Depression and Substance Use in Minority Middle-School Students

ABSTRACT

Objectives. This study investigated the association between depression and substance use in a sample of middle-school students.

Methods. The 5721 students (59%–63% Hispanic) completed self-report items on depressive symptoms, recent smoking and binge drinking, and lifetime use of marijuana, cocaine, and inhalants.

Results. Symptoms of depression were strongly and positively related to substance use. For every type of use, a stepwise increase was seen between the percentage of students with low symptom frequency and the percentage of students with more symptoms. A sizable number of users reported symptoms indicating major depression. Depression scores showed few clinically meaningful differences among demographic subgroups. Substance use scores, in contrast, showed meaningful intergroup differences for racial/ethnic group and other demographic variables.

Conclusions. Depressive symptoms and substance use were associated in a sample of middle-school students who were largely non-White and predominantly Hispanic. Greater understanding of the nature of this association is needed; this understanding should be used to design prevention programs, and prevention programs should be introduced at least in the middle-school years. (*Am J Public Health.* 2001;91:761–766)

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Adolescents' use of potentially addictive and harmful substances continues to be a public health problem. For example, the 1999 Monitoring the Future Study of students in eighth grade found the following 30-day prevalence figures: cigarette smoking, 17.5%; marijuana use, 9.7%; inebriation, 9.4%; cocaine use, 1.3%; and inhalant use, 5.0%.[1] Sizable proportions of adolescent substance users reported beginning that use by age 14 (about grade 8): 33% for alcohol, 27% for smoking, and 7% for marijuana.[2]

Efforts to deal with this problem have included attempts to identify factors that predict the initiation or the maintenance of substance use.[3] Depression is a factor that may be important. Cross-sectional studies of adolescents showed that depression was related to a variety of unhealthy behaviors, such as cigarette smoking,[4] alcohol consumption,[5] and substance use.[6,7] In longitudinal studies, depressive symptoms in teenagers aged 15 to 16 years were positively related to the teenagers' smoking status 9 years later,[8] a previous diagnosis of major depressive disorder was 3 to 4 times more common in students with a history of alcohol abuse or substance use than in control subjects,[9] and depressed mood predicted first-time use of marijuana and other illicit drugs in secondary-school students.[10]

Conversely, depressive symptoms were preceded by cigarette smoking in a large national sample of adolescents aged 12 to 18 years.[11] According to a 1996 review of literature from the past decade on children and adolescents, the comorbidity of major depressive disorder and substance use ranged between 20% and 30%, and depression preceded the initiation of alcohol or substance use by 4.5 years.[12] Although these studies reflect a complex mix of temporality, cause, and effect, all of them described a significant association between depression and substance use.

The prevalence of manifestations of depression among adolescents has been estimated to be 10% to 40% for depressed mood, 5% for depressive syndrome, and 0.4% to 8.7% for clinical depression.[12–16] The prevalence can vary among racial/ethnic groups. In a large sample of middle-school students from 9 racial/ethnic groups, Mexican American and White youths had the highest rates of depression, and African American and Asian youths had significantly lower rates.[15] If depression predicts or has a causal relation to substance use, then this level of depression in the adolescent population suggests the need for better understanding of whether, why, and how depression may contribute to substance use and, in turn, how preventive strategies aimed at depression may combat substance use.

Although many adolescents begin using substances by 14 years of age (about grade 8), few of the studies described above examined students at 14 years or younger. Furthermore, little is known about the relation of depression and substance use in adolescents from racial/ethnic minorities. In this exploratory study, we investigated whether self-reported symptoms

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of depression were associated with self-reported substance use in a sample of middle-school students who were largely Hispanic (61%) and African American (22%). We took advantage of an opportunity provided by a longitudinal intervention study (the Students for Peace Project[17]); the findings from these secondary analyses are suggestive rather than definitive.

Methods

Design

In this article, we describe a cross-sectional analysis of survey data. Participants were a sample of students in grades 6, 7, and 8 who attended school in the Houston, Tex, Independent School District. Cross-sectional data were collected at the baseline of the 3-year Students for Peace study, which was a school-based intervention to prevent violence in Texas urban middle schools.[17] When we designed the Students for Peace study, we wanted to include several variables that might be related to violence and that might both help us explain any differences in treatment effects among schools and allow us to examine relations such as the one we explore in this article. The present research question about depression and substance use was therefore not that study's primary purpose. We believe it was nevertheless worth examining.

Sample

The study sample came from one of the largest urban areas of the United States. The Houston Independent School District is the district for the city of Houston, which is the fourth largest city in the United States. From the pool of 33 district middle schools, we identified the largest schools that had not participated in any other violence prevention study. Administrators at 9 of the 21 eligible schools (schools had 900–1900 students) responded to our invitation to participate in the study. After we explained the intervention study, administrators at 8 schools agreed to participate. In 1994, we administered survey questionnaires to students in grades 6, 7, and 8 at the 8 district middle schools. These 8 schools formed a convenience sample for the main Students for Peace intervention study. Students at the selected schools appeared to be representative of the district's other schools of similar size.

The 8 schools had 9950 registered students. We administered the survey questionnaire to 8858 (89%) students in these schools. The depression items were at the end of the long questionnaire, and not all students had time to complete those items. After applying an imputation algorithm to salvage all potentially valid depression data (see details in the "Measuring Depression" subsection later in this article), we arrived at a sample of 5721 students with satisfactory data for this analysis.

TABLE 1—Characteristics of Middle-School Students, by Grade in School: Houston, Tex, 1994

	Grade in School		
	6 (n=1914)	7 (n=1828)	8 (n=2164)
Age, y			
Mean	12.12	13.15	14.16
SD	0.78	0.79	0.80
Sex, %			
Female	49.6	54.1	53.1
Male	50.4	45.9	46.9
Race/ethnicity, %			
Hispanic	59.2	61.4	62.7
African American	21.8	22.2	20.8
White	11.0	9.0	10.5
Asian	4.5	3.9	3.6
Other	3.4	3.3	2.4
Usual marks, %			
A's & B's	47.2	39.7	35.6
B's & C's	39.6	44.0	46.6
C's & D's	10.6	13.4	14.7
D's & F's	2.5	2.9	3.1

The sample was largely non-White (as is the district's student population as a whole). At each of the 3 grade levels, Hispanic, African American, Asian, and other non-White students made up 89% to 91% of the original sample, and Hispanics predominated (59%–63%) (Table 1). Samples at each grade level had similar proportions of girls and boys and of usual marks (Table 1). On the basis of criteria such as disciplinary actions, usual marks (A's, B's, C's, D's, or F's), and family income, school administrators at each school judged from 35% to 80% of the students in their schools to be at risk for dropping out of school (district average=50%). The percentage of students in each school who received free or cost-reduced lunches ranged from 37% to 61% (district average=55%). Almost one third of the students' parents had not completed high school, 50% of the students lived with both biological parents, and 70% of the students lived with either both biological parents or 1 biological parent and 1 stepparent. Students in the "other" category of race/ethnicity were not included in the analyses reported here.

Survey Instrument and Administration

The paper-and-pencil survey questionnaire contained 121 items to collect 3 types of information: matters related to the violence prevention study, level of depression, and substance use. Prestudy pilot testing of the survey questionnaire, in 95 students, indicated high student comprehension of the survey items. All student responses were confidential: students received a unique identifier that they entered on the answer form. Two survey items had students give their race/ethnicity and their usual marks.

Before the study began, we obtained approval to administer the survey questionnaire from both the University of Texas–Houston Committee for the Protection of Human Subjects and the school district's research department. We also obtained parents' approval by sending letters, signed by the school principal, that explained the evaluation's purpose and content. A parent could deny approval by signing the letter and returning it to the school. Students who did not wish to complete the questionnaire or whose parents denied approval (fewer than 50 students altogether) performed another activity while their classmates completed the questionnaire.

Students completed the survey questionnaire during homeroom periods or gym classes, which lasted 45 to 60 minutes. Trained data collectors administered the questionnaire. For students who were absent at the initial administration, we made at least 2 attempts during the following 2-week period to locate the students and administer the questionnaire.

Measuring depression. We used the 26-item DSM Scale for Depression (DSD)[15,18] to assess students' recent depressive symptoms. The scale is a self-report checklist developed specifically for use with adolescents. The items are indexed to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV),* criteria for major depressive disorder.[19] Responses indicate the frequency (from "hardly ever" to "almost every day") of experiencing each event during the past 2 weeks. The scale's internal consistency exceeded 0.90 in

several studies of adolescents.[15,18] The Cronbach α for this sample was 0.91. The scale demonstrated good concurrent validity with other commonly used depression checklists for adolescents and adults ($r>0.65$).[18] The scale score also correlated significantly with these constructs: loneliness ($r>0.50$), self-esteem and mastery ($r>-0.50$), social support ($r>-0.30$), and coping ($r>-0.30$).[18]

We created 3 variables to describe the students' depression status: (1) frequency of depressive symptoms (DSD scores), divided into quintiles; (2) prevalence of major depression according to *DSM-IV* diagnostic criteria; and (3) frequency of depressive symptoms (DSD scores) during the past 2 weeks (a continuous measure ranging from 0 to 78). The quintiles were derived empirically and represented the prevalence of DSD scores in each of 5 ranges of scores. We chose to report the data in quintiles because these categories best illustrated the underlying trends in the data; quintiles represented the data better than did percentiles of lower or higher value. The range of DSD scores within each quintile was 0 to 8 for quintile 1, 9 to 15 for quintile 2, 16 to 22 for quintile 3, 23 to 30 for quintile 4, and 31 to 78 for quintile 5.

Scores for the second variable, major depression, reflected the standard *DSM-IV* definition of a major depressive episode. That definition states that 5 or more specified symptoms must have been present during the same 2-week period (most of the day, nearly every day) and must represent a change from previous functioning. The 9 specified symptoms are (1) depressed mood; (2) markedly diminished interest or pleasure in all, or almost all, activities; (3) significant weight loss when not dieting, weight gain, or decrease or increase in appetite; (4) insomnia or hypersomnia; (5) psychomotor agitation or retardation; (6) fatigue or loss of energy; (7) feelings of worthlessness or excessive or inappropriate guilt; (8) diminished ability to think or concentrate, or indecisiveness; and (9) recurrent thoughts of death, recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide. At least 1 of the symptoms must be depressed mood or loss of interest or pleasure.

A valid DSD score requires responses for all 26 items. To deal with missing values for students who had 3 or fewer missing values, we used an imputation algorithm. We calculated each item's mean across the sample for sex, race/ethnicity, and grade level and then replaced missing values with the appropriate means. We applied the algorithm to data for the 604 students who originally had 3 or fewer missing values. Point estimates for samples with and without these students with imputed values varied only slightly. We therefore included the students with imputed values in our final sample and increased considerably the power of our statistical tests. Data from students who had more than 3 missing values were discarded from the analyses.

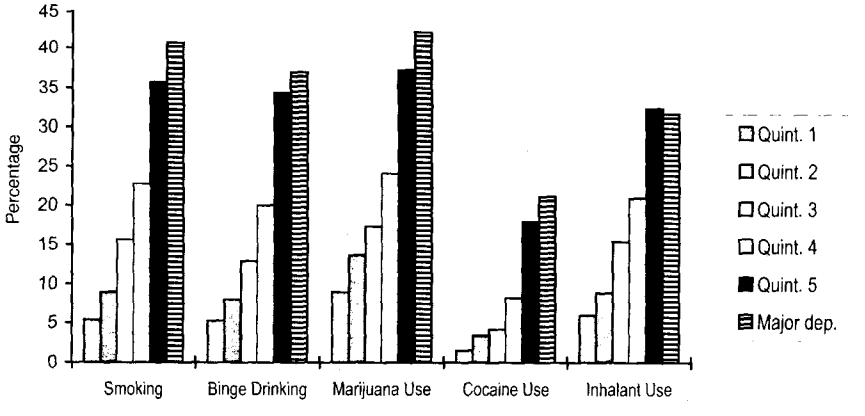
Measuring substance use. We selected 1 item per substance group from the Youth Risk Behavior Survey[20] to measure prevalence of smoking and of alcohol, marijuana, cocaine, and inhalant use. Responses indicate the 30-day frequency of cigarette smoking, the 2-week frequency of binge drinking, and lifetime frequencies of illicit drug use (marijuana, cocaine, and inhalants). The reliability of these items has proved acceptable (κ statistic for smoking = 0.76, drinking = 0.64, marijuana use = 0.87, and cocaine use = 0.73).[21]

Statistical procedures. To assess the relation between depression and substance use, we calculated univariate statistics and performed cross-tabulations. To further evaluate the relation between depression and substance use, we then developed logistic regression models for all analyses; quintile of depression scale score was used as the predictor variable, and substance use was used as the dependent variable, and we adjusted for the possible confounders of sex, usual marks, school grade, and race/ethnicity. We included a school term in each model to adjust for variation in the dependent variable at the school level. In all analyses, this term was highly nonnsignificant, so no evidence showed our results to vary by school.

To assess the statistical importance of variables, we calculated Wald statistics or either change-in-likelihood or conditional-likelihood ratio tests. We derived a final main effects logistic regression model by using backward stepwise variable selection and retaining variables for which the significance level was less than .05. To assess model fit, we calculated Hosmer–Lemeshow goodness-of-fit statistics[22]; as all showed $P>.05$, the models adequately fit the data. We also evaluated models for overdispersion. All analyses were performed with SAS 6.11.[23]

Results

In this sample of minority middle-school students, high numbers of reported depressive symptoms characterized the students who reported substance use (Figure 1). For every type of substance use examined here, high depressive symptom frequencies, as represented by quintiles 4 and 5 of DSD scores, were more prevalent than low symptom frequencies (quintiles 1 and 2). Indeed, for each type of substance use, a stepwise increase was seen between the percentage of students with the lowest symptom frequencies (quintile 1) and the percentage of students with the highest symptom frequencies (quintile 5). For example, for students who reported using marijuana during their lifetimes, 9% of the students reported 0 to 8 depressive symptoms (quintile 1), 14% reported 9 to 15 symptoms (quintile 2), 17% reported 16 to 22 symptoms (quintile 3), 24% reported 23 to 30 symptoms (quintile 4), and 37% reported 31 to 78 symptoms (quintile 5). Of particular note is that for every type of substance use, a sizable number of users reported



Note. Depression score categories are from the DSM Scale for Depression.[15,18] Quint. = quintile; dep = depression.

FIGURE 1—Frequency distributions for depression score categories (quintiles) in middle-school students, by type of substance use: Houston, Tex, 1994.

TABLE 2—Relation in Middle-School Students Between Depression Score Categories[a] (Quintiles) and Substance Use: Houston, Tex, 1994

Comparisons[b]	Smoking (n=5681)		Binge Drinking (n=5678)		Marijuana Use (n=5678)		Cocaine Use (n=5679)		Inhalant Use (n=5673)	
	OR[c]	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Q1	1.0		1.0		1.0		1.0		1.0	
Q2	1.8	1.3, 2.5	1.5	1.1, 2.2	1.7	1.3, 2.2	2.3	1.3, 4.0	1.5	1.1, 2.1
Q3	3.2	2.3, 4.3	2.5	1.8, 3.5	2.1	1.6, 2.8	2.6	1.5, 4.6	2.8	2.1, 3.7
Q4	4.9	3.6, 6.7	4.2	3.0, 5.7	3.2	2.5, 4.2	5.3	3.1, 9.1	4.0	3.0, 5.4
Q5	9.1	6.8, 12.3	8.7	6.4, 11.7	6.1	4.7, 7.9	13.5	8.1, 22.6	7.0	5.3, 9.3
Major depression (n=75)	10.0	6.9, 14.6	9.4	6.4, 13.7	7.6	5.4, 10.9	15.4	8.7, 27.6	5.7	3.9, 8.2

Note. OR=odds ratio; CI=confidence interval; Q=quintile.
[a]From DSM Scale for Depression.[15,18]
[b]Q1 was lowest scores (reference category), Q5 was highest scores. Major depression was compared with Q1.
[c]OR adjusted for sex, race/ethnicity, and usual marks.

symptoms consistent with a *DSM-IV* diagnosis of major depressive episode (Figure 1). Again, as exemplified by marijuana use, 42% of the students had symptoms indicating major depression.

The stepwise increase in symptom frequency signaled an increasing level of risk for substance use at each higher quintile of depressive symptom frequency (Table 2), and all prevalence odds ratios were significant at $P<.05$, according to the 95% confidence intervals. For example, students who reported 9 to 15 depressive symptoms (quintile 2) had a 1.7 risk of using marijuana, compared with students who reported 0 to 8 symptoms (quintile 1); students who reported 31 to 78 depressive symptoms (quintile 5) had a 6.1 risk of using marijuana, compared with quintile 1 students. In addition, students whose symptoms suggested major depression had a 7.6 risk of using marijuana, compared with quintile 1 students. Students who had the most depressive symptoms (quintile 5) were the most likely to use each of the substances examined here: 13.5 times greater likelihood (compared with students in quintile 1) for cocaine use, 9.1 times greater likelihood for tobacco smoking, 8.7 times greater likelihood for binge drinking, 7.0 times greater likelihood for inhalant use, and 6.1 times greater likelihood for marijuana use.

Supporting findings emerged from analyses of the 2 other variables that we used to describe depression. First, when students with symptoms suggesting major depression were compared with students with few depressive symptoms (quintile 1), the likelihood of using a substance ranged from 5.7 for inhalants to 15.4 for cocaine (Table 2; all odds ratios significant at $P<.05$). Second, analysis of the DSD score as a continuous variable rather than as a categoric (quintile) variable showed that the increased risk at each incremental unit on the scale ranged from 1.04 to 1.06 ($P<.001$ for all substances), with β weights ranging from 0.0460 to 0.0562.

For most demographic characteristics, depressive symptom scores (means for entire sample) were generally similar in the various subgroups (Table 3). Although depressive symptom variables among subgroups for sex, race/ethnicity (only for mean DSD score), usual marks, and grade in school (only for mean DSD score) had statistically significant differences, most differences among point estimates seemed clinically nonsignificant. An exception was the usual marks of students with symptoms indicating major depression: more students (10.4%) with poor marks scored as depressed than did students with moderate or high marks (6.0% and 3.5%, respectively).

In contrast, substance use differed significantly, both statistically and clinically, among various subcategories of demographic characteristics (Table 3). For all 5 types of substances examined here, more boys reported using substances than did girls. For most types of substance use, more Hispanic students reported use than did other groups of students (the exception was marijuana use, for which the highest prevalence was in African American students and the second highest was in Hispanic students). For all types of substance use, the lowest prevalence was in Asian students. White students ranked second in prevalence for smoking and inhalant use, whereas African American students ranked second for binge drinking and cocaine use. For all types of substances, a systematic relation was found between usual marks and prevalence of use: the poorer the marks, the greater the prevalence of use. For all types of substances, the prevalence of use increased systematically with each higher grade in school. The increase was most dramatic for marijuana use (increased 139% between grades 6 and 8) and binge drinking (increased 103%). The increase was least for inhalant use (increased 33%).

Discussion

The results presented here show that self-reported symptoms of depression were associated with self-reported substance use in a sample of minority middle-school students. The risk of substance use increased in a dose–response fashion with each higher level (quintile) of depression symptom frequency (DSD score), and all of the prevalence odds ratios describing this risk were significant at $P<.05$, according to the 95% confidence intervals (Table 2). Additionally, analogous results were obtained from analysis of the DSD score as a continuous variable, and the association existed for all 5 types of substance use that we examined.

Our finding supports and adds to existing knowledge. It is consistent with findings of other studies that used a variety of populations and methods.[4–12] Most previous studies described the association in high school students. Our study expands knowledge by describing the association in younger middle school students (aged approximately 12–14 years). Few studies have focused on minority students. Our study focused on non-White, predominantly Hispanic students who were poor and attended school in a large city.

Our finding in this cross-sectional analysis receives support from exploratory analyses that we performed on a cohort's longitudinal data from the Students for Peace intervention study. Students in the cohort (n=1694 in year 1; n≤979, depending on the variable, in year 3) answered the substance use items (but not the depression items) yearly for the 2 years following the baseline (this cross-sectional) assessment. In the second year, the association between depressive symptoms and substance use persisted to a significant degree ($P<.05$) in students whose DSD scores were in the higher quintiles (4 and 5) for smoking and binge drinking; in the third year, the association was significant for binge drinking in those students.

TABLE 3—Depression and Substance Use in Middle-School Students, by Demographic Characteristics: Houston, Tex, 1994

	Depression						Substance Use									
	Major Depression			Mean DSD Score			Smoking Past 30 Days			Binge Drinking Past 2 Weeks			Marijuana Use Lifetime			Cocaine Use Lifetime			Inhalant Use Lifetime		
	n	%	P^a	Mean	SD	P^b	n	%	P^a	n	%	P^a	n	%	P^a	n	%	P^a	n	%	P^a
Gender			<.05			<.01			<.01			<.01			<.01			<.01			<.01
Female	2991	6.5		22.0	13.7		2987	14.7		2986	13.1		2987	14.9		2985	4.3		2983	15.4	
Male	2730	4.8		19.8	12.8		2718	20.9		2716	19.2		2715	26.1		2718	10.1		2714	18.2	
Race/ethnicity			<.83			<.01			<.01			<.01			<.01			<.01			<.01
Hispanic	3609	5.9		21.9	13.4		3597	20.2		3599	17.7		3599	21.2		3598	7.9		3595	18.0	
African American	1274	5.5		20.0	13.0		1271	12.9		1266	15.6		1270	23.0		1270	6.3		1267	14.1	
White	601	5.5		17.9	13.6		601	17.1		601	11.8		599	14.9		601	5.3		600	16.2	
Asian	237	4.6		19.5	12.6		236	6.4		236	3.8		234	3.4		234	2.1		235	11.9	
Usual marks			<.01			<.01			<.01			<.01			<.01			<.01			<.01
A's & B's	2309	3.5		18.2	12.3		2305	8.5		2303	7.6		2305	9.5		2305	3.3		2300	11.9	
B's & C's	2495	6.0		22.0	13.4		2490	20.5		2489	18.6		2488	23.3		2487	8.3		2486	18.1	
C's & D's or F's	892	10.4		25.1	14.3		886	33.7		886	30.9		885	39.8		887	13.2		887	25.3	
Grade in school			<.44			<.01			<.01			<.01			<.01			<.01			<.01
6	1848	5.1		20.7	12.9		1839	12.6		1839	10.9		1842	11.7		1841	5.4		1836	14.2	
7	1765	5.9		20.4	13.4		1762	18.2		1761	14.2		1760	19.9		1759	5.9		1761	16.6	
8	2108	6.0		21.6	13.7		2104	21.6		2102	22.1		2100	28.0		2103	9.4		2100	18.9	

Note. DSD = DSM Scale for Depression.
[a]Chi-square test.
[b]One-way analysis of variance.

The evidence that depressive symptoms and substance use are associated in adolescents, from this study and previous studies, leads to questions about the precise nature of the association. Several longitudinal studies,[8-10] but not all,[11] indicated that depression has a causal relation to initiation of substance use. Depressed adolescents may self-medicate with tobacco, alcohol, and drugs to regulate feelings of depression or to cope with psychologic stressors.[9] That adolescents with mood disorders may use substances to reduce negative affect and provide stimulation is biologically plausible.[24] For example, nicotine stimulates dopamine release,[25,26] inhibits dopamine reuptake,[26,27] and activates and desensitizes midbrain neurons.[28]

Another causal possibility is that both depressive symptoms and substance use arise from a factor or factors that have not yet been identified or measured. For example, depression and substance use may be responses to exogenous life stressors,[29] such as violence in the family, poor academic achievement, lack of supportive friends, and boyfriend or girlfriend difficulties. Alternatively, depression and substance use may be related to endogenous factors, such as a biological predisposition, poor coping skills, and low self-esteem. Future research must explore these possibilities.

We need to understand the nature of the relation between depression and substance use, because that relation may affect the design of interventions to prevent substance use. Although encouraging evidence suggests that prevention programs can be effective, findings on the effectiveness of prevention or cessation programs for adolescent substance use, and especially for use of illicit substances, have been mixed. Interactive programs to prevent smoking and use of alcohol and illicit drugs have proved effective, but those effects often have been small.[30-32] This lack of consistent success suggests that we need to learn more about the causes of adolescent substance use, so that prevention programs can address those causes and could even be tailored to specific adolescents.

If a causal relation does exist between depression and initiation or maintenance of substance use, then failing to address adolescent depression reduces the likelihood that preventive measures will succeed. In addition, a frequent concomitant of depression is lack of motivation, and some adolescents who are depressed may fail to benefit from prevention programs simply because they lack the motivation to participate in the programs. Furthermore, our finding of an association between depression and substance use in middle-school students, along with existing evidence that sizable proportions of adolescent substance users began that use by 14 years of age,[2] suggests that prevention efforts should begin at least in the middle-school years.

In this sample of students, the prevalence of symptoms consistent with a diagnosis of major depression (Table 3; 6.5% for females, 4.8% for males) is consistent with findings from other studies.[12–16] The actual prevalence in our sample may have been higher than shown. The DSD items were at the end of the survey. If depressed students also were disproportionately slower in completing the survey, then they may not have completed the depression scale and therefore may not be included in our prevalence figures. Whatever the precise figure, this level of major depression in adolescents is of public health import.

We urge caution in interpreting the results presented here. We measured depression only once and in reference to feelings during the past 2 weeks. We cannot say whether use of a trait depression measure would yield results similar to those we report here. Others have documented the stability of depression (trait) in adolescents,[33,34] however, so it is reasonable to ask whether depression, even at a young age, may play a role in the onset of substance use. Our measure of use of marijuana, cocaine, and inhalants was lifetime use, which is not as specific a measure as annual or 30-day use. Because this was a secondary analysis, we had to use the measures at hand. Future studies should use depression and substance use measures with the same referent time. Finally, schools in the Students for Peace sample were selected by convenience and may not be representative of the larger population of adolescents within the school district.

We have shown that depressive symptoms and substance use were associated in a sample of largely non-White, predominantly Hispanic middle-school students (aged 12–14 years). This finding suggests that we must better understand the nature of this association, that we should incorporate new knowledge about the association into the design of substance use prevention programs, and that we should introduce prevention programs at least in the middle-school years. □

Contributors

S. H. Kelder, the principal investigator and the lead and corresponding author, planned the study, designed the study, and wrote the paper. N. G. Murray edited the drafts of the paper and wrote the "Methods" section. P. Orpinas, the co-principal investigator, edited the drafts of the paper and assisted in data analysis. A. Prokhorov provided expert advice on nicotine and addiction and read and edited the drafts of the paper. L. McReynolds, a student, read and edited the drafts of the paper, performed a literature review, and prepared the tables. Q. Zhang analyzed the data. R. Roberts, an expert on adolescent depression, read and edited the drafts of the paper.

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