Unsafe Driving by High School Seniors: National Trends from 1976 to 2001 in Tickets and Accidents after Use of Alcohol, Marijuana and Other Illegal Drugs*

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ABSTRACT. *Objective*: This study reports trends from 1976 to 2001 in the number of tickets or warnings that high school seniors receive, the number of vehicle accidents in which they are drivers and the number of these events that occur after use of alcohol, marijuana or other illegal drugs. *Method*: The data come from the Monitoring the Future study, in which nationally representative samples of high school seniors have been surveyed annually since 1976. *Results*: Results demonstrate that the problem of unsafe or inappropriate driving among American youth is of considerable magnitude, although there has been a down- ward trend when adjusted for number of miles driven. The frequency of tickets received and vehicle accidents that occurred after use of al- cohol has diminished markedly compared to the incidence of tickets and accidents after use of marijuana over the interval from 1976 to 2001. *Conclusions*: Despite the decline in the number of vehicle accidents oc- curring and tickets received after drinking or using illicit drugs, aggres- sive policies are still needed to deter youths from engaging in such risky behaviors. (*J. Stud. Alcohol* **64**: 305-312, 2003)

IT IS WELL RECOGNIZED that driving after drinking is a major problem among American youth, and there is a considerable literature about the extent of driving after drinking and about the characteristics of youths who are most at risk for driving after drinking (Donovan, 1993; O'Malley and Johnston, 1999; Townsend et al., 1998). Much less is known about the extent to which young Americans drive after smoking marijuana or using other illicit drugs. Studies of drivers involved in fatal crashes typically find considerable evidence of use of drugs other than alcohol, which suggests that drug use may increase the likelihood of crash involvement (Moskowitz, 1999; Terhune et al., 1992). Studies in which drivers were stopped and tested for drug use also provide evidence that reckless drivers are likely to be drug impaired (Brookoff, 1994).

This article reports findings from a series of annual na- tional surveys that measure the number of tickets or warn- ings high school seniors receive for moving violations and the number of vehicle accidents in which they are involved as drivers. We also report the number of these tickets/warn- ings or accidents that occur after use of alcohol, marijuana or other illegal drugs, as well as cross-time trends in these events from 1976 to 2001.

Method

The data presented here for the period 1976-2001 come from the Monitoring the Future (MTF) study, which is de- scribed in detail elsewhere (Bachman et al., 2001; Johnston et al., 2001). Nationally representative annual samples of approximately 16,000 12th graders located in about 135 schools have been selected each year since 1975 through a multistage scientific sampling procedure. Confidential, self- completed questionnaires are administered by University of Michigan employees during school hours, usually in a regularly scheduled class period. The University of Michi- gan Institutional Review Board approved this study and the consent information provided to respondents.

Outcome measures are assessed via the following two sets of questions:

Within the LAST 12 MONTHS, how many times, if any, have you received a ticket (OR been stopped and warned) for moving violations such as speeding, running a stop light, or improper passing? How many of these tickets or warnings occurred after you were … drinking alcoholic beverages?… smoking marijuana or hashish? … using other illegal drugs?

We are interested in any accidents which occurred while you were driving a car, truck, or motorcycle. ("Acci- dents" means a collision involving property damage or per- sonal injury—not bumps or scratches in parking lots.) During the LAST 12 MONTHS, how many accidents have you had while you were driving (whether or not you were responsible)? How many of these accidents occurred after

you were … drinking alcoholic beverages? … smoking mari-juana or hashish? … using other illegal drugs?
The response scale for these questions was: 0 = none, 1 = one, 2 = two, 3 = three, 4 = four or more.

Demographic and lifestyle measures

Parental education is a mean of two items indicating the amount of education achieved by parents, ranging from grade school or less (1) to graduate work (6). *Grades* are self-reported average grades in high school. *Truancy* is a mean of two measures, the frequency of skipping classes or whole days of school during the past 4 weeks. *Religious commitment* is a mean of two items assessing importance of religion and frequency of attendance at religious ser-vices. *Evenings out per week* is the number of evenings out for fun and recreation in a typical week. *Miles driven per week* is the number of miles driving a car, truck or motor-cycle in an average week. The *index of illicit drug use* is a measure reflecting any use in the past 12 months of any of nine classes of illicit drugs; respondents are classified as (1) nonuser, (2) user of marijuana only and (3) user of an illicit drug other than marijuana. All these measures of lifestyle factors have been used extensively in other pub-lications. More details on their psychometric properties, particularly construct validity, are provided elsewhere (Bachman et al., 1980).

Analyses were conducted with the SAS statistical analy-sis system (SAS Institute, 2000). The data are weighted to adjust for differential probabilities of selection of the sample. Logistic regressions utilized software that accommodates complex sample designs (Raghunathan et al., 2000).

Results

Figure 1 shows the trends from 1976 to 2001 in the number of tickets (or warnings) and accidents reported by high school seniors, both in absolute numbers (lower two lines), and in numbers per 100 miles driven per week (up-per two lines). In the period from 1976 to 1984, seniors averaged about 60 miles driven per week, but this increased by more than one third to over 80 miles per week in the most recent 3 years shown. In 1976 and 1977 seniors aver-aged just over 0.40 tickets per year; these values increased, though not consistently, through the 1980s and 1990s, reach-ing a high point of 0.56 in 1999. (Each estimate of the number of tickets received has a standard error of approxi-mately 0.018. To adjust for the complex sample design, a design effect is used. Using software developed by Raghunathan et al., 2000, we estimate that the design ef-fect for number of tickets is 5.7, and for number of acci-dents, 3.7.) The data for number of tickets per 100 miles driven per week show a different trajectory; again, the changes are by no means ordinal, but the overall trend is down.
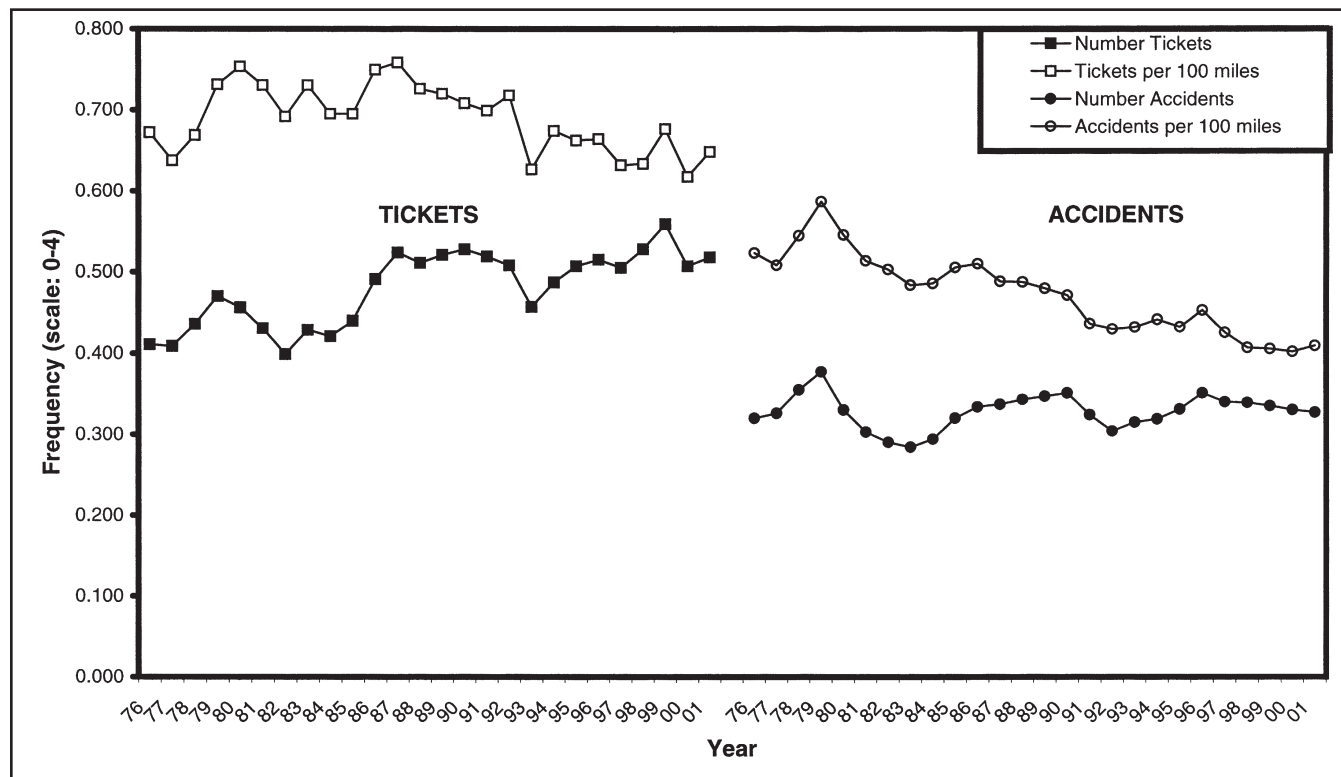

FIGURE 1.   Trends in frequency of tickets/warning and accidents per year and number per 100 miles driven per week, high school seniors, 1976-2001

For accidents, the mean number per year has varied, with periods of rises and falls. The lowest level (0.284) was reached in 1983, and the highest was in 1979 (0.377). (Each estimate has a standard error of approximately 0.010.) The trend line for the entire period is essentially flat, and the most recent (2001) year's mean is 0.33, just about equal to the overall 26-year mean. As with the data for tickets, the trend adjusted for amount of driving shows a different pattern. Here the trend is clearly down. In the last half of the 1970s, the mean number of accidents per 100 miles driven per week was between 0.5 and 0.6; by 2001, this number is at 0.41.

In terms of *percentages* or prevalence rates, between 25% and 30% of seniors from 1976 through 1985 reported having been ticketed or having received a warning in the prior 12 months (data not shown). Since 1986, approximately 30% report being ticketed or warned. The percentage reporting having an accident while driving has been relatively stable around a mean of 25%, varying from a low of 22% to a high of 28%. In recent years, about 45% of seniors report having either a ticket (or warning) or an accident.

Figure 2 shows the frequency with which students received a ticket (or warning) or had an accident after (1) drinking alcohol, (2) smoking marijuana or (3) using one or more other illicit drugs. The figure shows that more seniors received a ticket (or warning) or were in an accident after drinking alcohol than after smoking marijuana or using any other illicit drug. However, the gap between alcohol and marijuana has narrowed considerably in recent years. These trends generally follow the trend lines for overall reported use of alcohol and marijuana.

Figure 3 provides the trends in 12-month prevalence of use of alcohol, marijuana and other illicit drugs for comparison. Use rates rose in the late 1970s, peaked in the late 1970s or early 1980s, then generally declined through the 1980s to the early 1990s. Marijuana use then rose through 1997, while alcohol use remained fairly steady. Both have declined slightly in the years since. The trends for receiving a ticket and for being in an accident after using marijuana follow the trend in 12-month marijuana prevalence quite closely. The trends for receiving a ticket and being in an accident after drinking alcohol also follow the trend in alcohol prevalence. As a descriptive indicator of the degree to which the measures move in concert, product-moment correlations were calculated for the 26 years of data. The correlation between the percentage using alcohol in the past 12 months and the frequency of receiving a ticket/warning or being in an accident following alcohol use is 0.93 and 0.92, respectively; the corresponding correlations for marijuana are 0.92 and 0.93. The trend for receiving a ticket or being in an accident following use of an illicit drug other
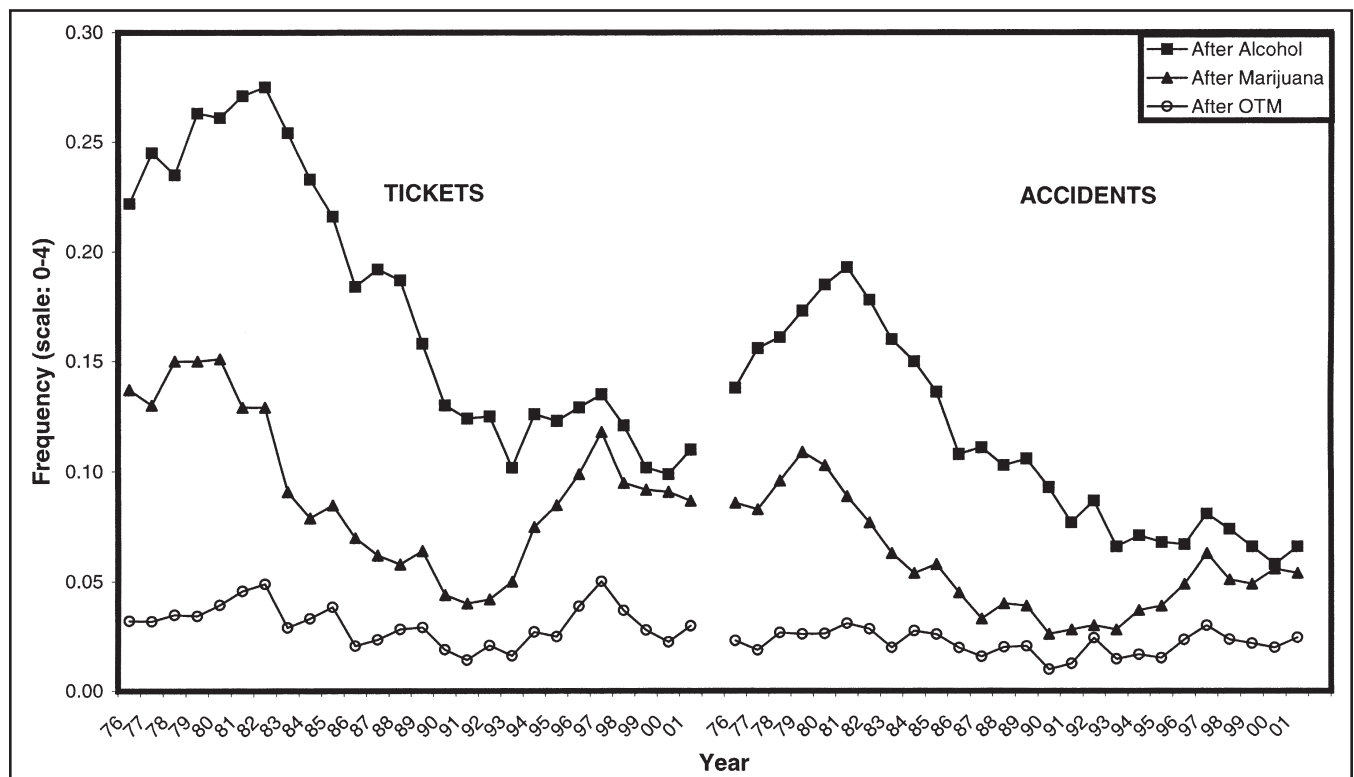

FIGURE 2.   Trends in frequency of tickets/warning and accidents per year after alcohol, marijuana and other illicit drugs (OTM), high school seniors, 1976-2001
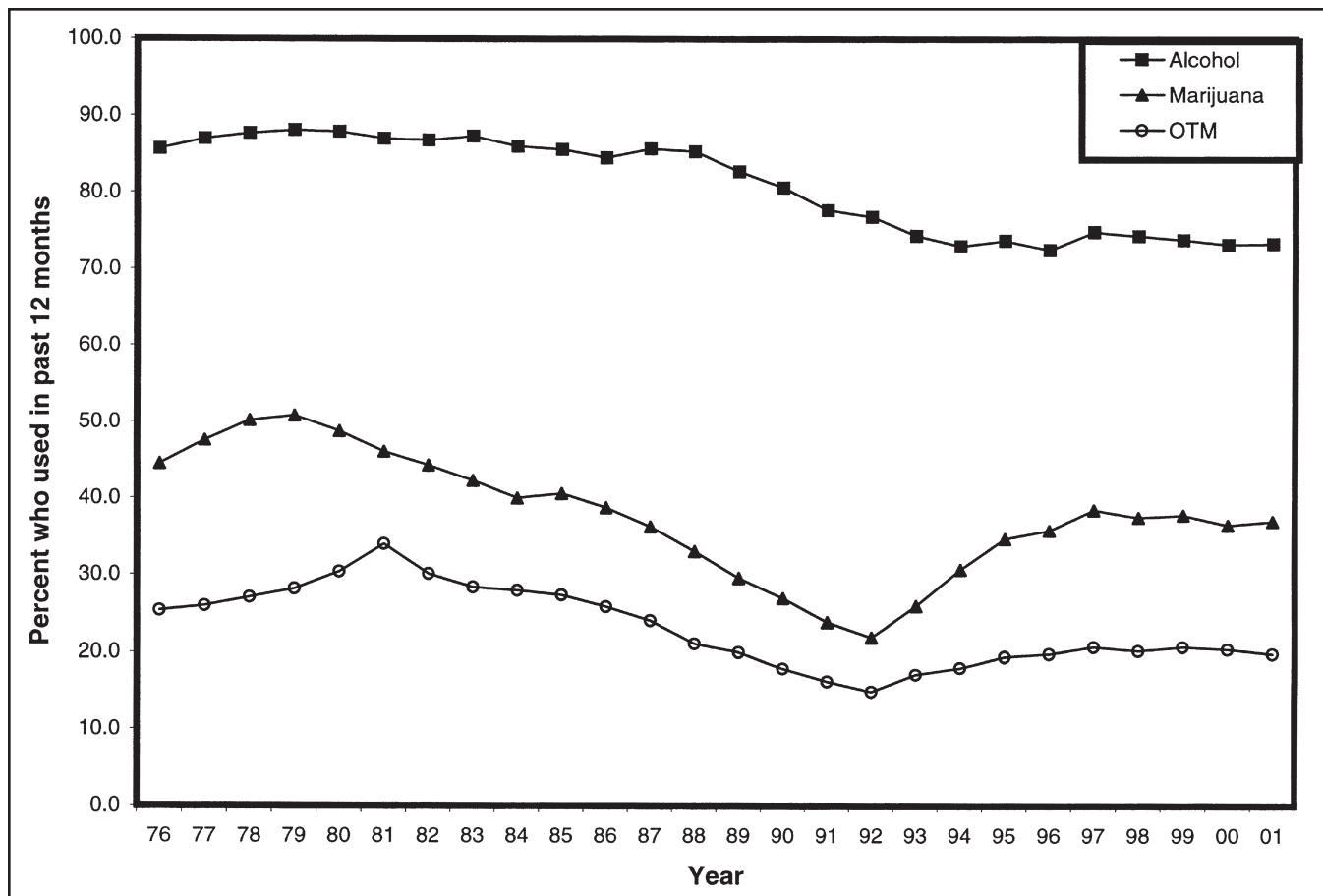
FIGURE 3.   Trends in annual prevalence of alcohol, marijuana and other illicit drugs (OTM), 1976-2001

than marijuana does not follow the trend in use of illicit drugs other than marijuana nearly as closely; the correlations here are only 0.60 and 0.62.

In terms of percentages (tabular data not presented), approximately 5% of seniors in the early 1980s reported having drunk alcohol prior to receiving a ticket. That percentage dropped fairly steadily through the mid to late 1980s, and into the early 1990s, reaching a low of 2.2% in 1993. Since 1993 there has been some increase, with the 1998 figure reaching 2.8% before falling to 2.4% in 2001. The percentage reporting having smoked marijuana prior to receiving a ticket also showed some decline through the 1980s and into the early 1990s, from a high in 1979 of 2.9% reaching a low of 0.7% in 1992. This percentage has also increased lately, standing at 1.7% in 2001. The percentages receiving a ticket after use of other illicit drugs shows a slightly different pattern: The pre-1990 peak occurred in 1981 at 0.7%. After declining through the 1980s, it reached a low of 0.3% in 1991-1993, but by 1997 it peaked at 0.8%. The 2001 percentage is 0.6%.

The percentage of seniors who had an accident after use of alcohol or marijuana declined substantially from 1980 (4.0% for alcohol and 2.0% for marijuana) to 1992 (1.5%

for alcohol and 0.4% for marijuana). Since then the rates for alcohol decreased further (1.2% in 2001), while marijuana rates increased (0.9% in 2001). The percentage of seniors who report having been in an accident following use of an illicit drug other than marijuana has stayed consistently low at between 0.2% (1990) to 0.5% (1981). The percentage in 2001 is 0.4%.

Subgroup data

Table 1 shows the number of miles driven per week and the percentage of seniors getting a ticket (or warning), total, after drinking alcohol, smoking marijuana or using other illicit drugs for various subgroups. Data for the 2-year period 2000-2001 are combined to increase the numbers of cases. Table 2 shows the percentages having an accident, total, after drinking alcohol, smoking marijuana or using other illicit drugs. Multivariate logistic regressions were conducted for each of the eight measures of risky driving, predicting from all variables except illicit drug use, which was excluded because of its collinearity with the measures of tickets/warnings or accidents after marijuana and other drug use. The symbols in the tables show significance levels for

TABLE 1. Miles driven per week and percent receiving a ticket (or warning), including after use of alcohol, marijuana or other illicit drugs: Classes of 2000 and 2001, combined

	Approx. N	Miles per week	Total (%)	After alcohol (%)	After marijuana (%)	After other drug (%)
				Tickets/warnings		
Total	24,379	81.0	31.5	2.35	1.83	0.52
Gender						
Male[a]	11,227	93.5	38.6	3.46	2.81	0.75
Female	12,474	70.2	25.0‡	1.23‡	0.86‡	0.28
Race/ethnicity						
Black[a]	2,984	50.5	22.3	0.93	1.01	0.48
White	15,975	93.6	35.3‡	2.74*	2.01	0.48
Hispanic	2,528	57.8	26.1	2.02*	1.52	0.56
Parental education						
1.0-2.0 (low)[a]	1,809	58.6	23.7	2.21	2.12	1.00
2.5-3.0	5,688	80.6	30.7	2.19	1.70	0.44*
3.5-4.0 (med.)	6,996	85.0	33.4*	2.62	1.79	0.31‡
4.5-5.0	6,077	84.3	33.0*	2.18	1.93	0.67
5.5-6.0 (high)	3,103	84.2	32.6*	2.28	1.73	0.41*
Region						
Northeast	4,438	63.0	23.3‡	1.71	1.92	0.49
North Central	6,521	90.3	36.0	3.03	1.95	0.64
South[a]	8,307	86.4	32.9	2.53	1.57	0.43
West	5,113	76.0	30.3	1.74	2.02	0.51
Population density						
Large MSA	7,057	71.6	29.0	1.96	1.52	0.56
Other MSA	11,091	78.2	30.4	2.16	1.96	0.48
Non-MSA[a]	6,231	96.5	36.1	3.14	1.95	0.52
Grades						
B- or lower	7,596	76.8	33.7‡	3.53‡	3.01†	0.87
B, B+	8,930	82.3	32.0†	2.12	1.43	0.25*
A[a]	7,664	83.6	28.6	1.40	1.07	0.42
Truancy						
None[a]	12,214	76.2	25.4	1.05	0.52	0.13
0.5 (low)	3,988	82.5	33.1‡	1.69	1.32†	0.12
1.0-1.5 (med.)	4,057	86.8	38.8‡	4.01‡	2.80‡	0.54†
2.0-5.5 (high)	3,116	92.1	44.3‡	5.80‡	6.30‡	2.34‡
Religious commitment						
1.0-2.0 (low)[a]	7,507	84.8	34.9	3.17	2.61	0.66
2.5-3.0 (med.)	6,611	84.7	34.2	3.00	1.98	0.52
3.5-4.0 (high)	7,493	80.3	28.5†	1.29*	0.67‡	0.27
Evening out/week						
0-1[a]	5,702	64.8	22.3	0.76	0.53	0.25
2	6,575	76.5	27.8†	1.25	0.80	0.15
3	5,898	83.6	34.5‡	2.47†	1.54	0.42
4 or more	6,002	99.1	41.3‡	4.76‡	4.39‡	1.19
Miles driven/week[b]						
0	3,677	0.0	5.1	0.84	0.57	0.23
1-50	7,169	23.9	22.5	1.44	1.04	0.22
51-99	5,441	75.5	38.1	2.33	2.32	0.60
100 or more	8,092	72.0	46.8‡	3.82†	2.77†	0.85*
Illicit drug use, 12 months[b]						
None	14,195	75.9	24.9	0.48	0.00	0.02
Marijuana only	4,942	82.6	38.4	3.12	1.64	0.20
Other than marijuana	4,850	95.2	43.7	7.07	7.42	2.31

[a]Referent, or excluded, category in multivariate logistic regression. [b]Miles driven entered as continuous variable; illicit drug use not included.
*$p < .05$; †$p < .01$; ‡$p < .001$ in multivariate logistic regression.

each variable, controlling for all other predictors (except illicit drug use). Miles driven per week was entered as a continuous variable in the multivariate regression.

Gender. Male seniors report driving more miles per week on average (94) compared to female seniors (70); thus they could be expected to report more instances of risky or unsafe driving, and indeed they do. Male seniors receive more tickets/warnings than female seniors (38.6% vs 25.0%) and more tickets/warnings after substance use. They are about three times more likely than female seniors to report some prior substance use. For accidents, the differences are smaller: 26.0% of male seniors and 23.5% of female seniors were involved in an accident in the prior 12 months. Proportionally, the differences are larger for accidents following substance use, with more than twice as many male as female seniors reporting accidents after use. The differences in all tickets/warnings and tickets/warnings occurring after alcohol and marijuana use are statistically significant, as are the differences in accidents occurring after alcohol and other illicit drug use.

Race/ethnicity. White seniors drive much more than black seniors (94 miles per week on average vs 51). They are also far more likely to receive tickets and to be in accidents, significantly so after multivariate controls, including for number of miles driven per week. White seniors are also more likely than black seniors to report tickets and accidents after substance use, except for accidents after other drugs, but only the tickets or warnings after alcohol remain significant after multivariate controls. Hispanic seniors are midway between white and black seniors in tickets/warnings and accidents, total, and after substance use—except for tickets/warnings and accidents after using illicit drugs other than marijuana and accidents after alcohol use, where Hispanic seniors report the highest levels. However, none of these measures for which Hispanic seniors are highest is statistically significant after multivariate controls.

Parental education. Parental education is positively (though not entirely monotonically) associated with both tickets and accidents. The association, however, is quite different for tickets and accidents after substance use. In these cases, the association is not strong and becomes mostly negative. After multivariate controls, higher parental education is significantly associated with more tickets/warnings overall but fewer tickets/warnings after illicit drug use, and with more accidents overall but fewer accidents after alcohol use (compared to the lowest parental education category).

Region. High school seniors in the Northeast region report the lowest number of miles driven per week and the fewest tickets, but regional differences are not large, particularly after multivariate controls.

Population density. The non-Metropolitan Statistical Areas (non-MSAs) are highest in both tickets and accidents, as well as in miles driven per week; but differences are generally not multivariately statistically significant.

Grades. Grades are negatively associated with both tickets and accidents, including after substance use. After

TABLE 2.   Percent reporting an accident while driving, including after use of alcohol, marijuana or other illicit drugs: Classes of 2000-2001, combined

			Accidents		
	Approx. N	Total (%)	After alcohol (%)	After marijuana (%)	After other drug (%)
Total	24,379	24.7	1.16	0.94	0.34
Gender					
Male[a]	11,227	26.0	1.52	1.33	0.49
Female	12,474	23.5	0.69*	0.54	0.16*
Race/ethnicity					
Black[a]	2,984	16.7	0.75	0.60	0.28
White	15,975	27.6‡	1.22	0.99	0.24
Hispanic	2,528	20.3†	1.48	0.79	0.71
Parental education					
1.0-2.0 (low)[a]	1,809	19.1	2.00	1.15	0.71
2.5-3.0	5,688	23.1	0.99*	0.79	0.19
3.5-4.0 (med.)	6,996	25.6	0.97*	0.72	0.19
4.5-5.0	6,077	26.3*	1.10	1.15	0.37
5.5-6.0 (high)	3,103	27.6*	1.21	0.99	0.50
Region					
Northeast	4,438	24.3*	1.10	1.27	0.35
North Central	6,521	25.7	1.24	1.06	0.27
South[a]	8,307	25.7	1.29	0.67	0.35
West	5,113	22.2	0.89	0.93	0.42
Population density					
Large MSA	7,057	25.0	1.16	1.19	0.51
Other MSA	11,091	23.8	0.85†	0.89	0.27
Non-MSA[a]	6,231	26.0	1.70	0.74	0.27
Grades					
B- or lower	7,596	25.4‡	1.62	1.53	0.49
B, B+	8,930	25.6‡	0.98	0.66	0.17*
A[a]	7,664	23.0	0.79	0.56	0.33
Truancy					
None[a]	12,214	20.9	0.45	0.37	0.11
0.5 (low)	3,988	26.8‡	0.75	0.46	0.15
1.0-1.5 (med.)	4,057	30.0‡	1.98‡	1.58‡	0.36
2.0-5.5 (high)	3,116	31.6‡	3.29‡	2.83‡	1.31‡
Religious commitment					
1.0-2.0 (low)[a]	7,507	27.5	1.40	1.33	0.42
2.5-3.0 (med.)	6,611	25.9	1.49	0.93	0.24
3.5-4.0 (high)	7,493	22.6*	0.66*	0.50*	0.26
Evening out/week					
0-1[a]	5,702	19.6	0.53	0.34	0.19
2	6,575	22.8	0.71	0.19	0.16
3	5,898	25.8*	1.26	1.00	0.28
4 or more	6,002	30.8‡	1.94*	2.15†	0.63
Miles driven/week[b]					
0	3,677	5.8	0.63	0.27	0.08
1-50	7,169	20.4	0.55	0.66	0.23
51-100	5,441	28.7	1.15	0.88	0.41
100 or more	8,092	34.3‡	1.85‡	1.50‡	0.49
Illicit drug use, 12 months[b]					
None	14,195	20.0	0.21	0.00	0.01
Marijuana only	4,942	28.0	1.25	0.68	0.18
Other than marijuana	4,850	35.4	3.74	3.97	1.45

[a]Referent, or excluded, category in multivariate logistic regression. [b]Miles driven entered as continuous variable; illicit drug use not included.
*$p < .05$; †$p < .01$; ‡$p < .001$ in multivariate logistic regression.

multivariate controls, the prevalence of accidents after sub-stance use is generally not statistically significant.

Truancy. Seniors reporting more truant behavior also re-port more driving and more tickets and accidents, as well as more events after substance use. Most of these differ-ences remain significant.

Religious commitment. Seniors who report high levels of religious commitment drive less and are less likely to receive tickets/warnings or to be in accidents, including after substance use. Most of these associations remain sig-nificant after multivariate controls.

Evenings out. The number of evenings the respondent typically goes out each week is strongly related to the num-ber of miles driven, tickets and accidents, and tickets and accidents after substance use. These associations are di-minished but remain generally significant after multivariate controls.

Miles driven per week. The number of miles driven per week is strongly related to the number of tickets and acci-dents, including after substance use. (Note that even though a respondent may report driving zero miles in an average week, he or she may do some driving. It could also be that some respondents who had received a ticket or been in an accident were restricted from driving.)

Illicit drug use. Those reporting drug use in the past 12 months report significantly more tickets and accidents, and more of each after alcohol use. Compared to seniors who report using no illicit drugs in the past 12 months, seniors who report using only marijuana report more tickets and accidents after marijuana use, as would be expected. (The latter also report a small amount of tickets and accidents after using drugs other than marijuana; this apparent anomaly could be due to misreporting, or it could be that they used illicit drugs other than marijuana that were not explicitly included in the calculation of this index.)

Discussion

Perhaps the most significant finding reported here is the magnitude of the problem of risky or unsafe or inappropri-ate driving among American youth. In 2000-2001, 32% of high school seniors reported having a ticket or warning, 25% were involved in an accident in the prior 12 months, and 44% reported having either a ticket/warning or an accident. An interesting aspect of the data is that, when adjusted for number of miles driven, there seems to be a downward trend in these behaviors in the last quarter cen-tury. This trend suggests that driving performance may be improving, although a considerable amount of inappropri-ate driving still occurs.

Rates of having tickets or accidents following substance use show trends that differ by substance. Over the interval covered, the frequency of tickets after alcohol use first in-creased, then declined substantially before becoming somewhat stable. This pattern follows that for alcohol con-sumption in general. Similarly, the pattern of tickets or ac-cidents after marijuana use generally follows the trends in prevalence of marijuana use. With respect to tickets or ac-

cidents after use of illicit drugs other than marijuana, the correlation is not as high. Still, there is some correspondence, with both overall use and tickets after use being a bit higher in the late 1970s, somewhat lower during the 1980s, then rising in the 1990s until peaking in 1997 and dropping a bit after that. The incidence of accidents after use of some illicit drug other than marijuana has been relatively stable and is therefore less connected to fluctuations in overall use.

The relative stability of these percentages is perhaps surprising, considering the rather large changes in the number of miles driven, which increased by about one third.

One finding of note is that the difference in frequency of tickets or accidents that occurred after use of alcohol as compared to marijuana has diminished markedly over the interval from 1976 to 2001. Among the classes of 2000 and 2001, there is not much difference between these two substances in the frequency with which seniors report having received tickets or having had accidents after their use. There is some overlap in individuals reporting having used both alcohol and marijuana before an accident; however, the great majority report using either alcohol or marijuana, but not both, before an accident. For example, in 2000, 149 seniors reported one or the other, and 39 reported both. The convergence that has occurred over time is largely due to the substantial decline in the frequency of teens getting a ticket or having an accident while driving after using alcohol.

The similarity in driving inappropriately after alcohol or marijuana reflects the similarity in the frequency with which seniors actually drive after use of alcohol or marijuana. New questions about driving after use of marijuana were added to the 2001 survey of seniors, and results show that 16% reported having driven at least once in the past 2 weeks after drinking alcohol, compared to 15% after smoking marijuana.

Because alcohol consumption is still considerably more prevalent than marijuana consumption, the fact that the use of these two substances in combination with driving has reached near parity suggests that teens are relatively less likely to drive after drinking than they are after using marijuana. This may reflect the concerted efforts in the past 20 years to deter drunk driving compared to the much more limited efforts to deter drug-impaired driving (Berger and Marelich, 1997; Hingson et al., 1994; Winsten, 1994). It could conceivably also reflect a belief (probably valid) that alcohol use is more likely than marijuana use to be detected, and thus seniors may be more likely to refrain from driving after drinking alcohol.

The variations by the several demographic and lifestyle variables examined here are much as might be expected, particularly for variations following substance use; that is, tickets or accidents following substance use are more likely to occur among subgroups whose use is higher. (See Johnston et al., 2001, for detailed information on subgroup variation in use.)

Limitations. The data reported here are based on self-reports. Like most such studies, this study has no direct objective measures for validation of the self-reports. However, as discussed in detail elsewhere (Harrison, 1995; Johnston et al., 2001; O'Malley et al., 1983), the weight of evidence suggests the procedures used in this study are likely to produce largely valid results. We believe this should be true for the key measures reported here—receiving tickets/warnings or being in an accident after use of alcohol, marijuana or illegal drugs. There may be some tendency for individuals to underreport (conceal) such behaviors, but the considerable numbers who do report suggest that the concealment rates must be quite low. And there is little reason to suspect significant overreporting; the questionnaires are self-administered under confidential procedures and quite obviously are to be optically scanned, thus providing little incentive for respondents to exaggerate. Moreover, any consistent biases would alter absolute levels but should not bias the trend data. We note that there is a reasonable correspondence with trends in official data. For example, seniors reported a 38% decline in accidents occurring after alcohol use between 1990 and 2000; in the same period, intoxication rates for drivers ages 16-20 decreased by 29 percent (National Highway Traffic Safety Administration, 2001).

In sum, the data reported here indicate there is a great deal of risky and unsafe driving behavior among American youth. Moreover, although the vast majority of tickets and accidents do not occur after substance use, many youths are obviously driving after using alcohol, marijuana or other illicit drugs. Although the percentages are relatively low— for example, 1% of all 2000-2001 seniors were drivers in an accident after using marijuana—they represent many individuals in just a single cohort of seniors, in this case approximately 28,000 seniors per year who were in at least one accident after using marijuana.

The data reported here indicate that considerable driving occurs after substance use, but it is not clear how much of that driving is "impaired." Although some driving after alcohol may involve only a small amount of alcohol, below the level needed to sustain a charge of "impaired" driving, we have shown that a considerable amount of driving after alcohol occurs after the driver has drunk a substantial amount (five or more drinks) (O'Malley and Johnston, 1999).

The effect of marijuana on driving behavior has been extensively studied in laboratory, on-road, and driving simulator studies; and nearly all have shown a resulting impairment in coordination, perception, vigilance, and attention (Moskowitz, 1999; Smiley, 1999). The extent to which that impairment translates into impaired driving is difficult to know. Fergusson and Horwood (2001) examined the association between marijuana use and traffic accident risks in

a cohort of young New Zealanders (ages 18-21). They concluded that the observed increased risks of traffic accidents appeared to reflect the characteristics of those who used marijuana, rather than the effects of marijuana use on driver performance. Longo et al. (2000) examined the relationship between prevalence and concentration of drugs and driver culpability in a large sample of injured drivers in Australia. They found that drivers who tested positive for alcohol only, benzodiazepines only, and alcohol in combination with marijuana or benzodiazepines were significantly more likely to be culpable for the crash than were the drug-free drivers. When only marijuana was detected, there was no significant increase in culpability. Longo et al. (2000) suggest that the lack of any finding of increased culpability may be because marijuana produces a decrease in risk-taking behavior, although studies have shown psychomotor impairment for the drug.

Despite the possibility that marijuana use may not always increase driving consequences, it seems clear that driving motor vehicles after having smoked marijuana is not a good idea for high school students. Various studies have demonstrated conclusively that psychomotor impairment occurs after marijuana use, and teenagers' relative lack of experience in driving surely contributes to a dangerous situation when combined with marijuana.

Use of some illicit drugs other than marijuana has been shown both to produce psychomotor decrements and to increase culpability. The data presented here indicate that relatively few (though not a negligible number) tickets or accidents occur after use of those substances, suggesting that most high school seniors who use illicit drugs other than marijuana may be exercising a degree of good judgment in not driving after such use (even if they do not show sufficient good judgment to abstain from such use).

Acknowledgments

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