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Research Note

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Results of the 2007 National Roadside Survey of Alcohol and Drug Use by Drivers

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Over the last four decades, the National Highway Traffic Safety Administration (NHTSA) and/or the Insurance Institute for Highway Safety have conducted four national surveys to estimate the prevalence of drinking and driving in the U.S. (Wolfe, 1974; Lund and Wolfe, 1991; Voas, et al, 1998). These surveys utilized a stratified random sample of weekend nighttime drivers in the contiguous 48 States. The first National Roadside Survey (NRS) was conducted in 1973, followed by national surveys of alcohol use by drivers in 1986, 1996, and 2007.

The 2007 NRS included, for the first time, measures to estimate the use of other potentially impairing drugs by drivers. Prior roadside surveys had collected breath samples to determine blood alcohol concentration (BAC). Due to developments in analytic toxicology, NHTSA determined it would be feasible in the 2007 survey to collect oral fluid and/or blood samples to determine driver use of a wide variety of other potentially impairing drugs. A pilot test conducted in 2005 demonstrated the feasibility of conducting this more complex survey procedure and confirmed that motorists would voluntarily participate in the study (Lacey, et al, 2007).

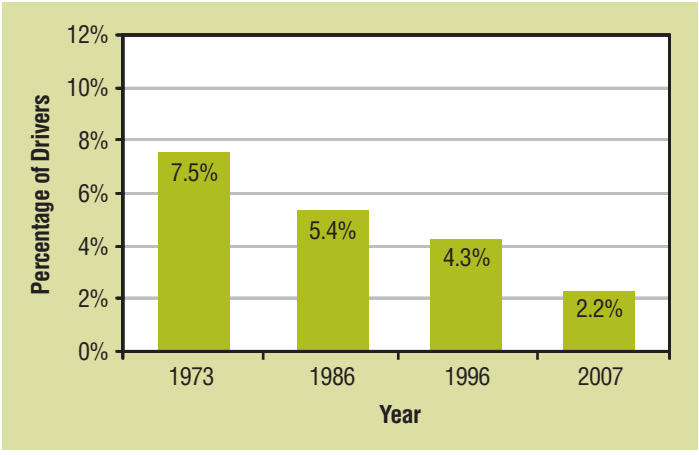
The 2007 NRS was designed to produce national estimates of alcohol and drug use by drivers. Thus, the use rates shown below are national prevalence rates calculated from the percentage of subjects using alcohol or drugs and adjusted with an appropriate weighting scheme.

Results of the 2007 Survey: Alcohol

The 2007 NRS found a dramatic decline in the number of drinking drivers with BACs at or above the current legal limit of 0.08 g/dL* on weekend nights compared to previous surveys (Figure 1). In 1973, 7.5% of drivers had BACs at or above 0.08 g/dL. In 2007, there were only 2.2% of drivers with a BAC at or above the current legal limit. This represents a decline of 71% in the percentage of alcohol-impaired drivers on the road on weekend nights. Similar declines were found at other BAC levels. For example, the percentage of drinking drivers (any positive BAC) declined almost as much over this time period, but one cannot infer impairment at very low BACs.

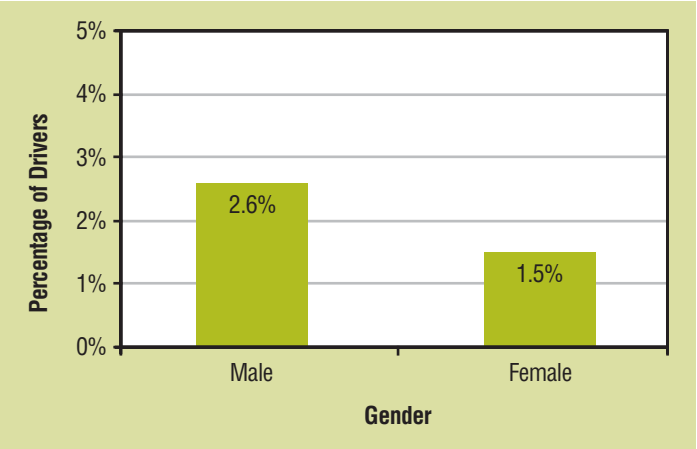
The percentage of male drivers with a BAC over the current legal limit of 0.08 g/dL was 42% higher than the percentage of female drivers with illegal BACs (Figure 2). A regression analysis showed that males were significantly more likely to have illegal BACs ($p < .01$). Over 2% of the weekend nighttime drivers had illegal BACs (≥0.08g/dL) while only 0.1% of daytime drivers had illegal BACs.

Figure 1
Percentage of Weekend Nighttime Drivers with BACs ≥ 0.08g/dL* in the Four National Roadside Surveys



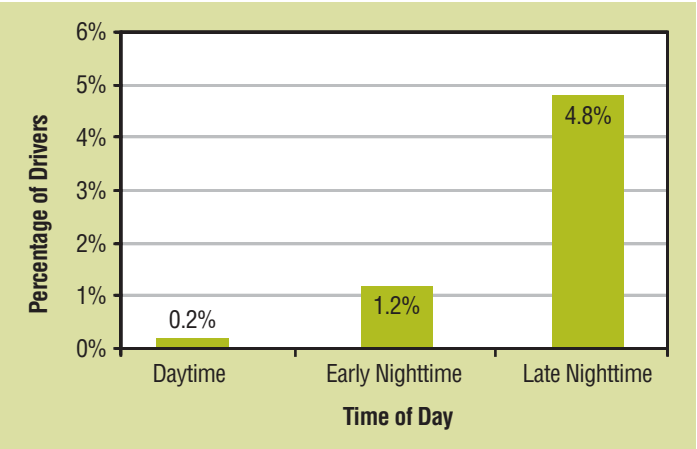
*During the period from 1973 through 1996 the States had BAC limits that ranged from 0.08 to 0.15 g/dL

Figure 2
Percentage of Weekend Nighttime Drivers with Illegal BACs By Gender



Time of day made a big difference in the likelihood of drivers having illegal BACs (Figure 3). Looking just at Friday daytime (9:30 a.m. to 11:30 a.m. and 1:30 p.m. to 3:30 p.m.), early nighttime (10:00 p.m. to midnight), and late nighttime (1 a.m. to 3 a.m. Saturday), only 0.2% of drivers had illegal BACs during the daytime, while 1.2% had illegal BACs during the early nighttime and 4.8% had illegal BACs during the late nighttime.

Figure 3
Percentage of Drivers with Illegal BACs by Time of Day (Fridays and Early Saturday Mornings)



Substantial differences were observed in the percentage of drivers with illegal BACs by vehicle type (Figure 4). Motorcycle riders were more than twice as likely as passenger car drivers to have had BACs ≥ 0.08 g/dL (5.6% compared to 2.3%). Pickup truck drivers were the next most likely vehicle type to have illegal BACs (3.3%).

Underage drivers are of special interest since they have been shown to be a high risk of crash involvement when drinking and driving. Figure 5 shows that the percentage of underage drivers in fatal crashes with a 0.08 g/dL or higher BAC decreased from 1973 to 1996. However, from 1996 to 2007, there has been a slight increase. The NRS data do not show this same trend; the percentage of underage drivers with 0.08 g/dL or higher BACs has been decreasing throughout this time period.

Figure 4
Percentage of Drivers with Illegal BACs by Vehicle Type

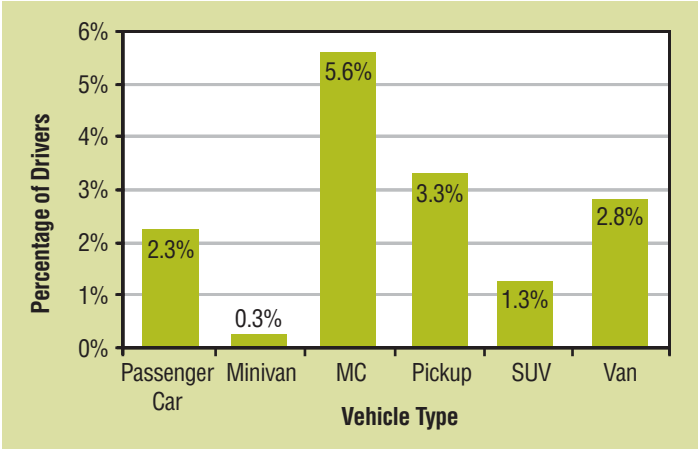
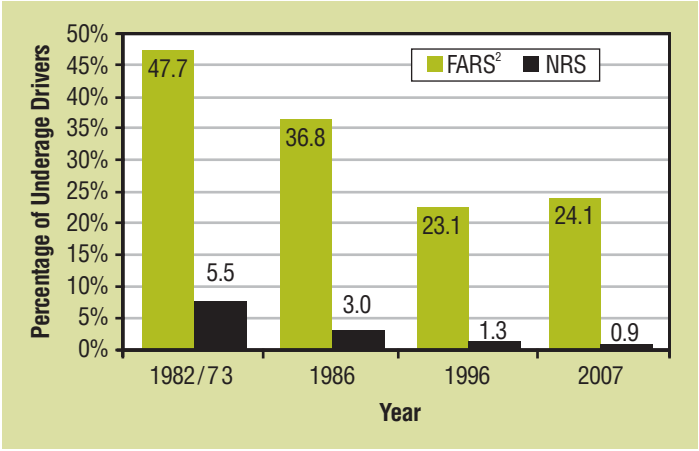


Figure 5
Comparison of FARS and National Roadside Surveys Underage (Age Under 21) Drivers with BAC ≥ .08 g/dL[1]



[1] In this figure, percentages are weighted.
[2] FARS is NHTSA's Fatality Analysis Reporting System.

Results of the 2007 Survey: Drugs

The 2007 NRS provides the first nationally-representative estimate of the prevalence of potentially-impairing drug use by drivers. While these estimates are not in themselves conclusive regarding the nature and scale of the drug-impaired driving problem, they are an important part of ongoing research by NHTSA and other organizations to understand the role of drugs in traffic safety.

In addition to the prevalence of drug use by drivers, several other questions need to be answered in order to assess the drug-impaired driving problem, including:

- Which drugs impair driving ability?
- What drug dose levels are associated with impaired-driving?
- Which drugs are associated with higher crash rates?

Determining which drugs and dosage levels impair driving related skills is a large undertaking given the number of potentially-impairing drugs. NHTSA has convened an expert panel to begin identifying methods for assessing impairment and some laboratory research has been conducted on a number of high priority drugs to measure the effect of drug dosage on driving-related skills (e.g. divided attention, visual tracking, reaction time to sudden events, etc.).

Prevalence of Drug Use by Drivers

Participants in the 2007 NRS were asked to provide an oral fluid and blood sample in addition to a breath sample. The oral fluid and blood samples were tested for the presence of a large number of potentially impairing drugs. The list of impairing drugs covered illegal, prescription, and over-the-counter products, including stimulants, sedatives, antidepressants, marijuana, and narcotic analgesics.

Table 1
Drug Prevalence by Time of Day and Test

Time of Day	Oral Fluid Test % Drug Positive	Blood Test % Drug Positive	Both Oral Fluid and/or Blood Test % Drug Positive
Daytime	11.0%	NA[2]	NA
Nighttime	14.4%	13.8%	16.3%

Caution should be exercised in assuming that drug presence implies driver impairment. Drug tests do not necessarily indicate current impairment. Drug presence can be measured for a period of days or weeks after ingestion in many cases. This latency of drug presence may partially explain the consistency between daytime and nighttime drug findings.

[2] Blood Samples were collected only at nighttime sessions

Based on the oral fluid results, more nighttime drivers (14.4%) were drug-positive then were daytime drivers (11.0%). Based on the blood test results which were administered only at nighttime, 13.8% of the drivers were drug-positive. Using the combined results of either or both oral fluid and blood tests, 16.3% of the nighttime drivers were drug-positive.

The most commonly detected drugs were Marijuana (THC) at 8.6%, Cocaine at 3.9%, and Methamphetamine at 1.3% of nighttime drivers.

The reader is cautioned that drug presence does not necessarily imply impairment. For many drug types, drug presence can be detected long after any impairment that might affect driving has passed. For example, traces of marijuana can be detected in blood samples several weeks after chronic users stop ingestion. Also, whereas the impairment effects for various concentration levels of alcohol is well understood, little evidence is available to link concentrations of other drug types to driver performance.

The full significance of these findings for highway safety will only become clear when ongoing and additional research conducted by NHTSA and others is completed. NHTSA is responding to these findings with programs to enable law enforcement officers to recognize drug impairment, and education for prosecutors and judges on factors associated with drug-impaired driving cases.

Under the Drug Evaluation and Classification program, NHTSA has prepared nearly 1,000 instructors and trained more than 6,000 officers in 46 states. Officers receive extensive training to recognize symptoms of driver impairment by drugs other than alcohol.

NHTSA has also initiated a follow-on study to the 2007 NRS to identify which drugs are associated with higher crash risk. This case-control study will include in-depth investigations of a large number of crashes of all severities. The proportion of drug use by crash-involved drivers will be compared to that of a similar sample of non-crash involved drivers to determine if drug use is associated with crash involvement. Findings from this large-scale study are expected in 2012.

Challenges in Determining How Drugs Affect Driving

Most psychoactive drugs are chemically complex molecules, whose absorption, action, and elimination from the body are difficult to predict, and considerable differences exist between individuals with regard to the rates with which these processes occur. Alcohol, in comparison, is more predictable. A strong relationship between BAC level and impairment has been established, as has the correlation between BAC level and crash risk.

Factors that make similar prediction difficult for most other psychoactive drugs include:

- The large number of different drugs that would need to be tested (extensive testing of alcohol has been undertaken over many decades; whereas relatively little similar testing has occurred for most other drugs)
- Poor correlation between the effects on psychomotor, behavioral and/or executive functions and blood or plasma levels (peak psychomotor, behavioral, and executive function effects do not necessarily correspond to peak blood levels; detectable blood levels may persist beyond the impairing effects or the impairing effects may be measurable when the drug cannot be detected in the blood)
- Sensitivity and tolerance (accentuation and diminution of the impairing effects with repeated exposure)
- Individual differences in absorption, distribution, action and metabolism (some individuals will show evidence of impairment at drug concentrations that are not associated with impairment in others; wide ranges of drug concentrations in different individuals have been associated with equivalent levels of impairment)
- Accumulation (blood levels of some drugs or their metabolites may accumulate with repeated administrations if the time-course of elimination is insufficient to reduce or remove the drug or metabolite before the next dose is administered)
- Acute versus chronic administration (it is not unusual to observe much larger impairment during initial administrations of drugs than is observed when the drug is administered over a long period of time)

The result of these factors is that, at the current time, specific drug concentration levels cannot be reliably equated with effects on driver performance.

Survey Methodology

The National Roadside Survey of Alcohol and Drug Use by Drivers is the first nationwide representative sample of drug use by drivers (three previous nationwide representative surveys of alcohol use have been conducted). The 2007 NRS involved random stops of drivers at 300 locations across the contiguous United States. Data were primarily collected on weekend nights (10:00 pm to midnight on Friday and Saturdays and 1:00 am to 3:00 am on Saturdays and Sundays). New to the 2007 NRS was the inclusion of weekday daytime data collection (Fridays 9:30 am to 11:30 am or 1:30 pm to 3:30 pm).

Participation in the survey was voluntary and anonymous. Whereas prior surveys excluded commercial vehicles and motorcycles, the 2007 NRS included motorcycles. Almost 11,000 eligible drivers entered the survey sites. Biological measures included breath-alcohol measurements on 9,413 drivers (86%), oral fluid samples from 7,719 drivers (71%), and blood samples from 3,276 nighttime drivers (39%).

The survey used a multistage sampling procedure based on the National Automotive Sampling System (NASS) – General Estimates System (GES). This system involves sixty primary sampling units (PSUs) from which five sites were selected randomly. The PSUs are large cities, counties or groups of counties representing four regions within the U.S. and three levels of population density. Each PSU was divided into one-square-mile grids. Five one-square-mile grids were then randomly selected and appropriate survey sites were located within the square-mile grids. Drivers were then randomly selected from the traffic passing the survey site. Limited access roads, residential, and purely rural roads were not included. Commercial vehicle drivers were excluded for logistical reasons (the need for a much larger area to safely pull over tractor-trailers) and motorcycle operators were over-sampled (motorcycle deaths have more than doubled over the last decade and motorcycle crashes have the highest alcohol involvement rate of any vehicle type). The basic survey procedure involved the use of law enforcement officers to direct traffic at the survey sites, but not otherwise to interact in any way with the survey subjects. Trained data collectors solicited participation of the drivers in the survey (offering incentives for participation). Participation was voluntary and anonymous.

The survey procedure involved a brief explanation of the purpose of the survey, a passive alcohol reading, a breath alcohol test, a brief set of demographic questions, drinking and driving behavior, oral fluid collection, Alcohol Use Disorder (AUD) questions, drug use questions, and blood sample collection. An impaired driver protocol was implemented whenever a suspected impaired driver was encountered to insure that potentially impaired drivers did not drive away from the survey site. In addition, an attempt was made to convert a random sample of drivers who refused to participate in

the survey into participants (by use of especially skilled interviewers and use of special incentives). This substudy was designed to collect information on whether non-participants were more likely to be alcohol- and/or drug-positive.

While 9,413 (86%) drivers out of 10,909 eligible drivers provided a breath sample; 1,496 drivers refused or were unable to provide a breath sample. Of those drivers, BACs were imputed for 1,296 drivers (87%) for whom a passive alcohol sensor reading was available.

National prevalence rates were derived from a complex weighting scheme based on the volume of serious crashes at each site and the probability of a survey driver being randomly selected from the total driving trips at that site.

Data collection, analysis, imputation, and weighting for the 2007 NRS were conducted by the Pacific Institute for Research and Evaluation (PIRE) under the direction of the Office of Behavioral Safety Research (Amy Berning project manager) in NHTSA through Federal contract number DTNH22-06-C-0040.

For More Information

For questions regarding the information presented in this document, please contact Amy Berning at amy.berning@dot.gov.

Detailed information about the study and results will be available in upcoming publications. Three technical reports are under development; one provides a complete description of the methodology used (sampling, analysis, weighting, and imputation procedures) and subject participation rates (report entitled *2007 National Roadside Survey of Alcohol and Drug Use: Methodology*). Detailed information on the use of alcohol by drivers and the relationship of alcohol use to various demographic factors (e.g., age, gender, race/ethnicity), region, vehicle type, alcohol abuse disorders, prior arrests involving alcohol, use of seat belts, etc. will be available shortly in a report entitled *2007 National Roadside Survey of Alcohol and Drug Use: Alcohol Prevalence Rates.* Detailed information on the use of drugs by drivers and the combined use of drugs and alcohol will be provided in a third report entitled *2007 National Roadside Survey of Alcohol and Drug Use: Drug Prevalence Rates.* These upcoming reports will be posted on NHTSA's web site at: www.nhtsa/trafficinjury/researchandevaluation later in 2009.

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