpreting these results from a self-medication perspective (Khantzian, 1997), we speculate that the current findings could suggest that teens might not be motivated to initiate tobacco use to modulate emotional functioning if they are already using drugs or alcohol. Alternatively, if emotion-substance relations may reflect the biological or psychosocial dysregulating effects of substance use on mental health (Patten & Barbui, 2004), the current findings might indicate that tobacco may not have any additional dysregulating effect over and above drug or alcohol use in teens as

predicted, suggesting that tobacco use is becoming more socially deviant and has similar associations with emotional psychopathology as other illicit substances.

This study focused on lifetime history of substance use to delineate groups because there are low base rates of frequent and problematic substance use in general adolescent samples in this age range (Parra, O'Neill, & Sher, 2003), and early substance initiation by age 14 or 15 is important marker of future substance use disorder risk, chronicity, and severity (Trenz et al., 2012). By utilizing a 'low-threshold' marker of substance use with high sensitivity (instead of a marker with greater specificity, such as substance use disorder), we potentially yielded findings that generalize to a greater proportion of the youth population, some of whom may not yet have escalated to regular use. Nonetheless, this study cannot address the important question of whether more frequent substance use or substance use disorder per se is associated with greater emotional pathology. It is possible that among teens with a lifetime history of using alcohol or drugs, those who are frequent (vs. infrequent) tobacco users exhibit greater emotional pathology. Such a distinction could have been obscured in the current study by collapsing such subgroups into a single lifetime tobacco use classification. Future research utilizing selected samples (e.g., those in substance use or smoking cessation treatment programs) may be better apt to shed light on variations in emotional pathology as a function of substance use frequency/severity.

Some additional limitations warrant discussion. We grouped all forms of tobacco together and did not isolate individual products from one another, including e-cigarettes, which are becoming increasingly prevalent among teens (Johnston, et al., 2015) and should be addressed further in future teen comorbidity research. In addition, we studied 9th graders only and utilized a cross-sectional design; hence, the non-significant findings for the comorbid tobacco use comparisons require further extension to younger and older age groups. Examining longitudinal relations will be necessary to fully evaluate if tobacco use might increase (or perhaps be a consequence of) emotional pathology over a broader period of time. The mood questionnaire used herein assessed state mood, leaving unclear whether different findings might have been identified from a trait measure that is more representative of one's generalized mood tendency.

Limitations notwithstanding, these findings may inform universal prevention strategies that could be implemented in public school settings and beyond. In addition to providing additional evidence suggesting the importance of considering concomitant roles of emotional psychopathology and substance use in teen health promotion, these findings suggest that targeting emotional vulnerability factors like distress tolerance and anhedonia may be relevant for mental illness and substance use prevention. Tactics such as behavioral activation, which teaches individuals how to seek out healthy alternative rewarding activities to enhance pleasure and counteract anhedonia without resorting to drug use may have preventive benefits in 9th graders, as has been shown in preliminary work in college alcohol prevention (Reynolds, Macpherson, Tull, Baruch, & Lejuez, 2011). Also, interventions such as acceptance and commitment based approaches that teach emotional acceptance and prevent avoidance of distress may be useful methods for reducing maladaptive coping strategies that recapitulate emotional disturbance and escape behaviors like substance use (Biglan, Hayes, & Pistorello, 2008). Such approaches may also promote refusal skills in

situations in which teens with poor distress tolerance might otherwise give in to social pressures to use substances. Furthermore, these findings indicate emotional health promotion may be important for the entire population of teenagers who have used alcohol or drugs, even those who have never used tobacco. The utility of separating adolescents with lifetime substance use and comorbid tobacco use from those with lifetime substance use without tobacco use for understanding and preventing emotional pathology is uncertain.

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References

Albers AB, Biener L. The role of smoking and rebelliousness in the development of depressive symptoms among a cohort of Massachusetts adolescents. [Research Support, Non-U.S. Gov't]. Preventive medicine. 2002; 34(6):625–631. doi: 10.1006/pmed.2002.1029. [PubMed: 12052023]

Audrain-McGovern J, Rodriguez D, Leventhal AM, Cuevas J, Rodgers K, Sass J. Where Is the Pleasure in That? Low Hedonic Capacity Predicts Smoking Onset and Escalation. Nicotine & Tobacco Research. 2012; 14(10):1187–1196. doi: 10.1093/ntr/nts017. [PubMed: 22387990]

Bakhshaie J, Zvolensky MJ, Goodwin RD. Cigarette smoking and the onset and persistence of depression among adults in the United States: 1994-2005. [Research Support, N.I.H., Extramural]. Comprehensive psychiatry. 2015; 60:142–148. doi: 10.1016/j.comppsych.2014.10.012. [PubMed: 25882595]

Barlow DH, Sauer-Zavala S, Carl JR, Bullis JR, Ellard KK. The Nature, Diagnosis, and Treatment of Neuroticism: Back to the Future. Clinical Psychological Science. 2014; 2(3):344–365. doi: 10.1177/2167702613505532.

Biglan A, Hayes SC, Pistorello J. Acceptance and commitment: implications for prevention science. [Research Support, N.I.H., Extramural]. Prevention science : the official journal of the Society for Prevention Research. 2008; 9(3):139–152. doi: 10.1007/s11121-008-0099-4. [PubMed: 18690535]

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(11):1039–1044. doi: 10.1001/archpsyc.59.11.1039. [PubMed: 12418937]

Buckner JD, Eggleston AM, Schmidt NB. Social anxiety and problematic alcohol consumption: the mediating role of drinking motives and situations. [Research Support, N.I.H., Extramural]. Behavior therapy. 2006; 37(4):381–391. doi: 10.1016/j.beth.2006.02.007. [PubMed: 17071215]

Chorpita BF, Moffitt CE, Gray J. Psychometric properties of the Revised Child Anxiety and Depression Scale in a clinical sample. [Evaluation Studies Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, P.H.S.]. Behaviour research and therapy. 2005; 43(3):309–322. doi: 10.1016/j.brat.2004.02.004. [PubMed: 15680928]

Chorpita BF, Yim L, Moffitt C, Umemoto LA, Francis SE. Assessment of symptoms of DSM-IV anxiety and depression in children: a revised child anxiety and depression scale. Behaviour research and therapy. 2000; 38(8):835–855. doi: 10.1016/S0005-7967(99)00130-8. [PubMed: 10937431]

Corstorphine E, Mountford V, Tomlinson S, Waller G, Meyer C. Distress tolerance in the eating disorders. Eating behaviors. 2007; 8(1):91–97. doi: 10.1016/j.eatbeh.2006.02.003. [PubMed: 17174856]

Daughters SB, Reynolds EK, MacPherson L, Kahler CW, Danielson CK, Zvolensky M, Lejuez CW. Distress tolerance and early adolescent externalizing and internalizing symptoms: the moderating role of gender and ethnicity. [Research Support, N.I.H., Extramural]. Behaviour research and therapy. 2009; 47(3):198–205. doi: 10.1016/j.brat.2008.12.001. [PubMed: 19135649]

Diener E, Emmons RA. The independence of positive and negative affect. [Research Support, U.S. Gov't, P.H.S.]. Journal of personality and social psychology. 1984; 47(5):1105–1117. [PubMed: 6520704]

Eaton DK, Kann L, Kinchen S, Shanklin S, Ross J, Hawkins J, Wechsler H. Youth risk behavior surveillance - United States, 2009. Morbidity and mortality weekly report. Surveillance summaries. 2010; 59(5):1–142. [PubMed: 20520591]

Frank JL, Bose B, Schrobenhauser-Clonan A. Effectiveness of a School-Based Yoga Program on Adolescent Mental Health, Stress Coping Strategies, and Attitudes Toward Violence: Findings From a High-Risk Sample. Journal of Applied School Psychology. 2014; 30(1):29–49. doi: 10.1080/15377903.2013.863259.

Frojd S, Ranta K, Kaltiala-Heino R, Marttunen M. Associations of social phobia and general anxiety with alcohol and drug use in a community sample of adolescents. [Research Support, Non-U.S. Gov't]. Alcohol and alcoholism. 2011; 46(2):192–199. doi: 10.1093/alcalc/agq096. [PubMed: 21245062]

Haines-Saah RJ JL, Repta R, Ostry A, Young ML, Shoveller J, Sawatzky R, Greaves L, Ratner PA. The privileged normalization of marijuana use- an analysis of Canadian newspaper reporting, 1997-2007. Critical Public Health. 2014; 24(1):47–61. doi: 10.1080/09581596.2013.771812. [PubMed: 24574580]

Janiri L, Martinotti G, Dario T, Reina D, Paparello F, Pozzi G, De Risio S. Anhedonia and substance-related symptoms in detoxified substance-dependent subjects: a correlation study. Neuropsychobiology. 2005; 52(1):37–44. doi: 10.1159/000086176. [PubMed: 15942262]

Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future National Survey Results on Drug Use, 1975-2014. Institute for Social Research; Ann Harbor, MI: 2015.

Khantzian EJ. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. [Review]. Harvard review of psychiatry. 1997; 4(5):231–244. doi: 10.3109/10673229709030550. [PubMed: 9385000]

Lammers J, Kuntsche E, Engels RC, Wiers RW, Kleinjan M. Mediational relations of substance use risk profiles, alcohol-related outcomes, and drinking motives among young adolescents in the Netherlands. [Research Support, Non-U.S. Gov't]. Drug and alcohol dependence. 2013; 133(2): 571–579. doi: 10.1016/j.drugalcdep.2013.07.030. [PubMed: 23998377]

Leventhal AM, Chasson GS, Tapia E, Miller EK, Pettit JW. Measuring hedonic capacity in depression: a psychometric analysis of three anhedonia scales. [Comparative Study Validation Studies]. Journal of clinical psychology. 2006; 62(12):1545–1558. doi: 10.1002/jclp.20327. [PubMed: 17019674]

Leventhal AM, Zvolensky MJ. Anxiety, depression, and cigarette smoking: a transdiagnostic vulnerability framework to understanding emotion-smoking comorbidity. [Research Support, N.I.H., Extramural]. Psychological bulletin. 2015; 141(1):176–212. doi: 10.1037/bul0000003. [PubMed: 25365764]

Leyro TM, Zvolensky MJ, Bernstein A. Distress tolerance and psychopathological symptoms and disorders: a review of the empirical literature among adults. [Research Support, N.I.H., Extramural Review]. Psychological bulletin. 2010; 136(4):576–600. doi: 10.1037/a0019712. [PubMed: 20565169]

Muris P, Schmidt H, Merckelbach H, Schouten E. Anxiety sensitivity in adolescents: factor structure and relationships to trait anxiety and symptoms of anxiety disorders and depression. Behaviour research and therapy. 2001; 39(1):89–100. doi: 10.1016/S0005-7967(99)00179-5. [PubMed: 11125726]

Novak A, Burgess ES, Clark M, Zvolensky MJ, Brown RA. Anxiety sensitivity, self-reported motives for alcohol and nicotine use, and level of consumption. Journal of anxiety disorders. 2003; 17(2): 165–180. doi: 10.1016/S0887-6185(02)00175-5. [PubMed: 12614660]

Parra GR, O'Neill SE, Sher KJ. Reliability of self-reported age of substance involvement onset. [Research Support, U.S. Gov't, P.H.S.]. Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors. 2003; 17(3):211–218. doi: 10.1037/0893-164X.17.3.211. [PubMed: 14498815]

Patten SB, Barbui C. Drug-induced depression: a systematic review to inform clinical practice. [Review]. Psychotherapy and psychosomatics. 2004; 73(4):207–215. doi: 10.1159/000077739. [PubMed: 15184715]

Reiss S, Peterson RA, Gursky DM, McNally RJ. Anxiety sensitivity, anxiety frequency and the prediction of fearfulness. Behaviour research and therapy. 1986; 24(1):1–8. [PubMed: 3947307]

Reynolds EK, Macpherson L, Tull MT, Baruch DE, Lejuez CW. Integration of the brief behavioral activation treatment for depression (BATD) into a college orientation program: depression and alcohol outcomes. [Randomized Controlled Trial]. Journal of counseling psychology. 2011; 58(4): 555–564. doi: 10.1037/a0024634. [PubMed: 21787070]

Silverman WK, Fleisig W, Rabian B, Peterson RA. Childhood Anxiety Sensitivity Index. Journal of Clinical Child Psychology. 1991; 20(2):162–168. doi: 10.1207/s15374424jccp2002_7.

Simons J, Gaher R. The Distress Tolerance Scale: Development and Validation of a Self-Report Measure. Motivation and Emotion. 2005; 29(2):83–102. doi: 10.1007/s11031-005-7955-3.

Snaith RP, Hamilton M, Morley S, Humayan A, Hargreaves D, Trigwell P. A scale for the assessment of hedonic tone the Snaith-Hamilton Pleasure Scale. The British journal of psychiatry : the journal of mental science. 1995; 167(1):99–103. [PubMed: 7551619]

Spring B, Cook JW, Appelhans B, Maloney A, Richmond M, Vaughn J, Hedeker D. Nicotine effects on affective response in depression-prone smokers. [Comparative Study Randomized Controlled Trial Research Support, N.I.H., Extramural Research Support, U.S. Gov't, Non-P.H.S.]. Psychopharmacology. 2008; 196(3):461–471. doi: 10.1007/s00213-007-0977-7. [PubMed: 17960366]

Stein DJ. Depression, anhedonia, and psychomotor symptoms: the role of dopaminergic neurocircuitry. [Case Reports Research Support, Non-U.S. Gov't Review]. CNS spectrums. 2008; 13(7):561–565. [PubMed: 18622360]

Trenz RC, Scherer M, Harrell P, Zur J, Sinha A, Latimer W. Early onset of drug and polysubstance use as predictors of injection drug use among adult drug users. [Research Support, N.I.H., Extramural]. Addictive Behaviors. 2012; 37(4):367–372. doi: 10.1016/j.addbeh.2011.11.011. [PubMed: 22172686]

Wills TA, Sandy JM, Shinar O, Yaeger A. Contributions of positive and negative affect to adolescent substance use: Test of a bidimensional model in a longitudinal study. Psychology of Addictive Behaviors. 1999; 13(4):327–338. doi: 10.1037/0893-164X.13.4.327.

Wolitzky-Taylor K, Bobova L, Zinbarg RE, Mineka S, Craske MG. Longitudinal investigation of the impact of anxiety and mood disorders in adolescence on subsequent substance use disorder onset and vice versa. [Multicenter Study Research Support, N.I.H., Extramural]. Addictive Behaviors. 2012; 37(8):982–985. doi: 10.1016/j.addbeh.2012.03.026. [PubMed: 22503436]

Wolitzky-Taylor K, Guillot CR, Pang RD, Kirkpatrick MG, Zvolensky MJ, Buckner JD, Leventhal AM. Examination of Anxiety Sensitivity and Distress Tolerance as Transdiagnostic Mechanisms Linking Multiple Anxiety Pathologies to Alcohol Use Problems in Adolescents. Alcoholism: Clinical and Experimental Research. 2015; 39(3):532–539. doi: 10.1111/acer.12638.

Zimmermann P, Wittchen HU, Hofler M, Pfister H, Kessler RC, Lieb R. Primary anxiety disorders and the development of subsequent alcohol use disorders: a 4-year community study of adolescents and young adults. Psychological medicine. 2003; 33(7):1211–1222. doi: 10.1017/S0033291703008158. [PubMed: 14580076]

Table 1

Demographic and Other Characteristics by Lifetime Substance Use Group (N = 575)

Outcome	No Use (n=294)	Substance Use - No Tobacco (n=166)	Tobacco & Other Substance Use (n=115)	Omnibus Test of Group Differences	
				F/χ^2	p
	M (SD)	M (SD)	M (SD)		
Age (years)	14.45 (0.51)	14.55 (0.56)	14.54 (0.58)	$F(2,572) = 2.48$	.08
	n (%)	n (%)	n (%)		
Gender				$\chi^2(2) = 5.14$	.08
Female	131 (44.6%)	92 (55.4%)	59 (51.3%)		
Male	163 (55.4%)	74 (44.6%)	56 (48.7%)		
Ethnicity				$\chi^2(14) = 26.59$	.02
American Indian/Native American	2 (0.7%)	2 (1.2%)	0 (0.0%)		
Asian	19 (6.5%)	7 (4.2%)	7 (6.1%)		
Black or African American	3 (1.0%)	4 (2.4%)	5 (4.3%)		
Hispanic or Latino	133 (45.2%)	103 (62.0%)	53 (46.1%)		
Native Hawaiian or Pacific Islander	19 (6.5%)	4 (2.4%)	0 (0.0%)		
White	76 (25.9%)	25 (15.1%)	31 (27.0%)		
Other	34 (11.6%)	14 (8.4%)	16 (13.9%)		
Multi-Racial	16 (5.4%)	6 (3.6%)	3 (2.6%)		
Highest Parental Education				$\chi^2(10) = 12.52$	.04
8th grade or less	10 (3.4%)	8 (4.8%)	9 (7.8%)		
Some high school	13 (4.4%)	14 (8.4%)	7 (6.1%)		
High school graduate	47 (16.0%)	35 (21.1%)	21 (18.3%)		
Some college	66 (22.4%)	36 (21.7%)	27 (23.5%)		
College graduate	88 (29.9%)	37 (22.3%)	31 (27.0%)		
Advanced degree	39 (13.3%)	19 (11.4%)	13 (11.3%)		

Note. Denominators used to generate percentages vary due to sporadic missing data across outcomes (Ns 520-575).

Table 2

Specific Drugs Use by Lifetime Substance Use Group

Substance	Substance Use - No Tobacco (*n*=166)	Tobacco & Other Substance Use (*n*=115)	χ^2
	n (%)	n (%)	
Cigarette	0 (0%)	66 (57.4)	-
Other forms of tobacco	0 (0%)	97 (84.3%)	-
Smokeless tobacco	0 (0%)	8 (7.0%)	-
Alcohol	134 (80.7%)	104 (90.4%)	**4.94***
Marijuana	57 (34.3%)	88 (76.5%)	**48.41*****
Inhalants	26 (15.7%)	29 (25.2%)	**3.94***
Cocaine	1 (0.60%)	4 (3.5%)	3.21
Methamphetamine	1 (0.60%)	3 (2.6%)	1.95
LSD, mushrooms, or other psychedelics	1 (0.60%)	8 (7.0%)	**8.85***
Ecstasy	0 (0%)	1 (0.87%)	1.45
Heroin	0 (0%)	5 (4.3%)	**7.35****
Salvia	4 (2.4%)	15 (13.0%)	**12.19*****
Prescription painkillers to get “high”	11 (6.6%)	21 (18.3%)	**9.11****
Barbiturates	0 (0%)	0 (0%)	**9.11****
Tranquilizers or sedatives	7 (4.2%)	13 (11.3%)	**5.16***
Cold/cough medicine to get “high”	7 (4.2%)	17 (14.8%)	**9.71****
Diet Pills	8 (4.8%)	2 (1.7%)	1.88
Prescription stimulant pills to get “high”	6 (3.6%)	9 (7.8%)	2.38
Antihistamine to get “high”	1 (0.60%)	2 (1.7%)	0.83
Any other pill or illegal drug to get “high”	2 (1.2%)	2 (1.7%)	0.14

Note. For all χ^2 tests, df = 1. Significant findings in bold.

*$p<0.05$

**$p < 0.01$

***$p < 0.001$

Table 3

Emotional Psychopathology and Traits by Lifetime Substance Use Group

Outcome	No Use (*n*=294)	Substance Use - No Tobacco (*n*=166)	Tobacco & Other Substance Use (*n*=115)	Omnibus Test of Group Differences	Pairwise Contrasts		
					Non-Users vs. Lifetime Drug/ Alcohol Users Without Tobacco	Non-Users vs. Lifetime Drug/ Alcohol Users With Tobacco	Lifetime Drug/ Alcohol Users With vs. Without Tobacco
	M(*SD*)	*M*(*SD*)	*M*(*SD*)	*F*(df)	*d*	*d*	*d*
RCADS- Generalized Anxiety	1.26 (0.69)	11.40 (0.74)	1.47 (0.65)	**4.04(2, 525)***	0.20	**0.31***	0.10
RCADS- Major Depression	0.70 (0.65)	0.91 (0.68)	0.99 (0.67)	**9.41(2, 522)*****	**0.32****	**0.44*****	0.11
RCADS- Panic Disorder	0.41 (0.50)	0.55 (0.56)	0.54 (0.52)	**4.64(2, 517)***	**0.27***	0.27	0.01
RCADS- Social Phobia	1.31 (0.77)	1.36 (0.73)	1.38 (0.66)	0.43(2, 515)	0.06	0.08	0.02
MQ- Positive Affect	3.98 (1.50)	3.66 (1.35)	3.77 (1.46)	2.74(2, 550)	0.23	0.14	0.08
MQ- Negative Affect	2.13 (1.26)	2.50 (1.23)	2.57 (1.30)	**7.06(2, 550)*****	**0.30****	**0.34****	0.05
Distress Tolerance (DTS)	2.55 (0.81)	2.72 (0.77)	2.78 (0.85)	**3.96(2, 524)***	0.21	**0.28***	0.08
Anxiety Sensitivity (CASI)	1.72 (0.37)	1.79 (0.38)	1.72 (0.36)	2.21(2, 551)	0.20	1.61	1.49
Anhedonia (SHAPS)	3.26 (0.46)	3.14 (0.45)	3.16 (0.44)	**4.62(2, 568)***	**0.28***	0.21	0.07

Note. Sample sizes vary across analyses due to sporadic missing data across outcome (Ns 518-570). RCADS = Revised Child Anxiety and Depression Scale; MQ = Mood Questionnaire; DTS = Distress Tolerance Scale; CASI = Childhood Anxiety Sensitivity Index; SHAPS = Snaith-Hamilton Pleasure Scale. *d* = Cohen's *d* statistic for pairwise comparison. Significant findings in bold.

*$p<0.05$

**$p < 0.01$

***$p < 0.001$.