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Substance Use and Depressive Symptoms among Adolescents Treated in a Pediatric Emergency Department

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Abstract

The current study examined associations between substance use and depressed mood by gender and type of substance used (no use, alcohol, marijuana or both alcohol and marijuana) in a sample of 713 adolescents ($M_{age} = 15.3$) recruited from a Pediatric Emergency Department (PED).

Adolescents who reported any marijuana use had higher overall depressed mood scores compared to all other adolescents. When examined by gender, females with both alcohol and marijuana use reported the highest overall depressed mood symptoms. These results suggest the usefulness of screening and identification of depressive symptoms among adolescents presenting to a PED for substance use-related problems.

Keywords

Adolescents; Depressed Mood; Substance Use; Gender Differences

Nationally representative data indicate that approximately 30% of adolescents initiate alcohol use by the eighth grade and that 69% of adolescents have experimented with alcohol by the time they reach the twelfth grade (Johnston, O'Malley, Bachman, & Schulenberg, 2013). Data on levels of problematic drinking, from being drunk to binge drinking indicate that 13% of eighth grade adolescents report being drunk and 5% report binge drinking (defined as five or more drinks on one occasion) in the past two weeks. By the time these adolescents reach the twelfth grade, their rates of being drunk increase to 54% and their rates of binge drinking in the past two weeks increase to 24%. Further, despite a noted decrease in the use of marijuana in 2012, marijuana continues to be the second most used substance by adolescents (Johnston et al., 2013). In 2012, the rates for lifetime prevalence of marijuana was 15% for 8th graders, 34% for 10th graders, and 45% for 12th graders (Johnston, O'Malley, Bachman, & Schulenberg, 2010, 2011).

These substance use rates among adolescents are of concern given previous research linking alcohol and marijuana use to depressed mood, including a greater risk for developing more severe and longer depressive episodes, and greater risk for developing severe alcohol- and drug-related problems (Bukstein et al., 1993; Hallfors, Waller, Bauer, Ford, & Halpern, 2005; King et al., 1996; Rohde, Lewinsohn, & Seeley, 1996). This association has been documented in both community and high-risk samples (Glieb & Pine, 2002; Kelder et al., 2001). For instance, Rohde and colleagues (1996) found that among a community-based sample of adolescents, 48% reported having co-occurring depressive symptoms and an alcohol use disorder (AUD), compared to 17% of alcohol abstainers. Another study found that teens who reported a history of AUD were almost four times more likely to have a history of major depressive disorder (MDD) than teens without a history of AUD (Deykin, Levy, & Wells, 1987). Similarly, high school seniors in Florida that reported depression were more likely than their non-depressed counterparts to use alcohol, cigarettes, and marijuana (Diego, Field, & Sanders, 2003).

Similar results have emerged from studies on high-risk adolescent samples. One study conducted among alcohol dependent adolescents participating in treatment found that 89% had a diagnosis of MDD, conduct disorder, or both (Clark, Lesnick, & Hegedus, 1997). Another study which followed adolescent outpatients with MDD over the course of one year demonstrated that excessive drinkers achieved depressive symptom remission on a monthly Beck Depression Inventory significantly less often than their nonexcessive drinking counterparts (Meririnne et al., 2010). Further, in a study of adolescents with and without arrest histories recruited from primary care clinics, adolescents with arrest histories and clinical levels of depressive symptoms showed greater use of alcohol, marijuana, and other substances than those without an arrest history and clinical levels of depressive symptoms (Tolou-Shams, Brown, Houck, & Lescano, 2008). Similarly, Orton, Riggs, & Libby (2009) found that among a child welfare sample, adolescent males with frequent substance use had significantly higher scores on a measure of depression than those without substance use.

Several explanations have been developed in an attempt to understand the mechanisms underlying these associations and to identify critical periods for prevention. One such explanation is that depression may result from the biological or psychosocial consequences of substance use behaviors. Epidemiologic and longitudinal studies have provided support

for this explanation (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Goodman & Capitman, 2000; Hallfors et al., 2005; Kosterman, Hawkins, Mason, Herrenkohl, & Lengua, 2010; Rao, Daley, & Hammen, 2000), thus suggesting that identifying and intervening on adolescents who use substances may help prevent the later development of depression. Another, yet less consistently supported explanation, is the self-medication hypothesis which posits that adolescents engage in substance use or abuse to cope with the symptoms of a mental health disorder (Kessler & Price, 1993; Khantzian, 1985). Several longitudinal studies provide support for the self-medication hypothesis, particularly with regard to cigarettes (Audrain-McGovern, Rodriguez, & Kassel, 2009; Orlando, Ellickson, & Jinnett, 2001; Repetto, Zimmerman, & Caldwell, 2004; Weinstein & Mermelstein, 2013; Wills, Sandy, & Yaeger, 2002) and among females (Measelle, Stice, & Hogansen, 2006). Finally, a third explanation suggests that both substance use and depression share common risk factors which contribute to the development and maintenance of the two (Goodman & Capitman, 2000; Hallfors, Waller, Bauer, Ford, & Halpern, 2005; Kandel, Raveis, & Davies, 1991).

The reasons underlying the relationship between depressed mood and substance use may vary according to the unique contribution a specific substance makes to the experience of depressed mood (Weinstein & Mermelstein, 2013). For instance, one longitudinal study of 4,412 adolescents found that higher levels of depressive symptoms in grade nine predicted faster increases in cigarette smoking, marijuana use, and hard drug use across grades 9 through 12. However, this was not the case with alcohol use (Hooshmand, Willoughby, & Good, 2012). Further, another study examining the moderating effects of substance use expectancies found that positive expectancies related to symptom reduction moderated the effects of depressed mood on later marijuana use, but not alcohol use (Clark, Ringwalt, & Shamblen, 2011). These studies suggest that marijuana may have unique contributions to the experience of depressed mood (Degenhardt, Hall, & Lynskey, 2003). Yet, marijuana use often co-occurs with alcohol use and existing research indicates that individuals who use both alcohol and marijuana experience higher rates of depression when compared to those who use either substance alone (Conway et al., 2013; Midanik, Tam, & Weisner, 2007; Pacek, Malcolm, & Martins, 2012; Pacek, Martins, & Crum, 2013). These studies demonstrate the benefits of examining the unique effects specific substances have on depressed mood (Hallfors et al., 2005).

Another factor which affects our understanding of the relationship between depression and substance abuse is the moderating effect gender has on this relationship. Some have found that the relationship may be stronger for females than for males (Crum, Brown, Liang, & Eaton, 2001; Locke & Newcomb, 2001), while others have found that this relationship may be stronger among males. For example, one study examining the associations between depressed mood and heavy drinking found that adolescent males had higher occurrences of depressed mood and heavy drinking than adolescent females (Windle & Davies, 1999). Additionally, a longitudinal study of urban youth aged 9 to 13 years found higher levels of depressed mood at baseline to be associated with an earlier and increased risk of initiating alcohol use among males but not females (Crum, Storr, Jalongo, & Anthony, 2008). Another study found that while females engaged in less substance use behaviors than males, those females who did were more likely to have depressive symptoms than males, and those symptoms became worse with the use of marijuana and other illegal drugs (Hallfors, Waller,

& Ford, 2004). Finally, Halfors and colleagues (2005) found that females who used marijuana did not have a significantly higher chance of developing depressive symptoms when compared to their male counterparts. Yet, males who used marijuana were more likely to develop depressive symptoms than males who did not use marijuana (Halfors et al., 2005).

While several studies have examined the associations between depressed mood and substance use, to date only a few have investigated gender differences in relation to depressed mood and the use of specific substances, with most research focusing on either one substance (e.g., marijuana) or on substance use at an aggregate level (e.g., any substance use). Consequently, relatively little is known regarding how the relationship between co-occurring depressed mood and substance use varies by gender and type of substance being used (Johnston et al., 2013; Kosterman et al., 2010). The purpose of this study was to 1) examine the associations between alcohol use, marijuana use and depressed mood, and 2) examine differences in these associations across gender and by type of substance being used (i.e., no substance use vs. alcohol only vs. marijuana only vs. both alcohol and marijuana) among a sample of adolescents recruited from an Emergency Department (ED). Examining these associations within a sample of adolescents recruited in the ED is timely given recent calls for screening, assessment, and referral of adolescents who may not meet formal diagnostic criteria for substance abuse but may be in need of intervention given other factors which may increase risk, such as depressed mood (Johnston et al., 2013; Kosterman et al., 2010). It was hypothesized that females with any type of substance use would be more likely to have depressive symptoms than their male counterparts, and that adolescents who reported both alcohol and marijuana use would be more likely to report depressive symptoms than those who abstained or those who report use of only one substance.

Methods

Participants

Study participants included 713 adolescents (58.1% male), ranging in age from 13 to 17 years ($M = 15.26$, $SD = 1.3$). In this sample, 69.4% of adolescents self-identified as non-Hispanic White, 6.6% self-identified as non-Hispanic Black, 18.4% self-identified as Hispanic, and 5.6% self-identified as belonging to an "Other" ethnic/racial category. All adolescents were treated in the pediatric or adult Emergency Department (ED) of a level I regional trauma center in the northeastern United States. Adolescents presented with a range of illness and injury. Thirty six percent of adolescents were evaluated in the ED solely for alcohol intoxication, without any co-morbid injury or illness.

Participants were recruited between 1997 and 2008 to be part of one of three studies. Two of the studies were clinical trials evaluating the efficacy of a brief individual motivational intervention for adolescents with an alcohol-related event that resulted in an ED visit (Spirito et al., 2004; Spirito et al., 2011). All participants in these two studies reported consuming alcohol within six hours of their ED admission; had a positive blood alcohol test or breathalyzer reading; and/or scored 4 or above on the Alcohol Use Disorders Identification Test (AUDIT; see "Measures"). Further, participants in these two clinical trial studies were classified as using alcohol for the purpose of the analyses presented here. If they also

responded positively to the marijuana screen, described below, then they were classified as using both alcohol and marijuana. Adolescents who were suicidal, were in police custody, or had serious injuries requiring hospitalization were not approached for participation in the study while those who had incomplete screening data were excluded from this study.

The third study recruited adolescents treated in the ED for an injury or illness to serve as a comparison group on baseline characteristics to the adolescents in the two clinical trials described above. Data was collected during the time period of the first clinical trial described above. For the analyses presented here, adolescents recruited as part of the comparison group study were classified based on their response to the AUDIT and question about marijuana use as no substance use, alcohol use only, marijuana use only, or alcohol and marijuana use. Given previous research demonstrating that experimentation with alcohol during adolescence is a developmentally normative behavior (Johnston et al., 2013; Masten, Faden, Zucker, & Spear, 2009), we chose to identify adolescents as “alcohol users” if they received an AUDIT score of four or above in order to distinguish adolescents engaging in drinking which increases risk from those who may have only used once in their lifetime as part of their normative experimentation.

Procedure

Adolescents recruited to be part of the two randomized clinical trials were referred to the studies by the ED or biochemistry lab staff, who were instructed to send an electronic page to research staff when an adolescent was identified in the ED either as having consumed any alcohol within six hours of their admission (in the case of ED staff) or as having tested positive for alcohol (i.e., BAC > 0.0) via medical staff-drawn blood test (in the case of the biochemistry lab). The data reported here were collected as part of the baseline adolescent assessments, which occurred before adolescents were randomized to either a control or experimental condition in the clinical trials. All alcohol-positive participants were required to pass a brief mental status exam before completing the baseline assessments. The mental status exam assessed temporal orientation, spatial orientation, memory, attention, and immediate and delayed recall. Adolescents were not approached until their BAC was less than 0.1% (g/ml) and/or they could pass the mental status exam. If participants were unable to complete the baseline assessment at the time of their ED visit, a follow-up visit was scheduled within a few days (Diego et al., 2003). Adolescents in the third study were approached during their ED visit and asked if they wanted to participate in a comparison group for a study examining the characteristics of alcohol-positive adolescents being treated in an ED.

Parental consent and adolescent assent were obtained for all families in the three studies. A Certificate of Confidentiality was obtained from the National Institutes of Health to further protect the confidentiality of the data collected. The overseeing university and hospital's Institutional Review Boards approved all study-related procedures.

Measures

For purposes of the current study, only measures on alcohol use, marijuana use and depressed mood are reported.

Adolescent Drinking Questionnaire (ADQ)—The ADQ consists of 4 items that assess recent drinking frequency (days per month), quantity (drinks per occasion), frequency of high-volume drinking (≥ 5 drinks per occasion), and frequency of intoxication (feeling “drunk” or “very, very high”) (Jessor, Chase, & Donovan, 1980). The ADQ has been widely used in survey research and demonstrated sensitivity to change in the two treatment trials associated with this study (Spirito et al., 2004; Spirito et al., 2011).

Marijuana Use—History of marijuana use was assessed with one question asking whether the adolescent had ever used marijuana.

Alcohol Use Disorder Identification Test (AUDIT)—The AUDIT was developed by the World Health Organization as a way to identify preliminary signs of hazardous drinking (Babor, Higgins-Biddle, Saunders, & Monteiro, 1992). Adolescents were scored on ten items assessing alcohol dependence symptoms or alcohol-related problems. A cut off score of 4 was used based on prior research (Fairlie, Sindelar, Eaton, & Spirito, 2006).

Center for Epidemiologic Studies-Depression Scale (CES-D)—The CES-D is a 20-item measure of depressive symptoms (Radloff, 1977). Items are rated on a four-point scale from 0 (rarely or none of the time) to 3 (most or all of the time) and summed for a total scale score. There are also four subscales derived which are labeled Depressed Affect (eight items), Somatic and Retardation (six items), Positive Affect (four items), and Interpersonal (two items). The CES-D has been used with adult and adolescent populations, and has good internal consistency and test-retest reliability with adolescents (Radloff, 1991). Examples of items on the CES-D included: “I felt like everything I did was an effort” (somatic), and “I felt I was just as good as other people” (positive affect), “I thought my life had been a failure” (depressed affect), and “I felt that people disliked me” (interpersonal). Internal consistency coefficients in this sample were as follows: Depressed Affect (.87), Somatic and Retardation (.68), Positive Affect (.84) and Interpersonal (.50). The scale as a whole generated a chronbach's alpha coefficient of .81.

Data Analytic Plan

Preliminary analyses compared the four substance use groups by age using analysis of variance (ANOVA), and by race and gender using chi square analyses. The primary analyses consisted of 2 (gender) × 4 (group membership) analysis of covariance (ANCOVA) controlling for age, to test for differences on symptoms of depressed mood as measured by the CES-D total score and subscales.

Results

Preliminary Analyses

The four groups were first compared on several demographic variables. Chi-square tests found no differences among the four substance use groups on gender $\chi^2(3, N = 713) = 2.97$, $p = 0.39$ or race collapsed into non-Hispanic White, non-Hispanic Black, Hispanic, or “Other” $\chi^2(9, N = 713) = 16.12$, $p = 0.06$. A one-way ANOVA on age revealed a significant difference among the groups, $F(3, 709) = 29.50$, $p < 0.0001$. Post hoc testing revealed that

adolescents who did not report substance use were significantly younger ($M = 14.7$, $SD = 1.3$) than the adolescents in the alcohol use only group ($M = 15.5$, $SD = 1.2$), marijuana use only group ($M = 15.6$, $SD = 1.1$), and the alcohol and marijuana group ($M = 15.3$, $SD = 1.3$). Consequently, age was controlled in subsequent analyses.

Further, to adjust for the unequal sample sizes, mainly due to the marijuana use only group, we conducted and report on Type III Sum of Squares analysis conducted in SPSS, which are based on unweighted marginal means, rather than means that depend on the sample size within specific cells.

Primary Analyses

CES-D Total score—For the total CES-D score, statistical analyses controlling for age revealed a significant difference by gender, $F(1, 699) = 9.11$, $p < 0.01$. Females ($M = 18.08$, $SE = 0.32$) reported higher overall CES-D scores than males ($M = 16.13$, $SE = 0.41$). There was also a statistically significant difference across substance use groups, $F(3, 698) = 11.34$, $p < 0.001$. As seen in Table 1, adolescents who reported no alcohol or marijuana use had lower CES-D total scores than those with both alcohol and marijuana use ($d = .34$). In addition, adolescents who reported alcohol use only had lower CES-D total scores than those with marijuana use only ($d = .56$) and those with alcohol and marijuana use ($d = .54$).

Table 2 presents the adjusted means and standard errors on the CES-D total score by gender and substance use after controlling for age. There was a statistically significant interaction effect, $F(7, 698) = 10.0$, $p < 0.001$. Females who reported both alcohol and marijuana use had significantly higher CES-D total mean scores than males and females who reported no substance use ($d = .79$; $d = .79$), males and females who reported alcohol use only ($d = .96$; $d = 1.05$), and males who reported both alcohol and marijuana use ($d = .78$).

CES-D Depressed Affect subscale—For the CES-D Depressed Affect subscale score, statistical analyses controlling for age revealed a significant difference by gender, $F(1, 705) = 32.54$, $p < 0.001$. Females ($M = 3.92$, $SE = 0.21$) reported higher scores than males ($M = 2.34$, $SE = 0.18$). There was also a statistically significant difference across substance use groups, $F(3, 708) = 13.77$, $p < 0.001$. As seen in Table 1, adolescents who reported no alcohol or marijuana use had lower Depressed Affect mean scores than those with marijuana use ($d = .59$) and both alcohol and marijuana use ($d = .58$). Adolescents who reported alcohol use only had lower Depressed Affect mean scores than those with both alcohol and marijuana use ($d = .40$).

Table 2 presents the adjusted means and standard errors on the CES-D Depressed Affect subscale scores by gender and substance use group after controlling for age. There was a statistically significant interaction effect, $F(7, 707) = 14.50$, $p < 0.001$. Females who reported either marijuana use only or both alcohol and marijuana use had significantly higher Depressed Affect subscale mean scores than males and females who reported no substance use, males and females who reported alcohol use only, males who reported marijuana use only, and males who reported both alcohol and marijuana use. Cohen's d for these significant differences were large, ranging between .85 to 1.30.

CES-D Interpersonal subscale—For the CES-D Interpersonal subscale score, statistical analyses controlling for age did not reveal a significant difference by gender, $F(1,708) = 3.40$, $p = 0.07$. Females ($M = 1.17$, $SE = 0.08$) reported comparable scores to males ($M = 0.98$, $SE = 0.07$). There was a statistically significant difference across substance use groups, $F(3, 710) = 3.16$, $p < 0.05$. As seen in Table 1, adolescents who reported alcohol and marijuana use had higher mean scores on the Interpersonal subscale than those with alcohol use only ($d = .27$).

Table 2 presents the adjusted means and standard errors on the CES-D Interpersonal subscale scores by gender and substance use after controlling for age. There was a statistically significant difference for the interaction effect, $F(7, 710) = 2.30$, $p < .05$, with females who reported both alcohol and marijuana use having higher Interpersonal subscale mean scores than males who reported no substance use ($d = .42$) and males who reported alcohol use only ($d = .51$).

CES-D Somatic and Retardation subscale—For the CES-D Somatic and Retardation subscale score, statistical analyses controlling for age revealed a significant difference by gender, $F(1,703) = 8.51$, $p < 0.01$. Females ($M = 5.59$, $SE = 0.22$) reported higher scores than males ($M = 4.74$, $SE = 0.18$). There was also a statistically significant difference across substance use groups, $F(3, 705) = 6.94$, $p < 0.001$. As seen in Table 1, adolescents who reported alcohol and marijuana use had higher Somatic and Retardation mean scores than those with alcohol use only ($d = .29$) or no use ($d = .41$).

Table 2 presents the adjusted means and standard errors on the CES-D Somatic and Retardation subscale scores by gender and substance use after controlling for age. There was statistically significant effect for the interaction, $F(7, 705) = 6.94$, $p < 0.001$. Females who reported both alcohol and marijuana use had significantly higher Somatic and Retardation subscale mean scores than males and females who reported no substance use ($d = .78$; $d = .79$), males and females who reported alcohol use only ($d = .63$; $d = .69$), and males who reported both alcohol and marijuana use ($d = .65$).

CES-D Positive Affect subscale—For the CES-D Positive Affect subscale score, statistical analyses controlling for age revealed a significant difference by gender, $F(1,706) = 9.99$, $p < 0.01$. Females ($M = 8.43$, $SE = 0.18$) reported lower scores than males ($M = 9.16$, $SE = 0.15$). There was also a statistically significant difference across substance use groups, $F(3, 708) = 14.14$, $p < 0.001$. As seen in Table 1, adolescents who reported both alcohol and marijuana use had lower Positive Affect mean scores than adolescents with no alcohol or marijuana use ($d = .62$) or those with alcohol use only ($d = .36$).

Table 2 presents the adjusted means and standard errors on the CES-D Positive Affect subscale scores by gender and substance use after controlling for age. There was a statistically significant interaction effect, $F(7, 708) = 8.51$, $p < 0.001$. Females with both marijuana and alcohol use had significantly lower Positive Affect subscale mean scores than males and females with no substance use ($d = .88$; $d = .75$), males and females with alcohol use only ($d = .61$; $d = .53$), and males with marijuana use only ($d = .84$). In addition, males with no substance use had significantly higher CES-D Positive Affect subscale scores than

males with both alcohol and marijuana use ($d = .51$) and females with marijuana use only ($d = 1.00$). Finally, females with no substance use had significantly higher Positive Affect subscale mean scores than females with marijuana use only ($d = .87$).

Discussion

While a number of studies have demonstrated associations between substance use and depressed mood, very few studies have examined whether these associations vary by type of substance used and gender. Even fewer studies have examined these associations among adolescents in ED settings, with most studies focusing on adolescents in the community and mental health or substance use treatment settings (Johnston et al., 2013; Kosterman et al., 2010). The purpose of this study was to examine 1) the associations between depressed mood and substance use and 2) gender differences in the associations between depressed mood and specific types of substance use. We hypothesized that adolescents who reported being both alcohol *and* marijuana users would report more depressive symptoms than those who reported being abstainers, primary alcohol users, or primary marijuana users. This hypothesis was not supported by the sample as a whole but was supported for females. We also hypothesized that females with any substance use would be more likely to have depressive symptoms when compared to their male counterparts who reported substance use. Results partially supported this latter hypothesis. The findings are discussed below.

Depressive Symptoms and Substance Use

Overall, adolescents who reported not using substances had the lowest depressive symptoms and the highest positive affect when compared to adolescents who reported using marijuana and both alcohol and marijuana. These results are consistent with previous findings demonstrating a co-occurring relationship between substance use and depression during adolescence (Diego et al., 2003; Fergusson, Horwood, & Swain-Campbell, 2002; Grant, Hasin, Chou, Stinson, & Dawson, 2004; Hussong & Chassin, 1994; Kaplow, Curran, Angold, & Costello, 2001; Kelder et al., 2001; Labouvie, 1986; Labouvie, Pandina, White, & Johnson, 1990; Poulin, Hand, Boudreau, & Santor, 2005; Silberg, Rutter, D'Onofrio, & Eaves, 2003; Waller et al., 2006). These results may lend support to the self-medication hypothesis, which suggests that adolescents are motivated to use alcohol and marijuana in an attempt to alleviate depressed mood (Khantzian, 1985). The self-medication hypothesis would also predict that the more depressive symptoms adolescents experience, the more substances they would use to alleviate these symptoms. However, this hypothesis suggests that depressive symptoms precede substance use. Given the cross-sectional nature of our data, we are unable to determine whether this is true for our sample and therefore must also consider that marijuana use and the combined use of alcohol and marijuana among our adolescent sample, particularly the females, may also be contributing to their increased experience of depressed mood (Conway et al., 2013; Degenhardt et al., 2003; Goodman & Capitman, 2000; Midanik et al., 2007; Pacek et al., 2012; Pacek et al., 2013).

As mentioned earlier, previous studies have examined the co-occurrence of substance use and a diagnosis of depression in adolescents, yet few have examined associations between the use of specific types of substances and depressive symptoms. Analyses examining these

differences revealed that adolescents who used marijuana, either with or without alcohol use, reported experiencing a greater number of depressive symptoms than adolescents who were in the no marijuana use groups. These findings are consistent with previous research demonstrating that depression worsens when marijuana is used in conjunction with other drugs than when marijuana is used alone (Hammer & Pape, 1997; Singer et al., 1995).

Gender Differences

Given research demonstrating higher prevalence of internalizing disorders in adolescent girls than adolescent boys, results indicating that females in our sample reported higher overall depressive symptoms than males are not surprising (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Further, examination of CES-D subscales revealed that while adolescent girls reported greater depressed affect, more somatic symptoms, and lower positive affect, there were no significant gender differences on interpersonal symptoms. This finding was surprising given the literature demonstrating associations between interpersonal stress and depressive symptoms in females (Cyranowski, Frank, Young, & Shear, 2000; Rudolph, 2002; Rudolph & Hammen, 1999). However, the absence of a significant gender difference in interpersonal symptoms may be the result of the fact that the CES-D Interpersonal Subscale contains only two items (“I felt people disliked me” and “I felt people were unfriendly towards me”) and had the lowest internal consistency of the subscales.

We predicted that females reporting any substance use would endorse a greater number of individual depressive symptoms as well as overall depressed mood than their male counterparts. Results from this study only partially supported this hypothesis. Females in either of the two marijuana use groups reported the highest depressed symptoms when compared to their female and male counterparts with no marijuana use history. These results are consistent with previous findings indicating that the co-occurring relationship between depressive symptoms and substance use is stronger for females than males (Locke & Newcomb, 2001). Previous research examining these gender differences help explain this result. For instance, a previous study found that alcohol-related problems among females were related to self-reported depressive symptoms, while alcohol-related problems among males were related to drinking to “feel high” (Harrell & Karim, 2008). Another study found that females were more likely than males to use alcohol to regulate negative affect (Nolen-Hoeksema, 2004). These previous findings may also help explain why males in the alcohol use only group had similar levels of depressive symptoms as adolescents in the no substance use group. Taken together, these gender differences may indicate that while females in our sample used alcohol and marijuana to self-medicate, males in our sample used these substances for recreational purposes.

Limitations

There are several limitations to the current study which must be taken into consideration when interpreting the results. First, the CES-D Interpersonal Subscale yielded a Cronbach's alpha coefficient of .50, which may have compromised the results generated from the current sample. Other studies have reported poor correlations between the Interpersonal subscale and the other CES-D subscales, while others have failed to find significant results with the Interpersonal subscale in studies with females, thus highlighting the weakness of this

particular subscale (Cole, Kawachi, Maller, & Berkman, 2000; Hertzog, Alstine, Usala, Hultsch, & Dixon, 1990; Pomerleau, Zucker, & Stewart, 2003). Future studies using the CES-D as a measure of depression may benefit from the addition of measures assessing interpersonal symptoms of depression to use in conjunction with the CES-D rather than relying solely on this particular subscale. Second, classifying marijuana users solely on their response to one marijuana use history question and the small number of participants in the marijuana use only group is also a limitation to the current study. The small size of the marijuana only group (n=33) may have affected our ability to detect significant differences between this group and the other much larger substance use groups. Finally, given the cross-sectional nature of the data collected, we are unable to determine the directionality of the associations between depressive symptoms and substance use. Therefore, whether adolescents in this sample are using substances to self-medicate depressive symptoms or whether substance use results in worse depressive symptoms remains unknown. Future studies examining the relationship between substance use and depression should examine causal relationships in adolescent substance use trajectories using longitudinal data collection.

Clinical Implications

Despite these limitations, there are several important clinical implications of this study. First, given that the majority of the adolescents in this study presented to the ED with substance use as a primary reason for admission, screening for depressed mood would be a useful addition to clinical decision making with these patients. Further, given that emergency departments offer a unique opportunity to identify these high-risk adolescents, development and implementation of referral procedures within an ED may be particularly beneficial for such settings and for these high-risk adolescents. These results also indicate the need for more thorough assessment and integrated treatment for both depressed mood and substance use, especially among females, after discharge from the ED (Johnston et al., 2013; Kosterman et al., 2010). Finally, these results along with previous research indicate the importance of prevention programs which focus on teaching and increasing the use of adaptive coping and affect management skills in general to address both mood and substance use.

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Table 1
Means & Standard Errors on the CES-D Total Score and CES-D Subscales by Substance Use Adjusted for Age

	No Substance Use ^a <i>n</i> = 257 Mean (SE)	Alcohol Use ^b <i>n</i> = 197 Mean (SE)	Marijuana Use ^c <i>n</i> = 33 Mean (SE)	Alcohol & Marijuana Use ^d <i>n</i> = 226 Mean (SE)	Group Differences
CES-D Total Score	16.35 (0.53)	14.73 (0.59)	19.25 (1.41)	19.14 (0.55)	a < d; b < c, d
Depressed Affect	2.05 (0.24)	2.71 (0.26)	4.21 (0.63)	4.16 (0.25)	a < c, d; b < d
Interpersonal	0.97 (0.09)	0.91 (0.10)	1.04 (0.24)	1.29 (0.09)	b < d
Somatic & Retardation	4.40 (0.25)	4.87 (0.27)	6.02 (0.66)	5.94 (0.26)	a, b < d
Positive Affect	9.72 (0.19)	8.95 (0.21)	8.37 (0.52)	7.88 (0.20)	d < a, b

Note: Significant differences among groups based on Scheffé' tests

SE = Standard Error

Table 2
Means and Standard Errors on the CES-D Total Score and Subscales by Gender and Substance Use Groups Adjusted for Age

	No Substance Use		Alcohol Use		Marijuana Use		Alcohol & Marijuana Use		Group Differences
	Males ^a <i>n</i> = 159 Mean (SE)	Females ^b <i>n</i> = 98 Mean (SE)	Males ^c <i>n</i> = 108 Mean (SE)	Females ^d <i>n</i> = 89 Mean (SE)	Males ^e <i>n</i> = 17 Mean (SE)	Females ^f <i>n</i> = 16 Mean (SE)	Males ^g <i>n</i> = 130 Mean (SE)	Females ^h <i>n</i> = 96 Mean (SE)	
CES-D Total Score	16.40 (0.66)	16.36 (0.82)	15.03 (0.78)	14.34 (0.86)	17.81 (1.93)	20.75 (1.98)	16.50 (0.71)	22.66 (0.82)	h>a,b,c,d,g
Depressed Affect	1.81 (0.29)	2.48 (0.36)	2.51 (0.34)	2.94 (0.37)	2.20 (0.85)	6.34 (0.87)	2.85 (0.31)	5.93 (0.36)	f,h>a,b,c,d,e,g
Interpersonal	0.96 (0.11)	1.00 (0.14)	0.85 (0.13)	0.98 (0.14)	1.07 (0.33)	1.01 (0.34)	1.10 (0.12)	1.54 (0.14)	h>a,c
Somatic & Retardation	4.43 (0.31)	4.39 (0.38)	4.96 (0.36)	4.74 (0.40)	4.77 (0.90)	7.33 (0.93)	4.92 (0.33)	7.31 (0.38)	h>a,b,c,d,g
Positive Affect	9.86 (0.24)	9.48 (0.30)	9.06 (0.29)	8.81 (0.32)	9.74 (0.72)	6.91 (0.74)	8.34 (0.26)	7.26 (0.30)	b>f; a>g,f; a,b,c,d,e>h

Note: Significant differences across groups based on Scheffe's test with Bonferroni correction.

Means represent age as covariates

SE = Standard Error;