

Forensic Toxicology Program: Alcohol and Drug Testing in Wisconsin Drivers

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ABSTRACT

The Forensic Toxicology Program of the Wisconsin State Laboratory of Hygiene (WSLH) provides analytical and support services to assist in the identification of alcohol- and/or drug-impaired drivers and to assist in determining cause of death. These services are provided to law enforcement agencies, the Wisconsin Department of Natural Resources, the Wisconsin Department of Transportation, and county medical examiners and coroners. Program staff is active in alcohol and drug training, policy-making, and research on a national and international level.

INTRODUCTION

Although the number of alcohol-related traffic injuries and fatalities decreased over the last decade, alcohol use remains a significant traffic safety concern. Data from the 2001 Wisconsin Alcohol Traffic Facts Book (the latest available) indicate there were 8965 alcohol-related motor vehicle crashes in Wisconsin in which 304 people were killed and 6586 injured.¹ In the same year, alcohol-related crashes accounted for 6.9% of all Wisconsin crashes, 40% of all motor vehicle fatalities, and 11% of all motor vehicle injuries. Similar figures can be expected for 2002.

There is an increasing awareness of the impact that drugs other than alcohol have on highway safety. Driving is a complex psychomotor task that requires processing information and adapting to the changing environment of traffic and vehicle conditions. Any drug that alters a driver's normal brain function can potentially cause significant impairment of driving ability. This impairment will exist regardless if the drug is appropriately prescribed and used, is an illicit drug, or even is an over-the-counter drug. Interpreta-

tion of drug results is complicated by a general lack of correlation of driving impairment as it relates to drug concentration and by the prevalent use of multiple drugs. The successful identification and removal of drug-impaired drivers from the road depends on the coordination of law enforcement officers, toxicologists, and prosecutors.

TRAFFIC FATALITY TESTING

The Wisconsin State Laboratory of Hygiene (WSLH) began testing for alcohol in samples from fatally injured drivers in the late 1960s. Testing was later expanded to include the analysis of other drugs. Coroners and medical examiners are required by statute to submit specimens for alcohol analysis from all drivers and pedestrians killed in accidents involving on-the-road motor vehicles and ATVs when the death occurs within 6 days of the accident. There are similar provisions for motor vehicle fatalities resulting from the operation of motorboats and snowmobiles. In 2002, there were 524 motor vehicle fatality cases submitted to the WSLH for alcohol testing. Testing for other drugs was conducted on 323 of these samples as requested by the submitter.

Alcohol analysis results are reported to the submitter and to the Wisconsin Department of Transportation (WDOT) for use in compiling statistics of the incidence of alcohol-related traffic fatalities. Results from motorboat and snowmobile fatalities are provided to the Wisconsin Department of Natural Resources. The Forensic Toxicology Program provides these required analytical services to coroners and medical examiners throughout most of the state. The Milwaukee County Medical Examiner's Office provides similar services to Milwaukee and several surrounding counties.

IMPAIRED DRIVER TESTING

The WSLH Forensic Toxicology Program provides alcohol testing for more than half of the suspected impaired drivers arrested in Wisconsin. The primary specimen type analyzed is whole blood, although a few urine samples are also submitted for testing. Results of

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Table 1. Laboratories Approved in 2003 by the Wisconsin Department of Health and Family Services for Alcohol Analysis Under 343.305 Wis. Stats.

Kenosha County Health Department, Kenosha
Marshfield Laboratories, Marshfield
Milwaukee County Medical Examiner's Toxicology Laboratory, Milwaukee
St. Vincent Hospital Laboratory, Green Bay
State Crime Laboratory, Madison
State Crime Laboratory, Milwaukee
United Hospital System-Kenosha Medical Center, Kenosha
Wisconsin State Laboratory of Hygiene, Madison

alcohol analyses are reported to the submitting law enforcement agencies and subjects and provided electronically to the WDOT to update driver's license records, and to provide alcohol use information on traffic crashes. The State Crime Laboratories in Madison and Milwaukee, as well as the other laboratories approved by the Wisconsin Department of Health and Family Services (WDHFS) listed in Table 1 also provide blood alcohol testing services. The Forensic Toxicology Program accredits methods of analysis for approved laboratories and provides proficiency testing samples for the Legal Alcohol Proficiency Testing Program administered by the WDHFS.

Approximately 40% of the testing on suspected impaired drivers is by breath alcohol analysis performed by police officers on instruments owned and maintained by the Wisconsin State Patrol, Chemical Test Section. The Forensic Toxicology Program works closely with the breath testing program to assist in research and training and to provide scientific support.

The following sections further describe the testing of impaired drivers in Wisconsin.

SAMPLE COLLECTION AND ANALYSIS

Collection kits are provided by the WSLH under Wisconsin Statute 343.305(6)(a). The collection kits are distributed to hospitals and law-enforcement agencies throughout the state. Whole blood collection kits include 2 10-mL grey-top vacutainer tubes, a benzalkonium chloride antiseptic towelette, labels, seal strips, packaging materials, and instructions. The blood collection vials contain potassium oxalate and sodium fluoride as the anticoagulant and preservative respectively. The kit container is also used as a mailer to send the specimens to an approved laboratory. Kits are also provided for collecting urine samples. Under Wisconsin Statute 343.305(5)(b), blood samples may be collected by "a physician, registered nurse, medical technologist, physician assistant, or person acting under the orders of

a physician." The law grants immunity from criminal or civil liability to the person collecting the blood, the person's employer, and the hospital, provided that they are not negligent in performing the procedure. Wisconsin case law has also established that a sample may be collected even if the subject refuses.²

ALCOHOL ANALYSIS AND INTERPRETATION

Alcohol analysis is performed on all traffic-related specimens submitted to the laboratory, even if alcohol use is not suspected. In 2002, the WSLH received and analyzed more than 20,500 samples from suspected impaired drivers. Forensic Toxicology Program analysts must provide testimony related to their testing when the cases result in trials. Testimony ranges from factual testimony regarding how the actual analysis was performed, to expert testimony regarding the pharmacological and toxicological properties of alcohol and its effect on driving ability. WSLH laboratory analysts received 5127 subpoenas from 71 counties in 2002. Only a fraction of the subpoenas received by the laboratory resulted in an actual court appearance. Trials are often cancelled on short notice or too late to avoid travel. In the year 2002, 15 different analysts made a total of 331 court appearances in 58 of Wisconsin's 72 counties. More than 68,000 miles were logged by analysts for court travel during this same period. The frequency of travel for court, as well as last minute cancellations, force the laboratory to maintain flexible work schedules and adopt innovative approaches to workload management in order to mitigate the negative impact that appearing in court has on laboratory efficiency. The increased capability of courts to accommodate video-conference testimony may somewhat alleviate this problem in the future by allowing analysts to testify from a specially equipped facility in the laboratory's building.

Alcohol analysis at WSLH is performed on a gas chromatograph equipped with a flame ionization detector. The method is simple, highly accurate, highly precise, and specific for ethyl alcohol. Blood alcohol concentrations are reported in grams of alcohol per 100 mL of blood. Blood specimens collected using WSLH-provided materials are stable for years. Issues may arise if an alcohol-based antiseptic is used during the phlebotomy procedure. Isopropyl alcohol antiseptics are most commonly employed and will not affect test results since the instruments used for the analysis are specific for ethyl alcohol.³

Occasionally an attending physician may order an

alcohol test for diagnostic purposes in cases where a police officer also requests a sample for legal purposes. The results from these 2 analyses will be different, even if they are collected at the same time. Medical alcohol tests are most frequently performed on serum or plasma samples, while forensic testing is performed on whole blood. Because alcohol is highly water soluble, it will concentrate in the serum or plasma portion of blood. When serum or plasma is the sample matrix, alcohol results will be higher than they would be if whole blood is analyzed. The mean serum/plasma:whole blood alcohol ratio has been found to be 1.14:1.⁴ An algorithm for converting serum to whole blood alcohol concentrations was published based on experimental data from 211 patients that found a 1.15:1 median serum:whole blood alcohol ratio.⁵

The effects of alcohol on driving performance are well known and extensively documented. Alcohol is an irregularly descending central nervous system depressant that affects the brain in a broad, non-specific manner. Among other effects, alcohol impairs psychomotor function such as coordination and balance, judgment, reaction time, vision, and visual perception. Impairment of at least some motor skills or behaviors can be demonstrated at any measurable alcohol concentration. It has been conclusively determined that all drivers are significantly impaired at alcohol concentrations of 0.08 and above. In 1986, the American Medical Association recommended that states adopt laws that make 0.05 alcohol concentrations per se evidence of impaired driving.⁶ Wisconsin recently passed legislation that took effect in September 2003 making it illegal to operate a motor vehicle while having an alcohol concentration of 0.08 and above for first and second offenses. Existing legislation imposes the 0.08 level for third offenders, while the legal limit for fourth and higher offenders is 0.02 and above.

DRUG ANALYSIS

The laboratory analyzes blood specimens for drugs other than alcohol when the blood alcohol concentration is below 0.10 g/100 mL or if the driver is charged with a felony offense, such as causing injury or death by intoxicated use of a vehicle. At concentrations of 0.10 g/100 mL and above, alcohol is the overwhelming cause of impairment, regardless of the presence of other drugs.

Approximately 10% of the samples received from impaired drivers in 2002 were also analyzed for other drugs. Drug analysis is a far more complicated analytical process than alcohol analysis (Figure 1). The testing

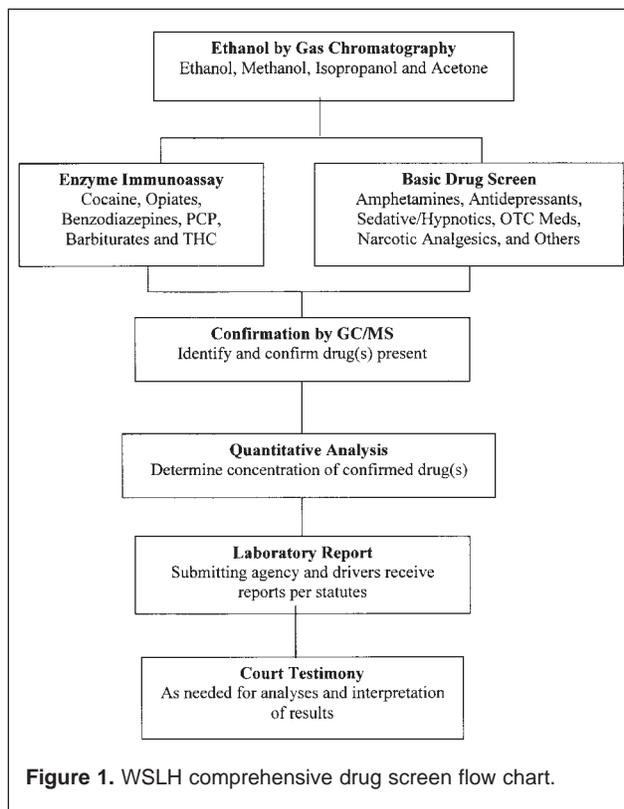


Figure 1. WSLH comprehensive drug screen flow chart.

process first involves a series of screening tests that target various drugs and drug classes. Positive results are then confirmed by an alternate analytical method, usually gas chromatography/mass spectrometry (GC/MS). After confirmation, the identified drugs are quantitated against pure drug standards, usually employing GC/MS analysis.

The focus of the laboratory's comprehensive drug screen is the detection and quantitation of drugs that may cause psychomotor impairment. The target drugs include illegal controlled substances as well as prescription and over-the-counter medications. Drugs administered for clinical treatment of metabolic disorders, antibiotics, etc. are not typically detected in the drug screen. Analytical methods must be continually updated as new drugs become available from pharmaceutical companies as well as the creative but illicit "recreational" drug providers.

Table 2 contains WSLH drug testing results for calendar years 2001 and 2002. The most frequently detected drugs, along with the number of times they were detected, are included with the total number of samples analyzed and the number of samples with drugs detected. A sample is considered positive when 1 or more drugs, other than alcohol, are present. This includes medications that may have been administered by med-

Table 2. 2001-2002 Implied Consent Drug Testing Statistics

General Testing Data	2002	2001
Samples analyzed	1,309	1144
Positive samples (one or more drugs detected)	900	751
Most Frequently Detected Drugs		
Individual Drug Substances	2002	2001
1. Cannabinoids	575	494
2. Cocaine/metabolites	178	149
3. Diazepam/nordiazepam	103	110
4. Alprazolam	61	51
5. Hydrocodone	53	28
6. Morphine	52	36
7. Clonazepam	46	27
8. Diphenhydramine	44	26
9. Citalopram/norcitalopram	8	26
10. Zolpidem	36	23
Drug Class	2002	2001
1. Cannabinoids	575	494
2. Benzodiazepines	271	232
3. Stimulants (cocaine and amphetamine-type drugs)	260	233
4. Narcotic analgesics	253	187
5. Antidepressants	210	175
6. Sedatives/hypnotics/muscle relaxants	111	95
7. Antihistamines	70	51
8. Anticonvulsants	49	24
9. Antiarrhythmics	36	56
10. Antipsychotics	19	12

ical professionals following injuries received from traffic crashes.

Delta-9-tetrahydrocannabinol (THC) and its metabolites are historically the most frequently detected drugs other than alcohol in Wisconsin drivers. For cases where 1 or more drugs were detected, 64% of the samples in 2002 and 66% in 2001 were positive for THC. Cocaine follows as the second most frequent single drug substance detected, accounting for 20% of the positive cases in both years. Recently prescription medications have been detected more often in Wisconsin drivers, both at and above medically therapeutic concentrations. When the 2002 data are grouped by drug class, cannabinoids are present in 64% of the positive samples, followed by benzodiazepines (30%), and stimulants (29%). Narcotic analgesics accounted for 25% of the positive cases and antidepressants for 23%.

These data also illustrate how most specimens contain multiple drugs in several drug classes, often mixing licit and illicit drug substances. While interpreting the effect of a single drug on driving ability is challenging

enough, it can be almost impossible when several drugs are present.

INTERPRETATION OF DRUG RESULTS

Wisconsin Statute 346.63(1)(a) states, "No person may drive or operate a motor vehicle while under the influence of an intoxicant, a controlled substance, a controlled substance analog or any combination of an intoxicant, a controlled substance and a controlled substance analog, under the influence of any other drug to a degree which renders him or her incapable of safely driving, or under the combined influence of an intoxicant and any other drug to a degree which renders him or her incapable of safely driving." Or in non-legal terms, operating a motor vehicle with any drug that affects your ability to drive safely is prohibited. This applies to illicit drugs, prescription medicines, and even over-the-counter medications.

Unlike alcohol, predicting impairment based solely on the reported drug concentration in blood is complex and challenging for most drug substances. It is also often difficult to determine when the drug was taken and if it was used as prescribed. The successful prosecution of drug-impaired drivers requires a prosecutor to tie together observations of impairment through witnessed poor driving and/or poor performance of field sobriety tests, the confirmed presence of a drug or drugs, and the effect that the drug(s) may have on driving performance. Law enforcement officers trained to be drug-recognition experts may perform a series of psychophysical and simple physiological measurements to demonstrate and classify drug use in drivers. Their testimony, combined with the drug test results and testimony of laboratory personnel, make prosecution of drug-impaired driving more successful. Several states have laws that make driving with any detectable amount of a restricted drug substance illegal, even in the absence of demonstrated impairment.

Many drugs are known to impair driving performance; however, the extent of the impairment and the risk to safe driving are difficult to determine and often poorly documented. Instructions to the patient from physicians and pharmacists, together with common sense, can reduce the risk of accidents and injuries that may occur when using potentially impairing medications. A good example is the use of zolpidem (Ambien®), a hypnotic drug prescribed for the short-term treatment of insomnia. Dosing instructions are to take the drug immediately prior to going to bed. Zolpidem has a short-half life, causing it to be completely eliminated from the bloodstream within 8 hours, so as not to

be present during hours of activity. Clearly any amount of zolpidem detected in a driver can be considered improper use of the medication. Startlingly, in 2002, the WSLH detected zolpidem in 36 drivers, at or above medically therapeutic levels intended to induce sleep. Not surprisingly is that the vast majority of these drivers were involved in traffic crashes.

While the interpretation of zolpidem's effects seems obvious, other drug interpretations are rarely as straightforward. General statements are difficult to make and dangerous to apply to the various drugs and drug classes. Researchers have evaluated many drugs by using performance studies, simulator operation, and road course-driving studies to understand what effect they may have on driving skills. While these studies provide helpful insights, individual tolerance varies widely and acquired tolerance to a drug's effects can occur with chronic, long-term use at a set dosing level.

SUMMARY

The use of alcohol and other drugs while operating a motor vehicle remains common in spite of state and national efforts to reduce the incidence of impaired driving. The WSLH Forensic Toxicology Program plays an

essential role in identifying alcohol- and drug-impaired drivers by providing blood analyses, interpretation of results, and the regulation of laboratories. Significant program outreach activities provide training and information to law enforcement officers, attorneys, and laboratory personnel. The extent of drug-impaired driving is an emerging issue that has attracted national attention. The Forensic Toxicology Program continues to actively pursue expanded drug analysis capability and enhanced knowledge of drug effects on driving to meet this challenge.

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