

Drugs and Driving by American High School Seniors, 2001-2006*

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ABSTRACT. Objective: The aim of this study was to report trends from 2001 to 2006 in the percentage of all high school seniors who drive after using marijuana, other illicit drugs, or alcohol or who are exposed as passengers to such behaviors. A second objective is to examine demographic and psychosocial correlates of these behaviors. **Method:** The data were obtained from the Monitoring the Future study, in which nationally representative samples of high school seniors have been surveyed annually since 1975. **Results:** In 2006, 30% of high school seniors reported exposure to a drugged or drinking driver in the past 2 weeks,

down from 35% in 2001. Exposure was demonstrated to be widespread as defined by demographic characteristics (population density, region of the country, socioeconomic status, race/ethnicity, and family structure). Individual lifestyle factors (religiosity, grade point average, truancy, frequency of evenings out for fun, and hours of work) showed considerable association with the outcome behaviors. **Conclusions:** Impaired driving by youth remains a problem needing serious attention despite some progress in recent years. (*J. Stud. Alcohol Drugs* **68**: 834-842, 2007)

MOTOR VEHICLE ACCIDENTS ARE A LEADING cause of death for teens and young adults (Subramanian, 2006). Driving under the influence of alcohol accounts for a substantial portion of accidents, but driving under the influence of other psychoactive substances may also account for a substantial portion (Longo et al., 2000; Couper and Logan, 2004). Analyses of body fluids from accident victims indicate that, although alcohol remains the most commonly found substance, illegal drugs such as marijuana are increasingly found to be contributors (Drummer et al., 2003, 2004; Holmgren et al., 2005; Mura et al., 2006).

There has been some success in recent decades at reducing driving after drinking among American youth (National Highway Traffic Safety Administration, 2007; O'Malley and Johnston, 1999), but little is known about the extent to which driving after using marijuana or other illicit drugs may have offset the reduction. One study showed that, between 1976 and 2001, the frequency of tickets received and vehicle accidents that occurred after use of alcohol diminished markedly compared with the frequency of tickets and accidents after use of marijuana, suggesting that the reduction may have been at least partially offset (O'Malley and Johnston, 2003).

In addition to the evidence based on analyses of crash victims, some epidemiological evidence indicates that drugged driving is clearly a public health risk. The National Study on Drug Use and Health reported that in 2002 about 5% of the total U.S. population age 12 years or older drove under the influence of illegal drugs in the past year (Substance Abuse and Mental Health Services Administration, 2003). The percentages were highest for persons ages 18-21 years, where 15% to 18% drove under the influence of illegal drugs in the past year. A study of Canadian adolescents found that, in the previous 12 months, 20% of high school students with driver's licenses had driven after using marijuana (Adlaf et al., 2003). Clearly, a considerable amount of driving after illicit drug use occurs. However, little is known about the psychosocial characteristics associated with this behavior or with riding in a vehicle whose driver has used illicit drugs.

In this study, we report data from six annual surveys from 2001 to 2006 of nationally representative samples of high school seniors on driving after the use of marijuana, other illicit drugs, and alcohol. We also report on the broader problem of young people being exposed to risk either by (1) driving a vehicle after drinking or using drugs or (2) riding in a vehicle when the driver has been drinking or using drugs.

The research questions addressed include the following:

(1) What proportion of high school seniors drive after using marijuana? Using other illicit drugs? Using alcohol? Having five or more drinks? What proportion ride as a passenger in a vehicle whose driver has been doing these behaviors?

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(2) What proportion of high school seniors are put at risk either by driving after substance use or by riding as a passenger in a vehicle whose driver has used drugs or alcohol?

(3) What are the recent trends (2001-2006) in these behaviors?

(4) What demographic and lifestyle characteristics are associated with these behaviors?

Method

The data presented here for the period 2001-2006 came from the Monitoring the Future study, which is described in detail elsewhere (Bachman et al., 2006; Johnston et al., 2006). Nationally representative samples of approximately 16,000 12th graders located in about 135 schools were selected each year since 1975 through a multistage scientific sampling procedure. Confidential, self-completed questionnaires were administered by University of Michigan employees, usually in a regularly scheduled class period. In the analyses reported here, we used participants who provided data about driving and riding behavior after substance use. The questions on driving after the use of marijuana and illicit drugs other than marijuana were added to the study in 2001 and were included in only one of six forms (distributed in a random sequence within classrooms); therefore, responses to these questions were based on a random one sixth of the total sample of seniors. This study was approved by the Institutional Review Board of the University of Michigan.

Outcome measures were assessed via the following questions: "During the last two weeks, how many times have you driven a car, truck, or motorcycle after . . . drinking alcohol?; . . . having five or more drinks in a row?; . . . smoking marijuana?; . . . using other illicit drugs?" A second set of questions asked, "During the last two weeks, how many times (if any) have you been a passenger in a car . . . when the driver had been drinking?; . . . when you think the driver had 5 or more drinks?; . . . when the driver had been smoking marijuana?; . . . when the driver had been using other illicit drugs?" Response categories for both questions were none, once, twice, three to five times, six to nine times, and 10 or more. These were collapsed into binary values of 0 = none, 1 = once or more. It should be noted that the questions were not necessarily asking about mutually exclusive behaviors. For example, an individual could have driven after smoking marijuana and drinking heavily on the same occasion.

Demographic and lifestyle measures

All measures except geographical region and population density were obtained by self-report. *Number of parents in the household* indicated whether the respondent lived with

zero, one, or two parents (or guardians). *Parental education* was a mean of two items about the amount of education achieved by parents, with response values of (1) completed grade school or less, (2) some high school, (3) completed high school, (4) some college, (5) completed college, and (6) graduate or professional school after college. *Religious commitment* was a mean of two items assessing the importance of religion (1 = not important, 2 = a little important, 3 = pretty important, 4 = very important) and frequency of attendance at religious services (1 = never, 2 = rarely, 3 = once or twice a month, 4 = about once a week or more). These two items were not asked of students in schools located in California; thus all California students were assigned missing data on this measure, and this was treated as a separate category. *Grades* (grade point average) were self-reported average grades in high school. *Truancy* was a mean of the frequency of skipping classes or whole days of school during the past 4 weeks. *Evenings out per week* was the number of evenings out for fun and recreation in a typical week (1 = less than one, 2 = one, 3 = two, 4 = three, 5 = four or five, 6 = six or seven). *Hours worked per week* was the average number of hours worked on a job per week during the school year. *Miles driven per week* was the number of miles the respondent reported driving a car, truck, or motorcycle in an average week. All of these measures of lifestyle factors have been used extensively in other publications. More details on their psychometric properties, particularly construct validity, are provided elsewhere (Bachman et al., 1980).

Geographic region was based on U.S. census classifications of states into four regions: Northeast, North Central, South, and West. Population density was based on U.S. census classifications of three categories: large metropolitan statistical areas (MSAs), other MSAs, and non-MSAs.

Analyses were conducted with the STATA statistical analysis system (Release 9.2.; StataCorp LP, College Station, TX). The data were weighted to adjust for differential probabilities of sample selection and to adjust for absenteeism. (Respondents were asked to report how many days they were absent in the previous 4 weeks. This information was used to calculate an appropriate weight for each respondent.) The STATA software provides statistical estimates (including appropriate confidence intervals) that take into account the complex sample design of the study. Logistic regressions were conducted for the multivariate analyses.

Results

Table 1 provides the percentage of seniors in the classes of 2001 through 2006 who reported driving in the prior 2 weeks after (1) use of marijuana, (2) use of an illicit drug (or drugs) other than marijuana, (3) drinking any alcohol, and (4) heavy drinking (having five or more drinks in a row). In 2006, the highest prevalence among these four

TABLE 1. Trends in the percentage of high school seniors driving after alcohol/drug use or riding in a vehicle after alcohol/drug use by the driver, 2001-2006

| Variable | 2001 % | 2002 % | 2003 % | 2004 % | 2005 % | 2006 % | 95% CI ^a |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------------|
| (No. of cases) ^b | (n = 1,793) | (n = 1,860) | (n = 2,120) | (n = 2,153) | (n = 2,144) | (n = 2,139) | |
| Drive after use of: | | | | | | | |
| Marijuana | 16.3 | 14.2 | 12.6 | 14.9 | 13.7 | 13.1 | 11.0-15.2 |
| OTM | 3.9 | 4.4 | 2.9 | 5.0 | 2.8 | 3.1 | 1.8-4.3 |
| Alcohol | 16.8 | 17.6 | 14.9 | 15.2 | 14.0 | 14.2 | 11.5-17.0 |
| Heavy drinking ^c | 10.8 | 11.3 | 9.1 | 10.9 | 8.2 | 9.5 | 6.7-12.3 |
| Marijuana, OTM, or heavy drinking | 21.3 | 20.0 | 18.6 | 19.9 | 17.7 | 18.2 | 15.9-20.5 |
| Ride after driver has used: | | | | | | | |
| Marijuana | 24.6 | 21.6 | 18.8 | 21.4 | 19.3 | 20.2 | 17.7-23.1 |
| OTM | 5.7 | 5.1 | 5.0 | 6.5 | 5.0 | 5.1 | 3.6-7.3 |
| Alcohol | 25.6 | 23.4 | 22.5 | 21.3 | 20.9 | 20.9 | 17.0-25.5 |
| Heavy drinking | 16.6 | 14.4 | 12.4 | 13.4 | 12.2 | 11.6 | 8.3-16.0 |
| Marijuana, OTM, or heavy drinking | 29.3 | 27.5 | 25.4 | 25.7 | 24.3 | 24.4 | 20.7-28.4 |
| Drive or ride after driver has used: | | | | | | | |
| Marijuana | 28.3 | 25.4 | 22.2 | 24.2 | 22.8 | 23.2 | 19.8-26.6 |
| OTM | 6.9 | 6.8 | 6.1 | 8.0 | 6.0 | 5.9 | 4.6-7.1 |
| Alcohol | 30.9 | 29.5 | 28.1 | 26.8 | 27.2 | 26.1 | 21.7-30.4 |
| Heavy drinking | 21.1 | 18.7 | 16.2 | 17.3 | 15.7 | 15.8 | 12.3-19.2 |
| Marijuana, OTM, or heavy drinking | 35.0 | 31.7 | 31.1 | 30.4 | 29.2 | 29.6 | 26.3-32.9 |

Notes: CI = confidence interval; OTM = illicit drugs other than marijuana. ^a95% CI provided for 2006 data only; ^bn listed is the minimal n for all outcomes per year; ^cheavy drinking defined as five or more drinks in a row.

behaviors was for drinking any alcohol, with 14.2% reporting driving a motor vehicle at least once in the prior 2 weeks after having drunk alcohol. The figure for driving after the use of marijuana was only slightly lower: 13.1%. Driving after heavy drinking (i.e., five or more drinks in a row) was reported by 9.5%, and driving after the use of an illicit drug other than marijuana was reported by 3.1%. A total of 18.2% reported driving in the prior 2 weeks after illicit drug use or heavy drinking.

Table 1 also provides the percentage of seniors who reported riding in a car whose driver had used marijuana, used an illicit drug other than marijuana, drunk any alcohol, or drunk five or more drinks. Each of these riding behaviors was somewhat higher than the corresponding driving behavior, but the pattern was otherwise very similar.

Finally, Table 1 shows the percentages who put themselves at risk by either driving after using drugs or drinking, or riding as a passenger in a car whose driver had been using drugs or drinking. Nearly a quarter (23.2%) of seniors in the class of 2006 reported driving or riding in the prior 2 weeks with a driver who used marijuana. A total of 29.6% reported driving or riding after use of any illicit drug or heavy drinking.

All of these behaviors showed some modest improvement between 2001 and 2006. In general, most of the decline occurred between 2001 and 2003, with little further improvement between 2004 and 2006. Figure 1 shows the trends in percentages of having been at risk either by driving after use or riding in a vehicle whose driver had been drinking heavily or using illicit drugs.

Table 2 provides the sample distribution for the various demographic and lifestyle subgroups, combining the classes of 2004-2006. The classes were combined to increase the numbers of cases in the various subgroups. (The numbers of cases in Tables 2-4 are slightly lower than in Table 1 because of missing data on various demographic and lifestyle factors.) As indicated in Figure 1, little change in the drug use/drinking and driving behaviors occurred between 2004 and 2006; therefore, combining classes should not distort the results. Table 3 provides the percentage of seniors in various subgroups in the classes of 2004-2006 combined who reported (1) driving after marijuana use and (2) driving after heavy drinking. The table provides the percentage in each subgroup who reported the relevant behavior, unadjusted odds ratios (ORs) from bivariate models that use one "predictor" variable at a time, and adjusted ORs from multivariate models that included all of the demographic and lifestyle variables (including class year, with 2004 being the referent year, and 2005 and 2006 each represented by a dummy variable).

Driving after the use of marijuana

Table 3 shows that several demographic factors are related to driving after the use of marijuana but that, in general, lifestyle factors were much stronger correlates. With respect to the bivariate results for demographic factors, compared with the relevant groups, males (16.3%, OR = 1.56), those who lived in the Northeast region (18.1%, OR = 1.65), and those who did not live with at least one parent or

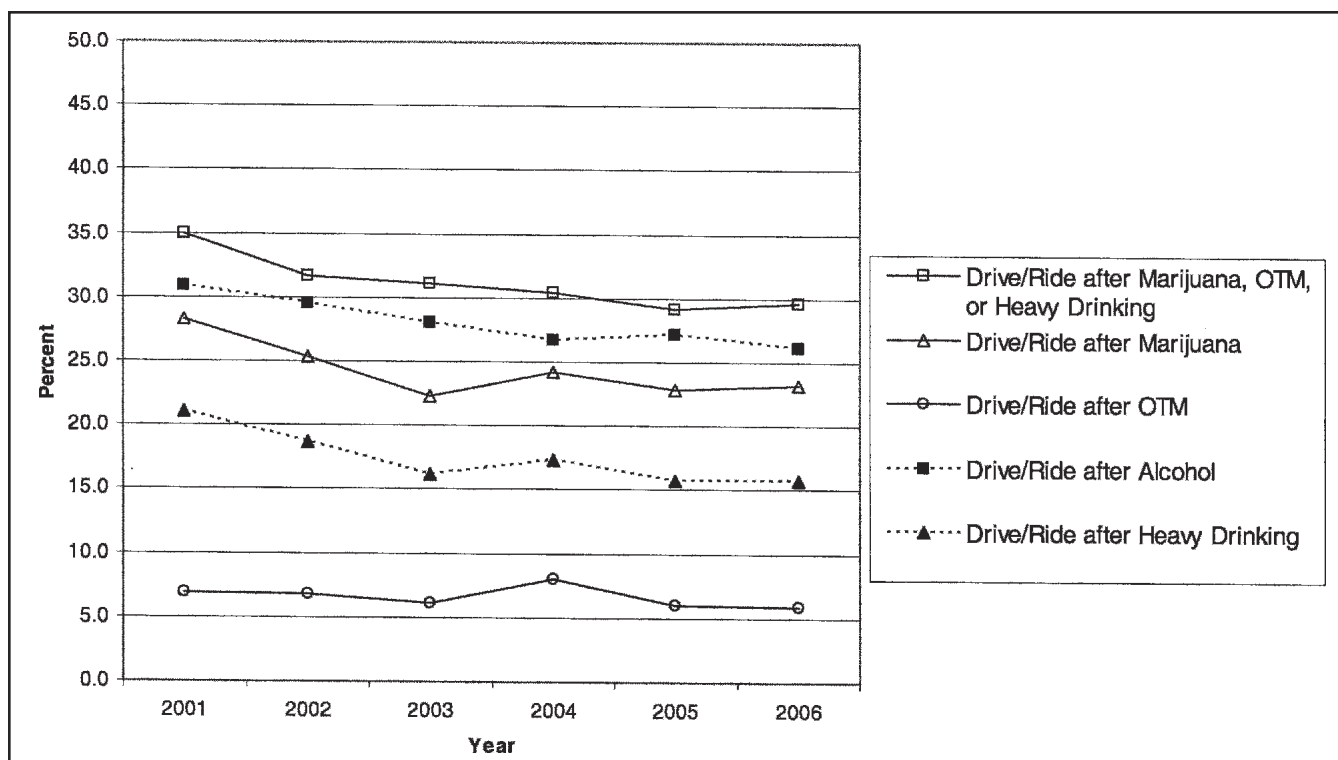


FIGURE 1. Trends in the percentage of high school seniors driving after alcohol/drug use or riding in a vehicle after alcohol/drug use by the driver, 2001-2006. OTM = illicit drugs other than marijuana.

guardian (23.8%, OR = 2.22) were more likely to drive after marijuana use. Hispanic students were less likely to do so (10.6%, OR = 0.70). Population density and average parental education showed no significant bivariate association with driving after marijuana use. There were no significant differences by year in 2004 through 2006.

Several lifestyle factors were significantly associated with driving after the use of marijuana. Significant negative associations were found for religious commitment and grade point average; significant positive associations were found for truancy, number of evenings out for recreation, hours worked per week, and miles driven per week.

The multivariate associations (i.e., with all covariates included) were generally similar, with a few noteworthy exceptions. The region of the country became more differentiated (apparently because of religious commitment varying by region, based on analyses not shown), and population density differences became significant (owing to race/ethnicity and miles driven). Hours worked per week became nonsignificant.

Driving after heavy drinking

The pattern of bivariate association for driving after heavy drinking was generally similar to that for driving

after marijuana use. Male seniors (12.3% drove after heavy drinking, OR = 2.25) and those not living with at least one parent (13.8%, OR = 1.62) were more likely to drive after heavy drinking compared with the relevant referent groups. Those with the most highly educated parents were less likely to do so (6.1%, OR = 0.54). An exception to the general similarity was that black students were significantly less likely than white students to drive after heavy drinking (4.7% versus 9.8%, OR = 0.46), whereas, for driving after marijuana use, it was Hispanic students who were less likely to do so (10.6% vs 14.6%, OR = 0.70). Multivariate associations were generally mitigated compared with the bivariate associations. An exception was that the difference for the South region became significant.

Table 4 provides the percentage of seniors in various subgroups in the classes of 2004-2006 combined who reported exposure to risk by (1) driving or riding after the driver had used an illicit drug (marijuana or other illicit drug) and (2) driving or riding after the driver had used an illicit drug or been drinking heavily. The table also provides unadjusted ORs from bivariate models that used one "predictor" variable at a time, and adjusted ORs from multivariate models that included all of the demographic and lifestyle variables (including class year, entered as two dummy variables).

TABLE 2. Distribution of sample by demographic and lifestyle variable subgroups, 2004-2006 (weighted $n = 5,806$)

| Variable | % (95% CI) |
|-----------------------------|------------------|
| Gender | |
| Female | 53.1 (51.9-54.4) |
| Male | 46.9 (45.6-48.1) |
| Region | |
| West | 19.4 (14.1-26.1) |
| Northeast | 18.6 (13.5-25.0) |
| North Central | 26.7 (20.4-34.1) |
| South | 35.4 (28.6-42.8) |
| Urbanicity | |
| Large MSA | 28.1 (22.0-35.1) |
| Other MSA | 48.1 (40.6-55.6) |
| Non-MSA | 23.9 (18.3-30.6) |
| No. of parents in household | |
| Two | 69.8 (67.0-72.5) |
| One | 24.7 (22.6-27.0) |
| None | 5.5 (4.5-6.7) |
| Average parental education | |
| Low | 7.8 (6.1-9.9) |
| 2 | 22.7 (20.0-25.7) |
| 3 | 28.1 (26.4-29.9) |
| 4 | 26.3 (24.4-28.3) |
| High | 15.1 (12.5-18.1) |
| Race/ethnicity | |
| White | 69.3 (63.2-74.7) |
| Black | 9.7 (6.1-15.2) |
| Hispanic | 9.7 (7.0-13.3) |
| Other | 11.3 (8.6-14.7) |
| Religious commitment | |
| High | 31.6 (26.2-37.6) |
| Medium | 26.5 (22.7-30.8) |
| Low | 32.6 (26.9-38.9) |
| Missing data (CA) | 9.3 (5.7-14.7) |
| GPA | |
| A or A- | 34.5 (31.9-37.2) |
| B+ or B | 35.3 (33.9-36.8) |
| B- or below | 30.2 (27.8-32.8) |
| Truancy | |
| None | 47.8 (45.2-50.5) |
| Low | 15.5 (14.6-16.5) |
| Medium | 17.3 (15.9-18.9) |
| High | 19.3 (17.4-21.4) |
| Evenings out | |
| 0 | 23.2 (21.2-25.4) |
| 0.5 | 27.3 (25.8-28.8) |
| 1-1.5 | 23.4 (22.3-24.6) |
| ≥ 2 | 26.0 (23.7-28.6) |
| Hours worked | |
| 0 | 26.6 (24.2-29.3) |
| 1-15 | 30.2 (27.4-33.2) |
| 16-30 | 35.0 (33.2-36.8) |
| >30 | 8.2 (7.0-9.5) |
| Miles driven | |
| 0 | 14.2 (12.2-16.3) |
| 1-50 | 31.3 (29.2-33.5) |
| 51-100 | 23.6 (21.6-25.6) |
| >100 | 31.0 (29.1-32.9) |
| Year | |
| 2004 | 34.0 (30.8-37.3) |
| 2005 | 33.4 (31.3-35.5) |
| 2006 | 32.7 (30.0-35.5) |

Notes: n derived using only cases with valid data on all controls, as well as on at least one of the following outcomes: (1) driving after using marijuana; (2) driving after heavy drinking; (3) driving/riding after using marijuana or illicit drugs other than marijuana; and (4) driving/riding after using marijuana, illicit drugs other than marijuana, or heavy drinking. MSA = metropolitan statistical area; GPA = grade point average.

Driving or riding after use of an illicit drug

Exposure to risk by driving after using an illicit drug (marijuana or other illicit drug) or by riding in a vehicle whose driver did varied by subgroup in much the same way as driving after marijuana use, although at distinctly higher levels. Males (25.3%, OR = 1.17) were more likely to be exposed to such risk, although the gender differences were actually small and were not significant when covariates were included (OR = 0.97). Differences in driving or riding after use of an illicit drug between other demographic subgroups tended to be rather small, particularly in the multivariate context, although respondents who did not live with both parents were significantly more likely to be exposed (35.4%, OR = 2.05). Lifestyle factors continued to be quite important in predicting who was most likely to be exposed to a driver who had used illicit drugs. The number of miles driven in an average week was understandably less important in predicting total exposure than in predicting actually driving after substance use.

Driving or riding after use of an illicit drug or heavy drinking

Exposure to risk by driving after using an illicit drug or heavy drinking, or by riding in a vehicle whose driver had used an illicit drug or had been drinking heavily, varied by subgroup in a manner very parallel to exposure to driving or riding after use of an illicit drug, although at a higher level. Indeed, the levels of exposure were impressively high: 31.3% of males and 27.6% of females. Lifestyle factors were again important: For example, seniors who reported grades of B- or below were almost twice as likely to be exposed as A or A- students (38.7% vs 19.9%, unadjusted OR = 2.55). Even after inclusion of all covariates, the unadjusted OR was still 1.53 for these groups.

Discussion

The most striking finding in this study was the sheer number of high school seniors who put themselves at substantial risk of harm by driving after using psychoactive substances that were likely to impair their driving performance. This behavior is not merely illegal, it is highly dangerous to themselves and others. In 2006, 30% of high school seniors reported driving after drinking heavily or using drugs, or riding in a car whose driver had been drinking heavily or using drugs at least once in just the prior 2 weeks. We should emphasize that the reporting interval in this study was just the prior 2 weeks; over the course of a year, the percentage exposed to this dangerously risky behavior would undoubtedly be considerably higher.

It is of some comfort that the 2006 figure of 30% was down from 35% in 2001; however, most of the improvement

TABLE 3. Unadjusted and adjusted odds ratios predicting driving after marijuana use and after heavy drinking, high school seniors, 2004-2006 combined

| Variable | Drive after marijuana (<i>n</i> = 5,779) | | | Drive after heavy drinking ^a (<i>n</i> = 5,791) | | |
|------------------------------------|---|-------------------------------|-----------------------------|---|-------------------|-------------------|
| | % | Unadjusted ^b OR | Adjusted ^c OR | % | Unadjusted OR | Adjusted OR |
| Gender | | | | | | |
| Female | 11.1 | (ref.) | (ref.) | 5.9 | (ref.) | (ref.) |
| Male | 16.3 | 1.56 [‡] | 1.26 [†] | 12.3 | 2.25 [‡] | 1.75 [‡] |
| Region | | | | | | |
| West | 11.8 | (ref.) | (ref.) | 7.3 | (ref.) | (ref.) |
| Northeast | 18.1 | 1.65 [†] | 1.66 [‡] | 8.5 | 1.19 | 1.08 |
| North Central | 12.5 | 1.07 | 1.36 [†] | 8.6 | 1.21 | 1.33 |
| South | 12.8 | 1.10 | 1.49 [‡] | 10.3 | 1.46 | 1.64 [*] |
| Urbanicity | | | | | | |
| Large MSA | 14.1 | (ref.) | (ref.) | 9.8 | (ref.) | (ref.) |
| Other MSA | 14.2 | 1.01 | 0.82 [*] | 8.2 | 0.83 | 0.70 |
| Non-MSA | 11.6 | 0.80 | 0.69 [*] | 9.3 | 0.95 | 0.69 |
| No. of parents in household | | | | | | |
| Two | 12.3 | (ref.) | (ref.) | 9.0 | (ref.) | (ref.) |
| One | 14.7 | 1.23 | 1.10 | 7.6 | 0.83 | 0.76 |
| None | 23.8 | 2.22 [‡] | 2.19 [†] | 13.8 | 1.62 [*] | 1.29 |
| Average parental education | | | | | | |
| Low | 16.7 | (ref.) | (ref.) | 10.7 | (ref.) | (ref.) |
| 2 | 14.9 | 0.87 | 0.68 | 11.7 | 1.10 | 0.87 |
| 3 | 11.7 | 0.66 | 0.50 [*] | 8.3 | 0.75 | 0.62 |
| 4 | 13.9 | 0.80 | 0.67 | 8.3 | 0.75 | 0.65 |
| High | 12.5 | 0.71 | 0.76 | 6.1 | 0.54 [*] | 0.58 |
| Race/ethnicity | | | | | | |
| White | 14.6 | (ref.) | (ref.) | 9.8 | (ref.) | (ref.) |
| Black | 11.3 | 0.75 | 1.06 | 4.7 | 0.46 [*] | 0.53 [*] |
| Hispanic | 10.6 | 0.70 [*] | 0.59 [*] | 9.3 | 0.95 | 0.85 |
| Other | 11.4 | 0.75 | 0.83 | 6.9 | 0.68 | 0.79 |
| Religious commitment | | | | | | |
| High | 6.1 | (ref.) | (ref.) | 5.9 | (ref.) | (ref.) |
| Medium | 14.2 | 2.54 [‡] | 2.10 [†] | 8.9 | 1.57 | 1.37 |
| Low | 20.3 | 3.92 [‡] | 2.76 [‡] | 12.7 | 2.33 [‡] | 1.69 [*] |
| Missing data (CA) | 13.1 | 2.31 [†] | 2.87 [‡] | 6.2 | 1.07 | 1.22 |
| GPA | | | | | | |
| A or A- | 9.7 | (ref.) | (ref.) | 6.0 | (ref.) | (ref.) |
| B+ or B | 12.4 | 1.32 [*] | 1.09 | 8.2 | 1.40 [*] | 1.19 |
| B- or below | 19.3 | 2.23 [‡] | 1.37 [†] | 13.0 | 2.33 [‡] | 1.45 [*] |
| Truancy | | | | | | |
| None | 5.7 | (ref.) | (ref.) | 3.9 | (ref.) | (ref.) |
| Low | 13.1 | 2.50 [‡] | 2.14 [†] | 7.7 | 2.06 [‡] | 1.73 [‡] |
| Medium | 16.3 | 3.24 [‡] | 2.58 [‡] | 10.9 | 3.02 [‡] | 2.68 [‡] |
| High | 30.9 | 7.43 [‡] | 5.03 [‡] | 20.7 | 6.48 [‡] | 4.86 [‡] |
| Evenings out | | | | | | |
| 0 | 5.7 | (ref.) | (ref.) | 5.5 | (ref.) | (ref.) |
| 0.5 | 10.0 | 1.84 [‡] | 1.73 [†] | 7.4 | 1.36 | 1.17 |
| 1-1.5 | 14.3 | 2.76 [‡] | 2.24 [‡] | 9.1 | 1.72 [†] | 1.37 |
| ≥2 | 23.5 | 5.07 [‡] | 3.24 [‡] | 13.4 | 2.63 [‡] | 1.48 |
| Hours worked | | | | | | |
| 0 | 9.9 | (ref.) | (ref.) | 6.2 | (ref.) | (ref.) |
| 1-15 | 9.9 | 0.99 | 0.90 | 7.5 | 1.24 | 1.08 |
| 16-30 | 17.9 | 1.98 [‡] | 1.46 | 9.9 | 1.68 [‡] | 1.07 |
| >30 | 19.8 | 2.24 [‡] | 1.23 | 18.8 | 3.53 [‡] | 1.70 [*] |
| Miles driven | | | | | | |
| 0 | 4.8 | (ref.) | (ref.) | 2.0 | (ref.) | (ref.) |
| 1-50 | 10.4 | 2.33 [‡] | 2.82 [‡] | 6.1 | 3.15 [†] | 3.39 [†] |
| 51-100 | 14.6 | 3.42 [‡] | 3.70 [‡] | 8.3 | 4.40 [‡] | 4.18 [‡] |
| >100 | 19.9 | 4.98 [‡] | 4.51 [‡] | 15.4 | 8.80 [‡] | 6.95 [‡] |
| Year | | | | | | |
| 2004 | 14.1 | (ref.) | (ref.) | 10.3 | (ref.) | (ref.) |
| 2005 | 13.6 | 0.96 | 1.07 | 7.9 | 0.75 | 0.78 |
| 2006 | 12.9 | 0.90 | 1.03 | 8.6 | 0.82 | 0.92 |

Notes: OR = odds ratio; ref. = reference group; MSA = metropolitan statistical area; GPA = grade point average. ^aHeavy drinking defined as five or more drinks in a row; ^bunadjusted = bivariate result with one predictor; ^cadjusted = multivariate result with all predictors.

**p* < .05; [†]*p* < .01; [‡]*p* < .001.

TABLE 4. Unadjusted and adjusted odds ratios predicting exposure to drug/drinking driving or riding, high school seniors, 2004-2006 combined

| Variable | Drive/ride after marijuana or OTM (<i>n</i> = 5,736) | | | Drive/ride after marijuana, OTM, or heavy drinking ^a (<i>n</i> = 5,735) | | |
|-----------------------------|---|-------------------------------|-----------------------------|---|-------------------|-------------------|
| | % | Unadjusted ^b OR | Adjusted ^c OR | % | Unadjusted OR | Adjusted OR |
| Gender | | | | | | |
| Female | 22.5 | (ref.) | (ref.) | 27.6 | (ref.) | (ref.) |
| Male | 25.3 | 1.17 [†] | 0.97 | 31.3 | 1.20 [†] | 0.98 |
| Region | | | | | | |
| West | 22.4 | (ref.) | (ref.) | 27.9 | (ref.) | (ref.) |
| Northeast | 30.3 | 1.50 [‡] | 1.60 [†] | 33.9 | 1.33 [†] | 1.46* |
| North Central | 22.3 | 1.00 | 1.31 | 29.0 | 1.06 | 1.46 |
| South | 22.3 | 0.99 | 1.33* | 27.9 | 1.00 | 1.39* |
| Urbanicity | | | | | | |
| Large MSA | 24.9 | (ref.) | (ref.) | 30.6 | (ref.) | (ref.) |
| Other MSA | 24.5 | 0.98 | 0.93 | 29.5 | 0.95 | 0.92 |
| Non-MSA | 21.1 | 0.81 | 0.86 | 27.2 | 0.85 | 0.89 |
| No. of parents in household | | | | | | |
| Two | 21.0 | (ref.) | (ref.) | 26.6 | (ref.) | (ref.) |
| One | 29.1 | 1.54 [‡] | 1.27 [†] | 34.1 | 1.43 [‡] | 1.18* |
| None | 35.4 | 2.05 [‡] | 1.70* | 42.4 | 2.03 [‡] | 1.65* |
| Average parental education | | | | | | |
| Low | 28.0 | (ref.) | (ref.) | 33.8 | (ref.) | (ref.) |
| 2 | 27.2 | 0.96 | 0.86 | 34.7 | 1.04 | 1.00 |
| 3 | 22.9 | 0.76 | 0.69 | 28.5 | 0.78 | 0.75 |
| 4 | 21.8 | 0.72 | 0.73 | 26.8 | 0.72 | 0.79 |
| High | 21.8 | 0.72 | 0.91 | 24.5 | 0.64 | 0.85 |
| Race/ethnicity | | | | | | |
| White | 24.4 | (ref.) | (ref.) | 29.9 | (ref.) | (ref.) |
| Black | 25.3 | 1.05 | 1.15 | 27.6 | 0.89 | 0.98 |
| Hispanic | 24.0 | 0.98 | 0.75 | 33.7 | 1.19 | 1.01 |
| Other | 18.9 | 0.72* | 0.73 | 23.1 | 0.70* | 0.73* |
| Religious commitment | | | | | | |
| High | 13.5 | (ref.) | (ref.) | 17.2 | (ref.) | (ref.) |
| Medium | 24.8 | 2.10 [‡] | 1.74 [‡] | 31.0 | 2.16 [‡] | 1.84 [‡] |
| Low | 32.8 | 3.11 [‡] | 2.24 [‡] | 39.4 | 3.12 [‡] | 2.36 [‡] |
| Missing data (CA) | 24.3 | 2.06 [‡] | 2.14 [†] | 30.0 | 2.06 [‡] | 2.21 [†] |
| GPA | | | | | | |
| A or A- | 16.0 | (ref.) | (ref.) | 19.9 | (ref.) | (ref.) |
| B+ or B | 24.4 | 1.70 [‡] | 1.44 [†] | 30.5 | 1.78 [‡] | 1.51 [†] |
| B- or below | 32.1 | 2.50 [‡] | 1.52 [†] | 38.7 | 2.55 [‡] | 1.53 [‡] |
| Truancy | | | | | | |
| None | 12.2 | (ref.) | (ref.) | 15.9 | (ref.) | (ref.) |
| Low | 23.7 | 2.24 [‡] | 2.02 [‡] | 28.6 | 2.11 [‡] | 1.87 [‡] |
| Medium | 28.1 | 2.82 [‡] | 2.33 [‡] | 36.8 | 3.07 [‡] | 2.56 [‡] |
| High | 49.1 | 6.98 [‡] | 5.07 [‡] | 56.4 | 6.83 [‡] | 4.89 [‡] |
| Evenings out | | | | | | |
| 0 | 14.7 | (ref.) | (ref.) | 18.6 | (ref.) | (ref.) |
| 0.5 | 18.2 | 1.30* | 1.32* | 24.5 | 1.42 [†] | 1.45 [‡] |
| 1-1.5 | 24.5 | 1.89 [‡] | 1.74 [‡] | 30.1 | 1.89 [‡] | 1.77 [‡] |
| ≥2 | 37.2 | 3.44 [‡] | 2.55 [‡] | 43.3 | 3.34 [‡] | 2.47 [‡] |
| Hours worked | | | | | | |
| 0 | 19.8 | (ref.) | (ref.) | 23.7 | (ref.) | (ref.) |
| 1-15 | 20.2 | 1.03 | 1.11 | 25.9 | 1.12 | 1.21 |
| 16-30 | 28.6 | 1.62 [†] | 1.37* | 34.1 | 1.66 [‡] | 1.36 [†] |
| >30 | 29.6 | 1.70 [‡] | 1.17 | 39.7 | 2.12 [‡] | 1.47 [†] |
| Miles driven | | | | | | |
| 0 | 24.6 | (ref.) | (ref.) | 28.7 | (ref.) | (ref.) |
| 1-50 | 20.2 | 0.78* | 0.84 | 24.5 | 0.80* | 0.88 |
| 51-100 | 22.1 | 0.87 | 0.84 | 27.8 | 0.96 | 0.92 |
| >100 | 28.5 | 1.22 | 1.03 | 35.6 | 1.38* | 1.17 |
| Year | | | | | | |
| 2004 | 23.9 | (ref.) | (ref.) | 29.3 | (ref.) | (ref.) |
| 2005 | 23.8 | 1.00 | 1.07 | 29.4 | 1.00 | 1.06 |
| 2006 | 23.7 | 0.99 | 1.13 | 29.3 | 1.00 | 1.15 |

Notes: OTM = illicit drugs other than marijuana; OR = odds ratio; ref. = reference group; MSA = metropolitan statistical area; GPA = grade point average. ^aHeavy drinking defined as five or more drinks in a row; ^bunadjusted = bivariate result with one predictor; ^cadjusted = multivariate result with all predictors.

**p* < .05; [†]*p* < .01; [‡]*p* < .001.

occurred between 2001 and 2003, with little change since then. It is difficult to know for certain what accounts for the slight improvement since 2001; however, rates of drinking heavily and of using marijuana or other illicit drugs declined from 2001 to 2006, which likely accounted for most of the change in driving after using these intoxicating substances. The proportional declines in the individual use behaviors were about 12% for heavy drinking and 20% for 30-day marijuana use, compared with a proportional decline of 15% in the at-risk behavior.

Perhaps it should not be surprising that so many young people are placing themselves at risk. Drinking alcohol, using marijuana, or using other illicit drugs and driving a motor vehicle are not uncommon behaviors. Based on data from the Monitoring the Future study (the same sample of students as used in this report), in 2006, 45% of seniors drank alcohol in the past 30 days, 22% used marijuana or an illicit drug other than marijuana, and 82% reported doing at least some driving in an average week. Moreover, many seniors (about 63%) said they owned their own car. Thus, with motor vehicles readily available and substantial percentages using alcohol or drugs, it is not surprising that the behaviors overlap.

Another finding was that driving or riding after drinking or using drugs was quite widespread among American high school seniors, at least as defined by the demographic and lifestyle characteristics investigated here. Variations by population density were not significant, and variations by region were not great, although the West region was a bit lower when all the covariates were included in the model. The regional variation was stronger for driving or riding after use of illicit substances, particularly driving after marijuana use, with the West being lower than average and the Northeast higher. Socioeconomic status, as indexed by parental education, certainly provided little protection: The relationship was generally negative but did not reach conventional statistical significance, even with the relatively large numbers of cases surveyed here. Living with both parents did seem to provide some protection. Compared with students who lived with two parents (or guardians), students who lived with no parent or one parent were more likely to report risky driving or riding. Compared with white students and controlling for all covariates, Hispanic students were significantly less likely to drive after using marijuana, whereas black students were significantly less likely to drive after drinking heavily. But neither minority group differed significantly from white students in exposure to driving or riding with a driver who had been drinking heavily or using drugs.

Individual lifestyle factors did show considerable variation in the outcome behaviors. Students with high religiosity, good grades, low truancy, infrequent evenings out for fun, or a low number of hours of paid work were less likely to put themselves at risk. Each of these factors re-

mained significant in the multivariate model when all other covariates were included. The fact that all of these individual characteristics related to risky driving behaviors suggests that these may all be indicators of "problem behaviors" and that any efforts at reducing risky driving/riding should be broad based, aimed at pervasive behavior tendencies (Jessor et al., 1997).

One interesting finding was that, in 2006, the prevalence of driving after the use of marijuana was greater than the prevalence of driving after having five or more drinks (13.1% vs 9.5%), and this was true for every year since 2001. The prevalence of driving after drinking alcohol in any amount (14.2% in 2006) was consistently a little higher than the prevalence of driving after using marijuana.

A natural question to ask is to what extent are individuals who reported driving after marijuana use the same individuals who reported driving after heavy drinking. For the years 2004-2006 combined, 4.3% of the seniors in the Monitoring the Future study reported driving after heavy drinking but not after marijuana use, 8.7% reported driving after marijuana use but not after heavy drinking, and 5.2% reported doing both. Driving after using marijuana or after heavy drinking need not be exclusive behaviors; an individual may be drinking heavily and using marijuana on the same occasion. Our questions do not allow determination of whether an individual may be reporting a single event of driving after marijuana use and heavy drinking.

There is some belief that driving after marijuana use is much less dangerous than driving after heavy drinking (Davey et al., 2005; Fischer et al., 2006). Persons who are "high" on marijuana are thought to be able to compensate for their reduced ability to respond to events while driving by concentrating more on the task at hand (Laberge and Ward, 2004; Terry and Wright, 2005). However, in this study, individuals who reported driving after marijuana use (but not after heavy drinking) reported having been in a traffic accident in the prior 12 months just about as often as individuals who reported driving after heavy drinking (but not after marijuana use)—38% and 39%, respectively. These individuals were significantly more likely to have been a driver in an accident than those who reported no driving after substance use, 23% of whom reported having been a driver in an accident. (It should be noted that these data do not allow for any causal interpretation as to whether substance use contributed to the accidents.)

Methods for detecting drug-impaired driving are not as well developed as those for detecting alcohol-impaired driving. As a result, young people may believe that their drug-impaired driving is unlikely to be detected, and indeed there may be some truth to this belief (Davey et al., 2005; Moskowitz, 1985). Thus perhaps prevention efforts should not emphasize that offenders will face grave consequences if apprehended (because the risk of apprehension is relatively low) but rather that they may face grave consequences

if their risky driving/riding results in serious accidents causing death or injury to others or injury to themselves.

Limitations

This study relied exclusively on self-reported measures. Thus there was inevitably some degree of measurement error. However, it seems unlikely that the errors would have been of a magnitude to have a serious effect on the results, which were very clear. The Monitoring the Future study was designed to maximize valid reporting by assuring the respondents of complete confidentiality. Questionnaires were administered in group settings in school by University of Michigan representatives who had no affiliation with the school. All responses were to close-ended questions and elaborate procedures were used to convey to respondents that their data would be well protected (Johnston and O'Malley, 1985).

Conclusions

Large numbers of American adolescents are putting themselves at great risk of harm by driving or riding when the driver has used illicit drugs or been drinking heavily. Impaired driving by youth remains a problem that needs serious attention despite some progress in recent years. We hope that the information provided here will help to stimulate and increase that attention.

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