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The Relationship Between Depressive Symptom Levels and Subsequent Increases in Substance Use Among Youth With Severe Emotional Disturbance*

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Abstract

Objective—This study examined the relationship between levels of depressive symptoms and subsequent increases in substance use among 784 youth with severe emotional disturbance enrolled in Medicaid-funded behavioral health care plans.

Method—Youth at five sites nationwide were interviewed about their emotional and behavior problems, as well as their use of cigarettes, alcohol, and drugs—at both baseline and follow-up.

Results—(1) Levels of depressive symptoms were significantly associated with concurrent substance use at baseline. (2) Baseline levels of depressive symptoms predicted subsequent changes in substance use, especially use of illicit drugs and multiple drugs. (3) These findings remained significant, even after controlling for sociodemographic, family, and individual characteristics.

Conclusions—These results indicate that depressive symptoms early in life may signal a risk for increasing involvement in substance use among severe emotional disturbed youth. This finding has important clinical implications for the prevention of substance misuse in this population.

Substance use and misuse in adolescents have long been matters of great public concern (Substance Abuse and Mental Health Services Administration, 2004). Also, increasing evidence has indicated that psychopathology plays a role as a risk factor for adolescent involvement in substance use and misuse (Brook et al., 1998; Bukstein et al., 1989; Costello et al., 1999; Deykin et al., 1987; Henry et al., 1993; Kandel et al., 1997; Kumpulainen and Roine, 2002; Rohde et al., 1996; Segal et al., 1980; Weinberg et al., 1998). Adolescents with severe forms of emotional disturbance are especially likely to have co-occurring substance use disorders (Aarons et al., 2001; Greenbaum et al., 1991; Kilian et al., 2006; Rao et al., 1999).

Individuals with these kinds of comorbid substance use and mental disorders have a worsened clinical course and outcome and are at increased risk for suicide, impairment, and disability (Hirschfeld et al., 1990; Kessler et al., 1996; Murphy, 1990; Svanum and McAdoo, 1989). Correlations between psychiatric disorders and substance use and abuse can be explained in

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several ways (Bukstein et al., 1989; Dierker et al., 2005; Meyer, 1986). One condition may have a direct causative effect on the other (i.e., depression may be a cause of substance abuse, or substance abuse or dependence may be a cause of depression); alternatively, third factors (either environmental or genetic) may influence both conditions in similar ways. Any combination of these three types of mechanisms may also be at work.

Longitudinal data provide us with the opportunity to elucidate the dynamic relationship between depression and substance use. Few of the previous studies on the co-existence of depression and substance use were longitudinal (Aalto-Setälä et al., 2002; Aneshensel and Huba, 1983; Bovasso, 2001; Breslau et al., 1998; Brook et al., 1998; Brown et al., 1996; Choi et al., 1997; Escobedo et al., 1998; Fergusson et al., 2003; Fergusson et al., 1996; Goodman and Capitman, 2000; Henry et al., 1993; King et al., 2004; Wang and Patten, 2001). Even fewer longitudinal studies focused on children and adolescents (Brown et al., 1996; Choi et al., 1997; Escobedo et al., 1998; Fergusson et al., 1996, 2003; Goodman and Capitman, 2000; Henry et al., 1993; King et al., 2004).

Among these longitudinal studies of youth, several found childhood depression to have a significant impact on age of onset of smoking (Brown et al., 1996; Escobedo et al., 1998; King et al., 2004); weaker evidence from some studies indicated that depression might also influence the likelihood of later becoming a daily, heavy, or dependent smoker (Breslau et al., 1998; Fergusson et al., 2003; Goodman and Capitman, 2000; King et al., 2004). A longitudinal study of high school students in New York State concluded that cigarette smoking and depressive symptoms had a fairly well-balanced reciprocal relationship and that a high level of either condition in a 10th or 11th grader predicted an increase in the other 1.5 years later (Windle and Windle, 2001).

Very few longitudinal studies of youth have examined the influence of depression on later use of substances other than tobacco. Of these studies, two that were performed in the United States (King et al., 2004; Wu et al., 2006) found early depression to be positively related to later alcohol use, whereas a New Zealand study found depression to have an impact only on later multiple drug use and not on alcohol or marijuana use (Henry et al., 1993).

It has long been recognized that progression of substance use in adolescents tends to begin with use of a single substance, usually either cigarettes or alcohol, later progressing to use of multiple substances, possibly including illegal drugs (Botvin et al., 2002; Golub and Johnson, 2002; Kandel, 2002). However, no previous study has, to our knowledge, taken this process of substance use development into account when examining the impact of depression on later changes in substance use. This article aims to begin to fill this gap. It examines the relationship between depression and use of cigarettes, alcohol, and other drugs in low-income adolescents diagnosed with severe emotional disturbance (SED). Also, it examines the impact of depressive symptoms on subsequent changes in patterns of substance use, controlling for sociodemographic and health-related factors that may be associated both with depressive symptoms and substance use. It is hoped that the findings will help to improve early identification and intervention programs for substance use and misuse in children with depression and other mental disorders.

Method

Sample

Data are from the Substance Abuse and Mental Health Services Administration-funded multisite Managed Behavioral Health Care in the Public Sector Study (Cook et al., 2004a,b). At each of five sites (Pennsylvania, New York, Oregon, Tennessee/Mississippi, and Ohio), Medicaid-eligible children (ages 4–17) with SED enrolled in Medicaid or Fee for Services

behavioral health plans were recruited into the study during May 1997 through May 1999. Children and youth with SED were defined as those having a Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994), diagnosis of mental disorder (excluding adjustment disorder that was viewed as too mild a diagnosis for inclusion in an SED population). Other criteria for inclusion were absence of a diagnosis of developmental disability; and use in the past year of intensive mental health services. Intensive services were defined as including inpatient, residential, day treatment, partial hospitalization, in-home support, rehabilitation, therapeutic foster care, special school, crisis services, intensive case management, and intensive outpatient mental health treatment (at least three visits per week) (Cook et al., 2004a). Of the 1,724 families interviewed at baseline (Wave 1), 88% ($n = 1,517$) completed follow-up (Wave 2) interviews 6 months later. For subjects younger than age 11, interviews were conducted with caregivers only. For those age 11 and older, interviews were conducted with the young subjects and their caregivers. Further details of the study procedures have been reported elsewhere (Cook et al., 2004a,b).

A subsample, consisting of those youth who were age 11 or older at Wave 1 and completed interviews at both waves ($n = 784$) was selected for inclusion in the current study. For this group, self-report information about substance use and depressive symptoms was available to us for both waves.

In the original study, data were checked for differences in attrition related to the child's age, gender, race/ethnicity, functional impairment, health status, symptomatology, and to the adult's level of caregiver burden. No statistically significant differences in attrition were found, except in relation to race/ethnicity. The families of white children were more likely to complete a follow-up interview, whereas the families of Hispanic children were less likely. Therefore, race/ethnicity is controlled in all of our multivariate analyses.

Measures

Substance use—Youth respondents were asked if they had ever used cigarettes, alcohol, cannabis, cocaine, amphetamines, barbiturates/sedatives, inhalants, hallucinogens, heroin/methadone, or other drugs. Those who reported lifetime use of a substance were also asked to report the number of days in the past month that they had used that particular substance. Because of the small number of children reporting use of each of the specific illicit drugs, all of the illicit drugs are combined into one category in our analyses.

Because the focus of our research was not only on adolescents' increases in use of particular substances but also on their progressions from cigarette and/or alcohol use to use of "harder" substances, variables were created to represent these progressions. These variables were used as outcome variables in our multinomial logistic regression analyses.

The outcome variable created for analyses related to cigarette use has the following five categories: (1) never smoked cigarettes (i.e., at both waves, reported never having smoked a cigarette); (2) no smoking increase or other substance use increase (i.e., had initiated smoking by Wave 1 but did not increase cigarette use between waves; also did not increase [or initiate] use of any other substance between waves); (3) smoking increase only (i.e., did increase [or initiate] cigarette use between waves but did not increase [or initiate] use of any other substance); (4) other substance use increase only (i.e., had initiated smoking by Wave 1 but did not increase cigarette use between waves; did, however, increase [or initiate] use of alcohol or other drugs); and (5) cigarette use increase *and* other substance use increase (i.e., the subject increased [or initiated] use of cigarettes and other substances [i.e., alcohol and/or illicit drugs] between waves).

The variable created for analyses related to alcohol use has the following five categories: (1) never used alcohol (i.e., at both waves, reported never having used alcohol); (2) no alcohol use increase or other substance use increase (i.e., had initiated alcohol use by Wave 1 but did not increase alcohol use level between waves; also did not increase [or initiate] use of any other substance between waves); (3) alcohol use increase only (i.e., did increase [or initiate] alcohol use between waves but did not increase [or initiate] use of any other substance); (4) other substance use increase only (i.e., had initiated drinking by Wave 1 but did not increase alcohol use between waves; did, however, increase [or initiate] use of cigarettes or other drugs); and (5) alcohol use increase and other substance use increase (i.e., increased [or initiated] use of both alcohol and another substance [i.e., cigarettes and/or illicit drugs] between waves). For these two analyses—changes in (1) cigarette use and (2) alcohol use—comparing Groups 3–5 of each set with the reference group (Group 1) provides a picture of the relationship between earlier depressive symptoms and later changes in patterns of substance use.

Illicit drug use is in a separate category from alcohol and cigarette use, because drug use generally begins after the onset of alcohol and/or cigarette use. For this reason, the variable we created for analyses related to illicit drug use has only the following three categories: (1) never used any illicit drug (i.e., at both waves reported never having used drugs); (2) no drug use increase (i.e., had initiated drug use by Wave 1 but did not increase drug use level between waves); and (3) drug use increase (i.e., increased or initiated use of illicit drug[s] between waves).

Baseline measures of depressive symptoms and externalizing behavioral problems—Children ages 11–18 completed the Youth Self-Report (YSR; Achenbach, 1991a,b). Twelve items from the YSR—covering (1) loneliness, (2) frequent crying, (3) self-harm, (4) talking about suicide, (5) feeling unloved, (6) feeling worthless, (7) being overtired, (8) excessive sleep, (9) inadequate sleep, (10) trouble sleeping, (11) underactivity, and (12) being depressed—made up our depression scale (Lengua et al., 2001). Children were assessed at both baseline and follow-up, but only the baseline measures of depressive symptoms were used in the current study.

The children's baseline depressive symptom counts were grouped into three categories—(1) low (zero to one depressive symptom), (2) medium (two to six depressive symptoms), and (3) high (seven or more depressive symptoms)—to create a ranked variable used as a predictor for changes in substance use over time. The cut-off score of seven symptoms was chosen because it represents the 75th percentile for our sample.

The YSR also provides a measure of child externalizing behavior problems (Achenbach, 1991a,b). Because externalizing behavior problems have frequently been found to be associated with both substance use and depressive behaviors (Henry et al., 1993; King et al., 2004; Wu et al., 2006), baseline levels of this score were used as a control variable in our analyses.

Other measures—Sociodemographic data—including child age, gender, and race/ethnicity—were available from parent interviews. Family structure variables included family composition (i.e., one vs two parental figures), as reported by the parent informant. Child-perceived health information was taken from the child interview. Children were asked if their health was excellent, with the choices of answers being “definitely true,” “mostly true,” “don't know,” “mostly false,” and “definitely false.” Poor perceived health was defined as a response of “definitely false.”

Statistical analysis

After obtaining descriptive statistics on the sample, we conducted chi-square tests to examine the bivariate relationship between Wave 1 substance use and depressive symptom levels. Finally, we assessed the relationship between Wave 1 levels of depressive symptoms and subsequent increases in substance use, using multinomial logistic regression analysis for categorical outcomes of increases in substance use. The regression analyses were conducted hierarchically. For our Model 1 analyses, baseline level of depressive symptoms was used as the main predictor, while controlling for study site. For Model 2 analyses, sociodemographic and family factor covariates (e.g., child age, gender, ethnicity, and child not living with two parents) were also controlled. Finally, in Model 3, measures of child-perceived poor health and child externalizing behavioral problems were also added into the equation. This hierarchical analysis, controlling for the covariates mentioned previously, was conducted to determine if the associations found between early depressive symptoms and subsequent increases in substance use could be explained by shared associations with these other factors.

Results

Descriptive and bivariate analyses

In Table 1—among the 784 children included in the current study—65.7% were boys, 44.3% were from minority groups, and 70.4% were not living in traditional two-parent households. At baseline, the children's ages ranged from 11 to 17, with a mean age of 13.7. In terms of substance use, the rates of lifetime use of cigarettes, alcohol, and illicit drugs among these children were 50.9%, 42.7%, and 31.5%, respectively. High levels of depressive symptoms (i.e., seven or more symptoms) were reported by 21.7% of the sample.

Table 2 displays the results of bivariate analyses of the cross-sectional relationships, at baseline, between depressive symptom levels and substance use. For example, among child respondents with high levels of depressive symptoms, 41.7% had ever used illicit drugs, whereas only 20.8% of the children with low depressive symptom levels had used drugs. Depressive symptom levels were also significantly associated with current smoking. The relationships with current alcohol use and drug use were nonsignificant, although this may be the result of low overall rates of past-month use, especially with regard to illicit drugs.

Impact of depressive symptoms on increases in substance use

Table 3 shows the results of multinomial logistic regression analyses focusing on the longitudinal relationships between baseline levels of depressive symptoms, and changes in levels of substance use between Wave 1 and Wave 2 (a 6-month interval). These analyses used Wave 1 depressive symptom levels (contrasted in two ways, i.e., medium vs low and high vs low) as the main predictor of subsequent changes in substance use status. For details on the definitions of the substance-use-related categories, please refer to the Method section.

Cigarette use

The results for Model 1 show that those children who had high levels of depressive symptoms (seven or more symptoms) at baseline were more likely to initiate or increase use of substances other than cigarettes (Group 4; adjusted odds ratio [AOR] = 2.42, $p \leq .05$), in some cases in conjunction with initiations or increases in smoking (Group 5; AOR = 2.77, $p \leq .001$), compared with those with low levels of depressive symptoms. This pattern also held true in Model 2, where demographic and family factors were controlled. However, in Model 3, where externalizing behavior problems and health status were further controlled, these associations weakened and were no longer statistically significant.

Alcohol use

Model 1 results focusing on alcohol use show that children with high levels of depressive symptoms at baseline were more likely to initiate or increase either only their alcohol use (Group 3; AOR = 2.09, $p \leq .05$) or their use of both alcohol and other substances (Group 5; AOR = 3.01, $p \leq .001$), compared with those with low levels of depressive symptoms.

A similar pattern was observed in Model 2 when demographic and family factors were controlled. However, when child externalizing behaviors and health status were further controlled in Model 3, only the association between depressive symptom levels and increases in both alcohol use and other substance use remained significant (Group 5).

Illicit drugs

Model 1 results focusing on illicit drugs show that children who had either high depressive symptoms (AOR = 3.28, $p \leq .001$) or medium depressive symptoms (AOR = 2.03, $p \leq .01$) at Wave 1 were significantly more likely to increase or initiate use of illicit drugs by Wave 2, compared with those with low depressive symptoms. These effects remained significant even after controlling for sociodemographic factors (Model 2) and child externalizing behavior problems (Model 3).

Among the covariates at family and individual levels, only child age and externalizing behavior problems were significantly associated with the substance use outcome variables.

Although results from the bivariate analyses shown in Table 2 indicate that the relationship between depression and concurrent smoking level was just as strong as the relationships between depression and concurrent alcohol use and illicit drug use, results of our multivariate longitudinal analyses indicate that earlier depressive symptom levels were not independently predictive of later increases in cigarette smoking. Results also showed that these depressive symptom levels were independently predictive of increases in use of both alcohol and illicit drugs, even when child age, gender, ethnicity, and family structure (Model 2) were controlled. When child externalizing behavior problems and child perceived health (Model 3) were also controlled, the predictive relationship with alcohol use was no longer significant, but depressive symptoms did remain significantly predictive of illicit drug use increases.

Discussion

Although longitudinal studies have been conducted examining the impact of depression on subsequent substance use behaviors, few studies have worked toward providing a general picture of the impact of depressive symptoms not only on use of individual substances but also on overall processes of substance use development. The adolescent period is a crucial one for the development of substance use—a development that generally begins with use of a single substance, usually cigarettes or alcohol, and later progresses to use of multiple substances that may include illegal drugs. It is important to find ways to take this developmental pattern into account when studying the co-occurrence of internalizing disorders and substance use/misuse among adolescents. This article has tried to do so.

The results of our analyses suggest that there are significant positive associations between depressive symptoms and substance use in this population of low-income youth with SED. Our findings of cross-sectional relationships between depressive symptoms and substance use in general are consistent with previous research in children (Angold and Costello, 1993; Brook et al., 1998; Bukstein et al., 1989; Castro et al., 1988; Costello et al., 1999; Deykin et al., 1987; Henry et al., 1993; Kandel and Davies, 1982; Kandel et al., 1997; Kumpulainen and Roine, 2002; Rohde et al., 1996; Segal et al., 1980; Weinberg et al., 1998; Wu et al., 2006).

Findings from our multinomial logistic regression analyses indicate that, in general, depressive symptoms do have an impact on adolescents' substance use pathways. Higher levels of depressive symptoms may lead to increased substance use involvement (e.g., progression from use of a single substance to use of multiple substances, or from use of licit substances only to use of illicit drugs).

In our sample, Wave 1 depressive symptom levels were most strikingly predictive of two types of subsequent changes in substance use over the 6-month interval: (1) increases in use of illicit drugs alone and (2) combined increases in use of multiple substances. Depressive symptoms were also moderately predictive of increases in alcohol use. With regard to cigarettes, however—the most commonly used substance in our sample—Wave 1 depressive symptoms were not independently predictive of changes in cigarette use.

Wave 1 levels of depressive symptoms were contrasted in two ways in our regression analyses: (1) medium versus low and (2) high versus low. Not surprisingly, the odds ratios for substance use changes for the high versus low contrasts were generally higher than those for the medium versus low contrasts. The relationship between depressive symptoms and changes in alcohol use (alone) was significant only for the high versus low contrast, not for the medium versus low contrast. For illicit drugs, however, even a relatively small difference in depressive symptom levels—medium versus low—was significantly associated with increases in use levels and remained so even when sociodemographic, family, and individual characteristics were entered into the model. Our results also showed child externalizing behavior problems associated with both depressive symptoms and substance use. Analyses that do not control for these behavior problems may overestimate the relationship between depressive symptoms and subsequent changes in substance use.

The stronger predictive relationships found here between earlier depressive symptoms and later use of illicit drugs and alcohol (as opposed to use of cigarettes) and between depressive symptoms and multiple substance use (as opposed to use of single substances) are consistent with the findings of Henry et al. (1993) and King et al. (2004). These findings are also consistent with those of a national cross-sectional study of adults (Kandel et al., 2001), which found that rates of depression were much more strongly associated with dependency on multiple substances than on single substances (Kandel et al., 2001).

Although our findings demonstrate that adolescents' depressive symptoms may be predictive of later increases in their substance use involvement, they do not prove that these symptoms are a direct cause of those increases. Substance dependence is very frequently found to be comorbid with depression, a fact that can be explained in terms of evidence that use of licit or illicit drugs may disrupt the functioning of systems in the brain that are responsible for internally generating sensations of pleasure. Such disruptions could lead simultaneously to increases in symptoms of both depression and substance dependence, although symptoms of each of these disorders may also reinforce the symptoms of the other disorder (Bruijnzeel et al., 2004).

This study is limited in several ways. The study's sample was one of adolescents with SED enrolled in Medicaid-financed behavioral health care plans; caution is, therefore, needed in generalizing findings to adolescents in the larger community. Another limitation is that our information on depression was only at the symptom, and not the diagnostic, level. Also, a substance use increase, as defined here, could be either an onset of use of a new substance or an increase in the individual's level of use of a substance. Thus, depressive symptoms' relationship with subsequent substance use initiations is not distinguished, in these analyses, from their relationship with subsequent escalation of use of particular substance(s). Additionally, there were only two waves of data collection, with the second occurring 6 months

after the first. Thus, we were unable to examine the research questions from a longer term perspective or to analyze trajectories of change in such a way as to avoid confounding true change with measurement error (Rogosa et al., 1982; Singer and Willet, 2003). Our findings can only suggest, but not demonstrate, causal effects. More prospective studies, including both community survey studies and genetically oriented ones, are needed to better understand the role of depressive symptoms in changes of substance use in youth. Our findings do, however, contribute to furthering understanding of the relationship between emotional problems and substance use progression in adolescents.

Our finding that depressive symptoms early in life may signal a risk for increasing involvement in substance use in SED children has important clinical implications for the prevention of substance use in this population. Early identification and treatment of depressive symptoms may help in preventing increases in substance use. Also, it is important to screen for depressive symptoms when treating youth with substance use-related problems.

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TABLE 1

Sample characteristics at baseline ($n = 784$)

Characteristic	% or mean	<i>n</i> or (SD)
Age, mean (SD)	13.7	(1.98)
Gender, %		
Boys	65.7	515
Girls	34.3	269
Race/ethnicity, %		
White	55.7	437
Black	32.0	251
Hispanic	7.2	56
Other	5.1	40
Living with two parents, %		
No	70.4	552
Yes	29.6	232
Smoking, %		
Ever	50.9	399
Past month	27.0	212
Drinking, %		
Ever	42.7	335
Past month	12.1	95
Drug use, %		
Ever	31.5	247
Past month	9.4	74
Depressive symptom count, % ^a		
Low (1)	22.4	173
Medium (2–6)	55.9	432
High (7–12)	21.7	168
Externalizing behavior		
Problems, mean (SD)	16.3	(9.06)
Poor health, %		
No	89.4	701
Yes	10.6	83

^aThere were 11 cases with depressive symptom information missing.

TABLE 2

Proportions with substance use at baseline, by baseline depressive symptom levels

Variable	Level of depressive symptoms			<i>p</i> ^a
	Low (<i>n</i> = 173) % (<i>n</i>)	Medium (<i>n</i> = 432) % (<i>n</i>)	High (<i>n</i> = 168) % (<i>n</i>)	
Lifetime use				
Cigarettes	38.2 (66)	51.9 (224)	63.1 (106)	<.0001
Alcohol	30.6 (53)	43.3 (187)	54.8 (92)	<.0001
Other drugs	20.8 (36)	32.2 (139)	41.7 (70)	.0002
Past-month use				
Cigarettes	19.1 (33)	27.6 (119)	35.7 (60)	.0027
Alcohol	8.7 (15)	9.3 (40)	14.3 (24)	.1413
Other drugs	5.8 (10)	10.4 (45)	11.3 (19)	.1484

^aChi-square test.

TABLE 3

Depressive symptom levels at baseline and subsequent changes in substance use

Changes/nonchanges in substance-use behaviors by Wave 2	Level of depressive symptoms at baseline					
	Model 1 ^a		Model 2 ^d		Model 3 ^d	
	Medium ^b vs low ^c AOR (95% CI)	High ^d vs low AOR (95% CI)	Medium vs low AOR (95% CI)	High vs low AOR (95% CI)	Medium vs low AOR (95% CI)	High vs low AOR (95% CI)
Cigarette related						
(1) Never smoked cigarettes (<i>n</i> = 339)	1.0	1.0	1.0	1.0	1.0	1.0
(2) No smoking increase or other substance use increase (<i>n</i> = 255)	0.98 ^e	1.92	0.95	1.77	0.56	0.75
(3) Smoking increase only (<i>n</i> = 73)	(0.42–2.31)	(0.73–5.07)	(0.40–2.30)	(0.64–4.90)	(0.22–1.44)	(0.24–2.43)
	1.35	1.19	1.31	1.12	0.90	0.58
(4) Other substance use increase only (<i>n</i> = 67)	(0.69–2.66)	(0.49–2.89)	(0.64–2.71)	(0.43–2.88)	(0.42–1.90)	(0.20–1.62)
	1.53	2.42 [*]	1.55	2.63 [*]	1.22	2.03
(5) Smoking increase and other substance use increase (<i>n</i> = 39)	(0.77–3.03)	(1.09–5.37)	(0.76–3.16)	(1.14–6.06)	(0.59–2.53)	(0.84–4.91)
	1.54	2.77 [‡]	1.53	2.72 [‡]	1.24	1.78
Alcohol related						
(1) Never used alcohol (<i>n</i> = 381)	1.0	1.0	1.0	1.0	1.0	1.0
(2) No alcohol use increase or other substance use increase (<i>n</i> = 213)	0.97	1.68	0.86	1.41	0.47	0.57
(3) Alcohol use increase only (<i>n</i> = 29)	(0.46–2.05)	(0.71–3.99)	(0.39–1.91)	(0.56–3.58)	(0.20–1.10)	(0.20–1.65)
	1.80	2.09 [*]	1.82	2.22 [*]	1.43	1.73
(4) Other substance use increase only (<i>n</i> = 98)	(0.98–3.32)	(1.01–4.33)	(0.96–3.43)	(1.04–4.77)	(0.74–2.74)	(0.71–3.89)
	0.99	0.95	1.06	1.09	0.78	0.76
(5) Alcohol use increase and other substance use increase (<i>n</i> = 52)	(0.40–2.45)	(0.29–3.11)	(0.40–2.84)	(0.30–3.93)	(0.28–2.16)	(0.19–2.97)
	1.79 [*]	3.01 [‡]	1.78 [*]	2.96 [‡]	1.44	2.15 [*]
Illicit drugs	(1.12–2.85)	(1.75–5.15)	(1.09–2.89)	(1.68–5.24)	(0.87–2.39)	(1.16–3.99)

Changes/nonchanges in substance-use behaviors by Wave 2	Level of depressive symptoms at baseline					
	Model 1 ^a		Model 2 ^a		Model 3 ^a	
	Medium ^b vs low ^c AOR (95% CI)	High ^d vs low AOR (95% CI)	Medium vs low AOR (95% CI)	High vs low AOR (95% CI)	Medium vs low AOR (95% CI)	High vs low AOR (95% CI)
(1) Never used any illicit drug (<i>n</i> = 506)	1.0	1.0	1.0	1.0	1.0	1.0
(2) No drug use increase (<i>n</i> = 200)	1.47 (0.73–2.99)	1.83 (0.80–4.17)	1.43 (0.68–2.99)	1.72 (0.71–4.15)	0.93 (0.43–2.04)	0.80 (0.30–2.14)
(3) Drug use increase (<i>n</i> = 67)	2.03 [†] (1.24–3.32)	3.28 [‡] (1.88–5.70)	2.17 [†] (1.27–3.71)	3.73 [‡] (2.01–6.90)	1.84 [*] (1.06–3.18)	2.86 [‡] (1.48–5.53)

Notes: AOR = adjusted odds ratio; CI = confidence interval.

^aModel 1: Site was controlled; Model 2: Site, child age, gender, race/ethnicity, and not living with two parents were controlled; Model 3: In addition to the variables controlled for in Model 2, child externalizing behavior problems and child perceived health were also controlled here

^bmedium = 2–6 symptoms

^clow = 0–1 depressive symptoms

^dhigh = ≥7 symptoms.

* *p* £ .05

[†] *p* £ .01

[‡] *p* £ .001.