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How Substance Use Differs Among American Secondary Schools

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Abstract The purpose of this study was to examine (1) the extent to which student drug use and related measures vary among American secondary schools, and (2) how substance use varies among schools by certain school characteristics. Data come from the Monitoring the Future project's annual surveys of nationally representative samples of 8th-, 10th-, and 12th-grade students from 1991 to 2002.

The results show that the preponderance of variance in drug use and related variables lies *within* schools; only a relatively small amount of variance is *between* schools. Although the variance lies primarily within schools, there remain important school-to-school differences in the extent to which students are exposed to drug use.

The analyses of school characteristics show that schools do indeed differ in drug use by their students, particularly by school type, socioeconomic status, and race/ethnicity. Eighth and 10th grade (but not 12th grade) students in public schools are more likely to be cigarette smokers than students in private schools. Students in public middle schools are at higher risk for use of alcohol and marijuana; however, among 12th graders, students in Catholic schools are at higher risk. School size is generally unrelated to substance use, with few exceptions. For the most part, there is a negative association between school socioeconomic status and student substance use among 8th graders; but by 12th grade, the association tends to be positive or not significant. Racial/ethnic composition is significantly associated with student substance use, with majority African American schools typically showing the lowest rates of use at all grades.

Keywords Substance use · School characteristics · Intraclass correlation

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Substance use among American secondary school students varies by many factors at a number of levels, including individual, family, school, neighborhood, community, and state levels. This article focuses on the extent to which student drug use and related measures vary among American secondary schools, and on how drug use varies by selected school characteristics. One important reason for considering the extent to which student drug use varies by school is to identify factors that could be manipulated to reduce student drug use. For example, if larger schools tend to have higher rates of student drug use than smaller schools, this may suggest the likely utility of reducing school size. A second important reason for considering the extent to which student drug use varies by school is that this sets outer limits on the extent to which school-level variables such as school size can explain variation in student use. If 95% of the variance in use of marijuana is within schools, then a school-level factor could explain at most 5% of the total variance. And similarly, factors at higher levels of aggregation–for example, community or state–likewise could explain at most 5% of the variance. It should be noted that this "outer limit" does not preclude higher percentages of explained variance in the future if schools become more differentiated in their

substance use than they are at present and/or more differentiated on dimensions of importance to the outcomes. A third reason for considering the extent to which student drug use varies by school is that this information is necessary in assessing power for interventions that employ schools as a unit of inference. Several reports have provided estimates of the extent of variation-such estimates are termed intraclass correlation coefficients – for various measures of substance use and other health-related behaviors and attitudes (Murray & Short, 1996, 1997; Murray et al., 2002; Scheier, Griffin, Doyle, & Botvin, 2002; Siddiqui, Hedeker, Flay, & Hu, 1996). Unlike this other research, the present study provides such information for large, nationally representative samples of schools, for three grade levels (8th, 10th, and 12th), and across a dozen years (1991–2002).

The second focus of this report is on how student substance use varies by important demographic and structural school characteristics including school type (public, private Catholic, and private non-Catholic), school size (number of students in the sampled grade), school socioeconomic status (as indicated by average parental education, reported by students), and racial/ethnic composition (derived from student self-identification). While there have been some investigations of these characteristics in prior research (e.g., Ennett, Flewelling, Lindrooth, & Norton, 1997; O'Malley, Bachman, & Johnston, 1988; Skager & Fisher, 1989), we report here on nationally representative samples, detailing differences observed in several recent years (2000 through 2002). Other important demographic characteristics that could be examined include region of country and population density; because these characteristics have been extensively discussed elsewhere (Johnston, O'Malley, Bachman, & Schulenberg, 2005), they are not examined further here but are used as control variables in multivariate analyses.

Substance-using behaviors (including cigarette, alcohol, and illicit drug use) are the focus of this article. But we also provide information on some other related dimensions, including disapproval of drug use and perceived availability of drugs.

Method

This study utilizes data from 8th, 10th, and 12th graders who participated in the University of Michigan's Monitoring the Future (MTF) project. The design and methods are summarized briefly below; more detailed descriptions are available elsewhere (Bachman, Johnston, & O'Malley, 2001; Johnston et al., 2005). The study employs a multistage sampling design to obtain nationally representative samples of 8th-, 10th-, and 12th-grade students from the 48 contiguous states. Data have been collected annually from 12th graders since 1975 and from 8th and 10th graders since 1991. The sampling procedures involve three stages: first, geographic regions are selected; second, schools are selected–approximately 420 each year; third, between 42,000 and 49,000 students are sampled each year from within those schools. University of Michigan representatives collect the data from the students, who complete a self-administered, machine-readable questionnaire during a normal class period. Student response rates have averaged 90, 86, and 84% for 8th, 10th, and 12th graders, respectively, during the study. Absence on the day of data collection was the primary reason that students were missed; it is estimated that less than 1% of students refused to complete the questionnaire. Schools are asked to participate for two years. Refusal schools are replaced by another school matched as closely as possible on demographic dimensions, including type of school, region, urbanicity, and size.

Use of alcohol and of various illicit drugs during the respondent's lifetime, the last 12 months, and the last 30 days are measured by questions having a standard, close-ended format with seven response alternatives as follows: (1) 0 occasions, (2) 1–2 occasions, (3) 3–5, (4) 6–9, (5) 10–19, (6) 20–39, and (7) 40 or more occasions. An additional question asks about heavy use of alcohol (how many times in the last two weeks the respondent had five or more drinks in a row); response alternatives range from 1 (None) to 6 (10 or more times). Cigarette use is measured by a question that asks about smoking in the past 30 days, with response categories ranging from none to 2 or more packs per day. A series of questions asks the respondent how much he or she disapproves of others using various drugs at various levels of intensity. Response categories were: don't disapprove; disapprove; strongly disapprove; can't say, drug unfamiliar. Availability is ascertained by asking how difficult it would be for the respondent to obtain a specific drug if he or she wanted some. Response categories were: probably impossible; very difficult; fairly difficult; fairly easy; very easy; can't say, drug unfamiliar.

School characteristics used in this study are school type (public, Catholic private, non–Catholic private), school size (number of students enrolled in the particular grade that participated in the MTF survey), race/ethnicity of the student body, and average parental education (a proxy for socioeconomic status). The latter two measures are based on an aggregate measure of the individual answers provided by the students surveyed in the school. For race/ethnicity, students were asked "How do you describe yourself?" and could check one of nine categories. These were aggregated to the school level, and schools were characterized as (1) predominantly white, if 66% or more students were white; (2) majority African American (50% or more); (3) majority Hispanic (50% or more); or (4) other. For parental education, respondents reported mother's and father's education on a six-point scale ranging from less than a high school diploma to graduate school. Father's and mother's education were averaged

(unless the educational level of only one parent is reported). Additional between-school measures used as control variables in multivariate regressions are geographical region of the country and population density.

Analyses were conducted with the SAS statistical analysis system (SAS Institute, 1999). The data were weighted in order to adjust for differential probabilities of selection of the sample.

Results

A note on prevalence rates

Before presenting results, it may be useful to note briefly how substance use rates vary by grade, by specific substance, and what the recent trends have been. In general, use rates increase with age; thus, 8th graders tend to be lowest and 12th graders highest. One exception is that inhalant use is reverse-ordered, with 8th graders highest and 12th graders lowest. The licit drugs, cigarettes and alcohol, have by far the highest prevalences. Of the illicit drugs, marijuana is the most prevalent, and heroin the least prevalent. From the early 1990s through about 1996 or 1997, use of illicit drugs increased rather sharply. From the peak levels reached in those years, almost all illicit drugs showed decreases that continued through 2002. Cigarette smoking followed a similar pattern of a sharp rise followed by a decrease. Alcohol, on the other hand, was much less volatile, showing only modest changes through the 1991 to 2002 interval.

Variance between schools

Table 1 provides the percentage of variance (the intraclass correlation coefficient, ICC) that is between schools for use of cigarettes (3 measures) and alcohol (2 measures), separately for grades 8, 10, and 12, for the years 1991–2002. About 3 to 6% of the variance in smoking cigarettes in the past 30 days lies between schools. Somewhat more variance was between schools among 12th graders (average 5.2%), compared to 10th (4.2%) and 8th (4.4%) graders. The amount of between-schools variance generally increased through the twelve year period (1991–2002) for 8th and 10th graders but not for 12th graders. The pattern is similar for the two other measures of cigarette smoking in the past 30 days (daily use, and use of one-half pack or more per day), though the amount of between-schools variance tends to be lower–particularly for the relatively rare half-pack use among 8th graders.

Alcohol use in the past 30 days shows a range of about 2 to 7% between-schools variance. As with cigarettes, somewhat more variance lies between schools among 12th graders (average 6.1%), compared with 10th (3.8%) and 8th (3.5%) graders. There was little systematic trending in the interval from 1991 to 2002. A measure of heavy drinking displays a pattern that is very similar to the 30-day prevalence measure, at slightly lower values.

Table 1 Use dichotomy: Percent variance between schools by grade, 1991–2002 cigarettes and alcohol

	Year												
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
Cigarettes, 30-day													
8th	3.5	3.2	3.0	2.9	5.4	3.5	3.9	4.7	5.3	6.2	4.8	6.0	4.4
10th	3.6	3.7	3.6	3.3	3.4	3.4	4.2	5.1	5.6	4.6	5.1	5.3	4.2
12th	4.8	5.1	5.4	5.5	4.7	6.6	5.6	5.4	5.1	6.1	5.2	3.5	5.2
Cigarettes, daily													
8th	2.9	1.9	2.7	2.5	3.1	3.1	3.1	3.4	4.1	4.7	3.1	4.6	3.3
10th	3.8	2.7	3.1	3.1	3.3	3.0	4.2	4.8	5.6	4.4	4.5	5.6	4.0
12th	4.6	4.2	5.4	5.2	5.1	5.3	5.0	5.3	5.0	5.4	5.1	3.8	4.9
Cigarettes, 1/2 pack^{+} per day													
8th	1.9	1.3	1.7	1.3	1.6	1.7	2.2	2.5	3.1	2.5	2.9	2.8	2.1
10th	4.4	1.4	2.5	1.9	2.5	2.2	3.4	4.1	4.2	3.0	4.6	4.4	3.2
12th	3.6	3.5	4.9	5.4	5.1	4.5	4.7	4.6	4.7	4.2	4.3	4.1	4.5
Alcohol, 30-day													
8th	3.7	3.3	2.3	2.9	4.3	2.7	2.6	3.9	3.1	5.1	3.9	3.8	3.5
10th	3.2	4.2	4.2	2.7	3.4	2.9	3.4	4.6	5.3	4.5	2.3	4.4	3.8
12th	7.0	6.7	4.9	5.4	5.7	7.4	6.4	7.0	5.8	6.6	5.5	5.1	6.1
Heavy drinking, 5^{+}, 2 weeks													
8th	3.8	2.2	2.2	2.4	4.3	2.1	2.4	2.5	3.9	4.2	3.3	3.8	3.1
10th	2.5	3.5	3.5	2.9	3.2	2.2	3.0	4.0	5.0	4.2	3.2	3.2	3.4
12th	6.6	6.1	3.7	4.4	4.2	7.3	6.5	5.7	5.5	6.4	5.0	5.2	5.6

Table 2 Use dichotomy: Percent variance between schools by grade, 1991–2002 illicit drugs (marijuana, cocaine, heroin, inhalants, index of any illicit drug)

	Year												
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
Marijuana, 12-month													
8th	3.0	3.4	4.5	4.4	4.5	5.4	4.4	4.8	4.9	6.1	4.7	5.0	4.6
10th	3.6	4.9	4.8	5.4	3.4	3.1	3.7	2.5	4.4	3.9	3.9	4.0	4.0
12th	6.8	4.3	5.9	4.0	5.0	6.1	5.6	5.9	5.0	5.0	4.2	5.9	5.3
Marijuana, 30-day													
8th	2.0	2.1	3.7	3.6	3.7	4.1	3.4	3.5	3.8	5.6	4.0	4.2	3.7
10th	3.6	3.6	3.0	3.8	3.1	2.3	2.7	2.0	3.9	3.5	3.1	3.1	3.1
12th	5.2	3.8	4.7	3.0	4.8	5.2	5.0	4.9	4.0	4.2	3.9	4.4	4.4
Cocaine, 12-month													
8th	0.5	0.8	1.3	1.9	1.0	0.9	0.8	2.2	1.3	1.8	1.3	1.0	1.2
10th	1.0	1.0	0.6	1.2	0.8	1.3	1.7	1.3	2.0	1.8	1.8	2.2	1.4
12th	1.5	1.8	2.6	2.0	2.2	4.4	2.0	1.7	2.7	2.4	1.1	1.6	2.2
Heroin, 12-month													
8th	0.6	0.3	0.5	0.4	0.5	0.6	0.4	0.9	0.5	0.7	0.8	0.5	0.6
10th	0.2	0.3	0.2	0.1	0.3	0.4	0.4	0.5	0.6	0.7	0.0	0.9	0.4
12th	0.6	0.3	0.2	0.5	0.8	0.6	0.8	0.8	1.2	1.2	0.4	0.7	0.7
Inhalants, 12-month													
8th	2.7	2.4	2.6	2.8	2.9	3.2	2.7	4.2	2.1	2.6	1.9	2.2	2.7
10th	1.4	1.0	1.4	2.0	2.2	1.9	1.9	1.5	1.7	1.4	1.0	1.2	1.6
12th	2.2	1.8	2.3	1.9	1.7	3.3	3.3	2.9	1.0	3.0	1.8	1.6	2.2
Any illicit drug, 12-month													
8th	2.1	2.3	3.3	3.7	4.4	4.3	3.8	4.2	4.6	5.1	4.4	4.6	3.9
10th	2.8	4.2	3.8	4.2	2.9	2.8	3.1	1.9	4.6	3.8	3.5	3.8	3.5
12th	5.6	3.6	5.2	3.3	4.4	5.8	5.0	5.4	4.8	5.0	4.0	5.3	4.8

Table 2 provides the percentage of variance that is between schools for use of selected illicit drugs (marijuana, cocaine, heroin, inhalants, and an index of any illicit drug use), again separately for grades 8, 10, and 12, for the years 1991–2002.

The index of use of any of the illicit drugs in the prior 12 months averages about 3.5% to almost 5% in amount of between-schools variance. As with cigarettes and alcohol, 12th graders tend to show more between-schools variance than 8th and 10th graders. In the interval from 1991 to 2002, 8th graders tended to increase in the amount of between-schools variance while 10th and 12th graders did not vary systematically.

Among the four specific illicit drugs, marijuana shows the largest amount of between-schools variation, averaging about 4 to 5% for annual use, and 3 to 4% for 30-day use. In the interval from 1991 to 2002, 8th graders tended to increase in the amount of between-schools variance while 10th and 12th graders did not vary systematically; this was also true for the overall index of illicit drug use, of which marijuana is a very important component.

Annual prevalence of inhalant use averages about 1.6 to 2.7%, with no systematic trending in the amount of between-schools variance. Annual prevalence of cocaine use averages about 1.2 to 2.2%. In the interval from 1991 to 2002, 10th graders tended to increase in the amount of between-schools variance while 8th and 12th graders did not vary systematically. Annual prevalence of heroin use averaged only about 0.4 to 0.7%, with no systematic trending.

In sum, with respect to specific illicit drugs, marijuana shows the most evidence of variation by school. Inhalants and cocaine show only a moderate amount, while heroin shows very little.

In general, for both licit and illicit drugs, the amount of variance between schools tends to vary with prevalence rates, with higher prevalence being associated with higher amounts of between-schools variance. Thus, cigarettes and alcohol have the highest proportions, followed by marijuana. Inhalants and cocaine are lower, and heroin lower still. Because 12th graders generally have higher prevalence rates than 10th and 8th graders, the percentage of variance between schools tends to be highest for the 12th graders. The sole exception is in the case of inhalants, for which 8th graders actually have the highest prevalence of annual use. The increases in percentage of between-schools variance observed between 1991 and 2002 for some substances and some grade levels are probably due largely to the increases observed in actual use rates. An exception to this general rule occurs for cigarette use among 8th and 10th

graders. From 1991 to 1997 all but two of the ICCs for 30-day cigarette prevalence were less than 4.0%, and from 1998 to 2002 all were over 4.0%. In contrast, use rates increased from 1991 to 1997 and declined thereafter. One possible contributor to this unusual pattern may have been several state-wide anti-smoking media campaigns aimed at youth. Some of the programs appeared to have been successful in reducing smoking rates (e.g., Emery et al., 2005; Friend & Levy, 2000), and if that increased *between-states* variance in student smoking, that would be reflected in *between-schools* variance. (If campaigns were more successful with younger students, that might explain why the changes in ICCs were most pronounced among 8th and 10th graders.)

Disapproval of substance use

An important measure of school climate is the overall student acceptance or disapproval of substance use (Kumar, O'Malley, Johnston, Schulenberg, & Bachman, 2002). Table 3 provides information on the extent to which disapproval of use of cigarettes, alcohol, and marijuana varies between schools. Disapproval of smoking a pack or more of cigarettes per day averages 2.5% to 3.1% of variance between schools. Disapproval of alcohol at various levels of use (try one or two drinks, take one or two drinks nearly every day, have five or more drinks once or twice each weekend) varies widely in the extent of between-schools variance; the averages range from 2.2% to 7.3%. Disapproval of marijuana at various levels of use (try marijuana once or twice, smoke occasionally, smoke regularly) varies almost as widely; averages range from 2.5% to 6.3% of variance between schools. The proportions of between-schools variance associated with most of these measures show no systematic trends over time, with one exception: the percentage of between-schools variance associated with 8th-grade disapproval of smoking generally increased from 1991 to 2002.

In general, the percentage of variance between schools is higher when prevalence values are near 50%, and lower when the prevalence of the attitude or behavior is closer to 0% or 100%. Thus, for example, 8th graders tend to have high disapproval of heavy weekend drinking (about 80% disapprove), while 12th graders are less disapproving (about 65%); and, accordingly, 12th graders show a

Table 3 Disapproval dichotomy: Percent variance between schools by grade, 1991–2002

	Year												
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
Cigarettes, one or more packs per day													
8th	2.1	1.8	2.2	2.5	2.8	2.3	2.3	2.9	2.6	2.5	2.7	3.1	2.5
10th	3.1	2.7	2.5	2.7	2.8	2.8	3.0	3.4	3.5	3.5	3.1	2.3	3.0
12th	2.8	1.8	2.5	3.3	3.1	4.0	3.9	3.8	3.2	2.9	3.1	2.8	3.1
Alcohol, 1–2 times													
8th	4.3	4.4	4.1	2.8	4.2	3.7	2.9	4.5	3.4	4.1	4.3	3.5	3.9
10th	5.4	6.5	5.9	4.6	3.8	5.0	4.4	5.6	7.6	5.9	4.0	4.5	5.3
12th	9.4	7.7	6.9	6.6	7.3	8.4	6.9	7.3	6.1	7.0	5.9	8.3	7.3
Alcohol, 1–2 drinks every day													
8th	2.2	2.0	1.6	1.9	2.9	1.8	2.1	2.3	3.0	2.4	2.2	2.2	2.2
10th	2.3	2.1	2.5	1.7	1.9	2.1	1.9	2.3	3.5	3.5	2.8	2.1	2.4
12th	3.2	2.1	1.8	2.0	1.7	3.8	2.8	3.3	2.8	2.4	2.4	2.2	2.5
Heavy drinking, 5 or more drinks 1–2 times each weekend													
8th	3.1	2.3	2.1	2.2	2.9	2.8	2.6	3.0	4.1	3.7	2.8	2.6	2.9
10th	3.2	3.1	4.1	3.3	3.0	2.5	3.4	3.3	4.7	4.8	3.4	3.1	3.5
12th	5.5	4.5	3.6	3.7	2.6	6.1	4.2	5.1	3.6	4.5	3.9	3.7	4.2
Marijuana, 1–2 times													
8th	4.0	5.8	5.2	4.8	4.5	5.1	3.9	5.4	4.2	4.4	3.6	4.2	4.6
10th	4.1	7.3	7.0	6.7	4.4	3.9	4.5	4.5	5.6	5.3	3.9	4.6	5.2
12th	7.5	6.0	5.7	5.7	7.2	8.0	6.4	7.6	5.3	5.8	5.4	5.6	6.3
Marijuana, occasionally													
8th	2.4	2.9	3.8	4.1	3.8	4.4	3.8	4.8	3.9	4.0	3.1	3.8	3.7
10th	3.2	4.9	4.9	5.5	3.4	2.9	3.3	2.8	4.7	4.0	4.0	4.4	4.0
12th	4.7	3.7	4.5	4.1	5.8	6.5	5.0	6.7	5.3	4.8	4.4	4.2	5.0
Marijuana, regularly													
8th	2.3	1.7	3.1	3.7	2.5	3.4	3.6	3.4	3.9	4.1	3.1	2.7	3.1
10th	1.8	2.6	2.9	2.4	2.0	1.9	2.1	1.8	3.5	3.1	2.5	3.1	2.5
12th	1.8	1.4	3.0	2.2	3.9	4.0	2.8	3.7	3.0	3.0	3.2	2.3	2.9

Table 4 Availability dichotomy: Percent variance between schools by grade, 1992–2002

	Year											
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
Cigarettes												
8th	2.1	2.9	3.0	3.3	2.8	2.9	2.8	2.8	2.6	3.5	3.1	2.9
10th	2.0	3.1	1.7	2.7	1.8	2.1	3.4	3.3	3.6	2.2	4.0	2.7
12th	—	—	—	—	—	—	—	—	—	—	—	—
Alcohol												
8th	2.7	2.5	2.0	3.3	2.4	2.5	2.4	2.6	2.7	3.2	3.1	2.7
10th	2.6	2.6	1.4	2.0	1.9	1.9	1.8	3.1	3.9	1.9	2.9	2.3
12th	—	—	—	—	—	—	—	—	—	—	—	—
Marijuana												
8th	5.6	6.5	6.9	6.3	4.7	5.4	4.8	5.1	4.0	4.9	4.4	5.2
10th	6.0	8.5	9.2	7.5	4.0	3.1	3.7	6.4	4.6	2.5	3.3	5.3
12th	4.3	6.1	7.3	7.5	4.4	3.3	5.4	2.5	3.6	2.9	5.4	4.7
LSD												
8th	3.8	3.8	2.9	2.7	2.2	3.4	3.2	2.7	2.3	2.7	1.4	2.7
10th	5.1	6.0	5.5	6.0	5.1	4.3	4.5	3.9	2.7	3.2	3.6	4.5
12th	5.1	6.4	6.4	7.7	9.3	6.2	6.6	3.9	4.0	3.9	3.3	5.6
Heroin												
8th	2.7	3.4	2.5	1.7	1.5	3.0	2.1	2.0	2.3	3.0	2.0	2.4
10th	4.1	3.3	2.5	2.4	1.6	3.2	1.7	2.4	1.9	2.4	1.9	2.7
12th	6.2	4.5	3.9	4.6	4.2	6.0	4.6	3.7	3.0	7.5	5.0	4.9
Amphetamines												
8th	3.1	2.3	2.5	3.2	2.3	3.0	2.3	2.5	2.1	3.5	2.9	2.6
10th	2.4	3.9	3.9	3.7	3.7	2.8	4.4	3.7	2.4	3.9	5.3	3.7
12th	5.4	6.3	6.1	5.8	5.4	7.6	5.8	5.8	4.6	7.3	6.8	6.0

higher proportion of between-schools variance than do 8th graders.

Availability of substances

Another potentially important indicator of substance use problems at the school level is the availability of drugs. Table 4 shows the extent to which the reported availability of various selected substances, licit and illicit, varies between schools from 1992 to 2002. (Some of the questions about availability were changed between 1991 and 1992, so 1991 is not included here.) Availability of cigarettes and alcohol has not been asked of 12th graders, because it was believed that these substances are readily available to the great majority. As shown in Table 4, the availability of cigarettes and alcohol varies only slightly between schools, less than does actual use. For cigarettes the variance between schools averages 2.8%, and for alcohol, 2.5%; in each case, variance between schools is slightly higher for 8th- than for 10th-grade students. Availability for selected illicit drugs varies by substance. Marijuana has a relatively high degree of variance between schools, at about 5% for all grades. LSD, heroin, and amphetamines are at about 5% to 7% for 12th graders and under 3% for 8th graders, with 10th graders intermediate. Trends for availability of marijuana and LSD show declining proportions of variance between schools, indicating that schools are becoming more alike in the extent to which these substances are available. The diminution in between-school differences in LSD availability may be one result of a sharp decline in LSD use nationally, with a reduction in availability a likely important contributor to that decline (Johnston et al., 2005). The other substances do not show systematic trending.

School characteristics

The second objective of this study is to provide information on how student substance use varies by selected school characteristics, including school type (public, Catholic private, other private), school size (number of students in the sampled grade), school socioeconomic status (as indicated by average parental education, reported by students), and racial/ethnic composition (derived from student self-identification).

Table 5 (a and b) shows the percentage of students, separately for 8th, 10th, and 12th graders, who use various substances by school characteristics. Data for the years 2000, 2001, and 2002 are combined to provide sufficient numbers of cases. Two columns labeled “Biv.” and “Mul.” provide for each school characteristic (a) the statistical significance associated with the characteristic in a bivariate model that uses the characteristic by itself, with no other variables predicting the substance use (asterisks indicate the statistical

Table 5 Percentage of users of various substances by school characteristics and grade, 2000–2002 combined data

	(a)									
	Type of school									
		Private				Size of school grade				
Grade	Public	Catholic	Other	Biv.	Mul.	<75	75–225	>225	Biv.	Mul.
Approximate Wtd N										
8th	43894	2697	1471			10835	17256	19973		
10th	39350	1993	1206			4926	17094	20387		
12th	35379	3287	490			5634	18113	15409		
Cigarettes, 30-day										
8th	13.2	6.3	4.1	***	+	11.9	13.8	11.9		
10th	21.3	17.7	13.7	***	+++	26.8	21.8	18.9	**	++
12th	28.8	33.2	27.2		+	33.8	30.3	26.2		
Cigarettes, daily										
8th	6.4	1.9	1.8	***		5.5	6.9	5.5		
10th	12.5	7.9	5.9	***	+++	16.1	12.5	10.8	**	++
12th	18.7	20.0	18.6			22.3	20.1	16.1		
Alcohol, 30-day										
8th	21.7	18.4	11.3	**		20.2	22.1	21.0		
10th	38.6	41.6	29.3	**	++	37.9	39.9	37.4		
12th	48.5	59.7	45.7	***	+	52.5	48.9	49.0	*	
Alcohol, 5^+, 2 weeks										
8th	13.9	8.5	3.4	***	+++	12.1	14.0	13.3		
10th	24.7	24.5	17.1	***	++	26.2	25.7	23.1		
12th	28.7	37.8	28.2	***	+	32.8	29.3	28.4		
Marijuana, 30-day										
8th	9.4	4.2	3.0	***		7.1	9.7	9.2		
10th	19.6	12.9	13.3	***	+++	17.0	18.9	19.9		
12th	21.5	25.2	24.2			19.1	21.9	22.8		
Marijuana, 12-month										
8th	16.0	8.8	5.5	***		12.9	16.1	15.7		
10th	32.3	24.5	24.5	***	++	28.8	31.7	32.6		
12th	36.0	42.6	36.2	**		34.1	37.0	37.0		
Inhalants, 12-month										
8th	8.8	9.6	6.0			8.7	8.7	8.9		
10th	6.5	7.6	6.1			7.7	6.5	6.4		
12th	4.8	6.5	5.8			6.0	5.2	4.4		
LSD, 12-month										
8th	2.2	1.2	0.7	***		1.5	2.3	2.2		
10th	4.0	2.6	2.3	***	++	3.8	3.6	4.3		
12th	5.5	6.5	4.3			4.9	5.9	5.4		
Ecstasy, 12-month										
8th	3.3	2.2	0.4	***	++	2.1	2.8	4.0		++
10th	5.4	5.8	5.1			4.4	5.2	5.7		
12th	7.8	10.9	6.5	*		6.8	7.6	8.9		
Cocaine, 12-month										
8th	2.6	1.6	0.5	***	+	1.9	2.4	2.9		
10th	4.2	2.2	1.4	***	+++	4.9	4.1	3.7		+
12th	4.9	4.7	5.5			4.8	5.1	4.7		
Heroin, 12-month										
8th	1.0	0.7	0.5			0.9	0.9	1.1		
10th	1.1	1.2	0.6	*		1.0	1.2	1.1		
12th	1.2	0.9	1.5			1.0	1.2	1.1		
Amphetamines, 12-month										
8th	6.5	4.2	3.3	***		5.3	6.6	6.4		
10th	11.3	8.7	9.5	**	+	13.1	10.5	11.2		
12th	10.8	11.3	12.9			11.2	11.4	10.1		

Table 5 Continued

Grade	(a) Type of school: Public	Private: Catholic	Private: Other	Biv.	Mul.	Size of school grade: <75	75–225	>225	Biv.	Mul.
Any illicit, 12-month										
8th	19.7	12.5	9.1	***		16.1	19.9	19.7	*	
10th	36.7	29.1	28.7	***	++	34.5	35.9	36.8		
12th	40.6	46.2	39.1	*		39.2	41.5	41.3		
Other than marijuana, 12-month										
8th	10.1	6.9	5.2	***		8.1	10.2	10.3		
10th	17.0	13.1	12.7	***	++	18.0	16.0	16.9		+
12th	22.6	25.3	22.5			22.1	23.1	22.9		

	(b) Parental Education: <3.5	3.5–4.2	>4.2	Biv.	Mul.	Racial/Ethnic Composition: ≥66% White	>50% AfrAmer	>50% Hisp	Other	Biv.	Mul.
Approximate Wtd N											
8th	9253	25507	13302			23538	4380	2016	18129		
10th	8864	23059	10627			25449	2492	3959	10650		
12th	7785	21373	9998			22190	2389	2220	12357		
Cigarettes, 30-day											
8th	17.2	13.7	7.1	***	+++	13.4	10.3	9.2	12.5	***	+++
10th	21.3	21.8	18.9	***	++	23.4	10.2	13.8	20.2	***	+++
12th	25.9	29.5	31.1			33.9	13.3	19.4	25.5	***	+++
Cigarettes, daily											
8th	8.5	6.9	2.6	***	+++	6.9	4.8	3.1	5.4	***	+++
10th	12.5	13.1	9.6	***	+++	13.9	5.4	6.1	11.5	***	+++
12th	17.6	19.4	18.6		+++	22.8	8.1	7.6	15.8	***	+++
Alcohol, 30-day											
8th	23.8	22.8	16.3	***	+++	21.5	16.6	23.2	21.6	***	+++
10th	37.6	38.1	39.8			40.3	25.1	36.3	37.7	***	+++
12th	41.5	48.6	57.1	***	+++	54.4	28.8	47.9	44.5	***	+++
Alcohol, 5^+, 2 weeks											
8th	17.5	14.5	8.1	***	+++	12.9	11.4	16.1	13.9		+
10th	25.9	24.1	24.3	*		26.0	11.9	26.0	23.2	***	+++
12th	23.9	28.3	36.0	***	+	34.2	10.2	26.6	24.8	***	+++
Marijuana, 30-day											
8th	11.7	9.8	5.1	***	+++	7.9	9.0	8.7	10.1		
10th	18.9	19.1	19.3			19.4	15.5	17.4	19.9	**	++
12th	18.2	21.5	25.5	**		23.2	17.4	20.6	20.5	*	+
Marijuana, 12-month											
8th	19.6	16.6	9.6	***	+++	14.1	15.5	14.8	16.7		
10th	31.6	31.8	31.7			31.8	26.2	29.6	33.6	***	+++
12th	30.4	36.4	41.7	***	++	38.5	27.7	35.2	35.0	***	+++
Inhalants, 12-month											
8th	9.6	9.0	7.8			9.3	4.8	9.6	8.9	***	+++
10th	6.1	6.7	6.8			7.4	2.5	4.8	6.2	***	+++
12th	4.0	5.2	5.2			5.8	1.5	3.1	4.6	***	+++
LSD, 12-month											
8th	2.4	2.3	1.3	**	++	2.2	0.6	1.6	2.3	***	+++
10th	3.2	4.3	3.8	*		4.3	0.5	2.2	4.4	***	+++
12th	4.5	5.6	6.1			6.5	1.4	3.7	4.8	***	+++
Ecstasy, 12-month											
8th	3.9	3.3	2.3	*	++	2.9	0.9	5.0	3.8	***	+++
10th	4.5	5.4	6.1			5.7	1.9	3.5	6.3	***	+++
12th	6.2	8.1	9.3			8.7	1.9	7.8	7.9	***	+++

Table 5 Continued

	(b) Parental Education					Racial/Ethnic Composition					
	<3.5	3.5–4.2	>4.2	Biv.	Mul.	≥ 66% White	>50% AfrAmer	>50% Hisp	Other	Biv.	Mul.
Cocaine, 12-month											
8th	3.2	2.6	1.7	***	+++	2.4	0.6	2.8	3.1	***	+++
10th	5.1	4.1	2.9	***		3.9	0.7	6.5	4.0	***	+++
12th	5.1	4.9	4.7			5.7	0.7	4.9	4.4	***	+++
Heroin, 12-month											
8th	1.1	1.1	0.8			1.1	0.3	1.1	1.1	***	+++
10th	1.0	1.2	1.1			1.3	0.2	0.9	1.1	***	+++
12th	0.9	1.3	1.1			1.3	0.5	0.5	1.1	**	+
Amphetamines, 12-month											
8th	7.4	6.8	4.5	***	+++	7.1	2.7	3.9	6.3	***	+++
10th	10.8	11.8	10.1	**	+++	13.0	3.4	7.2	10.0	***	+++
12th	9.4	11.4	10.8			13.0	3.6	6.8	8.9	***	+++
Any illicit, 12-month											
8th	23.8	20.3	13.0	***	+++	18.0	17.8	19.4	20.3		
10th	37.0	36.3	35.0	*		36.5	28.5	34.0	37.7	***	+++
12th	35.0	41.1	45.6	***	+	43.4	30.4	39.4	39.0	***	+++
Other than marijuana, 12-month											
8th	12.3	10.4	7.0	***	+++	10.2	4.4	9.2	10.6	***	+++
10th	17.2	17.3	14.9	***	+++	18.2	5.7	14.6	16.1	***	+++
12th	19.0	23.6	24.2			25.9	8.1	18.9	20.7	***	+++

Note. Multivariate analyses include school type, size, average parental education, race/ethnicity, region of country, and population density.

$^{*}P < .05$; $^{**}P < .01$; $^{***}P < .001$ (Bivariate associations).

$^{+}P < .05$; $^{++}P < .01$; $^{+++}P < .001$ (Multivariate associations).

significance level), and (b) the statistical significance associated with the characteristic in a multivariate model that uses all four school characteristics simultaneously, as well as indicators of region and population density (plus signs indicate the statistical significance level). As can be seen by the pattern of asterisks, in general, substance use varies significantly by school type, school socioeconomic status, and racial/ethnic composition; variations by school size are generally not statistically significant.

Bivariate associations

School type

Among 8th-grade students, public schools show significantly higher rates of cigarette use (both 30-day and daily) than private schools, with Catholic schools being somewhat higher than other private schools. A similar pattern holds for 10th graders, but by 12th grade there is no longer a significant difference. Alcohol use shows a pattern similar to cigarette use for 8th graders, with public schools having significantly higher rates of alcohol use (both 30-day and heavy drinking) than private schools, and Catholic schools being somewhat higher than other private schools. In this case, there are still significant differences at 12th grade, where Catholic schools show the highest rates of use. Thus, there is an important reversal of differences, with students in public schools being at higher risk for alcohol use in middle school, but students in Catholic schools being at higher risk late in high school.

Marijuana use shows a pattern similar to alcohol use, with use being higher in public schools among 8th graders, but higher in Catholic schools among 12th graders. The 12th-grade differences are significant in the case of annual use, though not for 30-day use.

Inhalant use in the past 12 months does not vary significantly by school type.

Like cigarettes, alcohol, and marijuana, among 8th graders public school students are at significantly higher risk for using LSD, ecstasy, cocaine, and amphetamine than private school students. And as was true for cigarettes, at 12th grade use of these substances (except for ecstasy) does not differ significantly by school type.

Heroin use shows a different pattern: use generally does not vary significantly by school type, except that among 10th graders, non-Catholic private schools are lower than other schools.

A measure of use of any illicit drug in the past 12 months shows significant differences, with 8th-grade public schools

higher than the others, and 12th-grade Catholic schools higher than the others. Any use of an illicit drug other than marijuana shows a similar pattern, though the 12th-grade differences are not significant.

Size of school grade

School size shows only a few significant bivariate associations with substance use. Cigarette use is a bit higher in small schools compared to larger schools in 10th and 12th grades, significantly so for 10th grade. The measure of school size used here is relatively crude, with only three categories. A more fine-grained measure was also examined, using decile rankings to construct measures with ten categories for each grade, but no clear relationships emerged.

School socioeconomic status

As might be expected, schools whose students average higher in socioeconomic status (as indicated by parental education) have significantly lower smoking rates, at least among 8th and 10th graders. Perhaps surprisingly, however, among 12th graders there are no significant differences in smoking associated with school socioeconomic status. Thirty-day alcohol use, on the other hand, does show a significant association at 12th grade, but the association is positive; whereas for 8th graders the association is also significant, but negative. For 10th graders there is no significant association. The positive association between alcohol use and school socioeconomic status among 12th graders is perhaps surprising, given the negative association between individual-level college plans and alcohol use that we have observed and reported for many years (Johnston et al., 2005). One possible explanation may be that 12th graders in schools where many students plan to attend college (that is, in schools with high parental education) are more likely to be already socializing with college students, and college students tend to be higher than nonstudents in their use of alcohol; similarly, such students may be engaging in what amounts to "anticipatory socialization" in terms of expectations about alcohol and other drug use during college (Mauss, 1969; Schulenberg & Maggs, 2002). Marijuana use, both 30-day and 12-month, shows a similar reversal: a negative association with school socioeconomic status among 8th graders, no significant association among 10th graders, and a positive association among 12th graders. LSD, ecstasy, and amphetamines follow similar patterns of use, though the association among 12th graders does not reach statistical significance. Cocaine deviates from the pattern of reversal, having a negative association for all three grades, significantly so for 8th and 10th graders. Past 12-month use of heroin and inhalants shows no significant association with school socioeconomic status at any grade. The indexes of any illicit use and use of any illicit drug other than marijuana follow the general pattern of negative association in 8th grade, turning to positive by 12th grade.

Racial/ethnic composition

The racial/ethnic composition of the school shows significant associations for all substances included in Table 5. Schools that are majority African American generally have the lowest substance use rates, while schools in which White students comprise two-thirds or more of the total tend to have the highest rates of use, particularly at the 10th- and 12th-grade levels. Among 8th graders, schools with a Hispanic majority tend to have relatively high rates of heavy drinking and use of marijuana, inhalants, ecstasy, and cocaine. These findings are consistent with individual-level analyses of racial/ethnic association with substance use (Johnston et al., 2005; Wallace et al., 2003). Higher rates of dropping out among Hispanics may alter these relationships in the later grades.

Multivariate associations

Essentially, multivariate models that include all school-level predictors, plus region of country and population density, did not change the associations seen in the bivariate models, with the possible exception of school type: in that case, a number of significant bivariate associations became less or not significant in the multivariate analyses. This was particularly true for 8th-grade schools. Additional analyses (not shown) suggest that socioeconomic status appeared to be the factor that was most important in rendering the school type association less or not significant. (Public schools are significantly lower in average parental education than the private schools.)

Discussion

There has been considerable interest in understanding how the school context might relate to drug use. Based on large national samples of adolescents within thousands of schools, the present study was undertaken to examine (1) the extent to which student drug use and related measures vary among American secondary schools, and (2) how substance use varies by selected school characteristics.

With respect to the first goal, the results show that most of the variance in drug use and related variables lies within schools; only a small proportion of variance is between schools. However, it should not be concluded that the variation by school is unimportant. Among 12th-grade schools in 2002, for example, the range of annual marijuana prevalence was from zero (no student reported using marijuana in the

past 12 months) to 64% (almost two-thirds of the seniors reported using marijuana in the past 12 months). In that particular class, a quarter of all seniors attended schools where less than 20% of the class reported using marijuana in the past 12 months, and another quarter attended schools where more than 44% used marijuana. Thus, although the variance lies primarily within schools, there remain important differences in the extent of marijuana use that students in different schools are exposed to.

With respect to the second goal, the analyses of school characteristics show that schools do indeed differ in drug use by their students, particularly by school type, socioeconomic status, and race/ethnicity. The relationships are not all simple. School type, for example, showed higher rates of use of cigarettes among 8th and 10th graders in public schools compared to private schools, but no significant difference among 12th graders. Students in public middle schools are at higher risk for use of alcohol and marijuana, but among 12th graders, students in Catholic schools are at highest risk. School size is generally unrelated to substance use, with the exception of cigarette use among high school students, where 10th graders in small schools smoked at a higher rate than in larger schools. The average socioeconomic status of the students is related to substance use, but again not in a simple fashion. Generally, there is a negative association between school SES and student substance among 8th graders. But by 12th grade, the association tends to be positive or not significant. This may be due in part to differential dropout rates for the different SES strata, possibly to changing behavioral patterns by age. Racial/ethnic composition (as defined by majority race/ethnicity) is significantly associated with student substance use. Again, the relationship is not uniform across grades. Majority African American schools typically have the lowest rates of use at all grades. Predominantly White schools generally have highest rates at 10th and 12th grades, while majority Hispanic 8th-grade schools have elevated rates of some substances.

As noted, most of the variance in drug use and related attitudes and behaviors lies within schools. Although there is still room for schools to differ importantly, the relatively small amount of variance between schools means that investigation of existing factors that differentiate schools in terms of drug use rates must recognize that only small amounts of variance will be explained. Thus, efforts to show neighborhood effects or effects of state-level policies will inevitably appear to explain little variation. This does not vitiate the value of these efforts for prevention policies and programs, but it does set limits on what can be expected. And, of course, it does not preclude the development of new policies or programs that can produce more differentiation among schools. Indeed, as our findings show, there were some notable historical shifts in the extent of between school variance during the 1990s and early 2000s.

One important implication from the analyses of school characteristics is that it is simplistic to think of "good" schools and "bad" schools in terms of drug use. School SES, for example, has a negative association with student substance use among 8th graders (middle school), but a positive or insignificant association among 12th graders (high school). Various factors could account for the shift, and school dropout rates are likely one such factor in this case. The racial/ethnic composition of schools has an important association with student drug use, but again, the association varies with grade. This shift is also very likely affected by dropout rates. One school characteristic that appears not to be related to drug use in any important or systematic way is school size. Perhaps the variation in school size in American schools today is not great enough for this to be as important a factor as it may have been in earlier times. Public schools are often thought to be more likely than private schools to have drug use problems. In this study we did indeed find higher rates for cigarettes, alcohol, and some illicit drugs use among 8th and 10th grade students in public schools, but we also found higher alcohol use rates among 12th grade students in Catholic schools. All of these results emphasize the need for prevention programs that address individual risk factors for substance use, in addition to broader contextual factors.

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