

T2007



CONFERENCE ABSTRACTS

Joint Meeting of the
The International Association of Forensic Toxicologists
(TIAFT)
and
International Council on Alcohol, Drugs and Traffic Safety
(ICADTS)
and featuring the
8th Ignition Interlock Symposium
(IIS)



Seattle, Washington, USA
August 26-30, 2007



Drugged Driving Related Abstracts from T2007 Seattle Meeting

Table of contents:

Worldwide Trends in Impaired Driving

- 22 Alcohol, Drugs, and Traffic Safety in Australia: Initiatives and Indicators
- 27 Worldwide Trends in Alcohol and Drug Impaired Driving
- 28 Drugs in Driving – The South Australian Experience

DUI Enforcement and Prevention

- 69 Comparison of Drugged-Driving Laws and Their Roadside Enforcement Procedures Across the European Union
- 92 A Data Driven Approach to Addressing Impaired Driving Enforcement

DRE and Field Impairment Testing and Assessments

- 15 Drug Recognition Expert (DRE) Evaluations and Prevalence of Drug Impaired Drivers in Alaska
- 16 Evaluation of the Standardised Field Sobriety Tests to Test for the Presence of Cannabis, Cannabis Combined with Alcohol, Dexamphetamine, Methamphetamine and Fatigue
- 17 An Evaluation of the Standardised Field Sobriety Tests for the Detection of Impairment Associated with Cannabis with and without Alcohol
- 18 The Accuracy of Evaluations by Drug Recognition Experts in Canada

Review of Oral Fluid Testing Field Trials

- 80 ROSITA II Project: Project Overview, and an evaluation of the Drugwipe-5 device in Salt Lake City, Utah

164 Analytical Evaluation of a New Oral Fluid Sample Drugs of Abuse Diagnostic System

Prevalence of Drugs in Driving Populations

82 Frequency of Illegal Drugs and Medicines in a Norwegian Road-Side Survey

84 Driving Under the Influence of Psychoactive Substances

85 Studies on Drugs and Driving Realised in European Countries: Focus on Cannabis and Benzodiazepines

86 Investigations on Driving Under the Influence of Drugs in Vienna: Experiences from 1996 to 2006

87 Prevalence of Drug Impaired Driving In Canada 2000 – 2003

88 Blood Drug Concentrations of Frequently Encountered Drugs in Impaired and Fatally Injured Drivers

89 Recommendations for Toxicological Investigation of Drug Impaired Driving

90 An Overview of the Existing Drugs and Driving Categorisations

DRUID: Driving Under the Influence of Drugs, Alcohol and Medicines- an Integrated Research Project in Europe

122 Driving Under the Influence of Drugs, Alcohol and Medicines

123 A Meta-Analysis of Alcohol Studies: An Attempt to Multi-Dimensional Risk Functions

124 Experimental Drug-driving Studies in DRUID

125 Protocols for Road-side Surveys and Hospital Studies

126 Selection of an Oral Fluid Collection Device for EU-project DRUID

129 Drug-Related Crash Risk Calculation in the DRUID Project

130 An Attempt to Integrate Data From Different Methodological Approaches to Estimate Traffic Risk for Substances – Some Theoretical Considerations

- 131 Analytical versus risk thresholds for psychoactive substances – Synopsis of the DRUID results

Drug Impaired Drivers: Patterns of Use

- 200 Screening for Drugs in Oral Fluid: Illicit Drug Use and Drug Driving in a Sample of Queensland Motorists
- 201 Roadside Detection of Drugs in Drivers
- 202 Mandatory Random Roadside Drug Testing of Truck Drivers, Nightclub Patrons and the General Driving Population in Victoria, Australia
- 203 Saliva as a Possible Second Sample Matrix
- 204 Pilot Study for the US National Roadside Survey, 2007
- 205 Plans for the US National Roadside Survey, 2007

Drug Effects on Driver

- P70 Adolescent Marijuana- and Alcohol-Impaired Driving Behaviours
- P71 Driving Under the Influence of Cannabis, Reckless Driving and Accident Involvement
- P72 Simulator Test Bed for Testing Effects of Alcohol and MDMA on Driving Performance
- P74 Can a Positive THC Metabolite (THC-COOH) in Urine Be Used to Prove Impairment in a Driving Under the Influence (DUID) of Cannabis Case?
- P83 Using Responsibility Analysis to Evaluate Fatal Accident Risk for Drivers in Québec Who Used Drugs
- P84 A Short Series of Toluene Impaired Drivers
- P85 The Effect of Sleep Deprivation, and Acute d -amphetamine and d -methamphetamine Administration on Visual Field Function: An Event-Related Potential Study
- P86 Observations on Pupil Sizes of Drug Users and its Applicability to the Drug Evaluation and Classification Criterion

- P89 Alcohol, Illicit and Medicinal Drugs Involved in Fatal Accidents in the North West of Spain**
- P92 Use of Drugs of Abuse and Alcohol in Less than 30-year-old Drivers Killed in a Road Crash in France. Cannabis and Alcohol Shoulder to Shoulder**
- P93 Young Adult Driving After Using Drugs**
- P94 Fatal Traffic Accidents in Which No Alcohol is Detected: Are Drugs Related?**
- P97 Roadside Survey of Alcohol and Drugs in Norway – Data Collection and Analysis**

Drugs in Motor Vehicle Accidents

- 116 Characteristics of Fatal Crashes Involving Drugs in Victoria and Associated Contributory Factors**
- 117 Driving Under the Influence of Cannabis. Incidence in Fatal Road Traffic Accidents**
- 119 Cannabis Among Fatally Injured Drivers: Circumstances Surrounding the Accident**
- 120 Fatal Accident Drivers with Earlier Arrests Due to Drugged Driving**
- 121 Driving Behaviour Under the Influence of Cannabis and Cocaine**
- 183 Concern about Drinking and Driving and Drugs and Driving**

Marijuana and Driver Impairment

- 37 Cognition and Motor Control as a Function of $\Delta 9$ -THC Concentration in Serum**
- 38 Cannabis Intoxication and Fatal Road Crashes in France: Population Based Case-Control Study - Results and Comparison With the Alcohol the SAM Group**
- 42 Assessment of Driving Capability Through the Use of Clinical and Psychomotor Tests in Relation to Blood Cannabinoids Levels Following Oral**

Administration of 20 mg Dronabinol or of a Cannabis Decoction Made With 20 or 60 mg D9-Tetrahydrocannabinol

- 44 Validation of a Model for Estimating Time of Last Cannabis Use From Known Concentrations of Tetrahydrocannabinol and the Major Metabolite**

Prevention and Intervention

P106 After Two Years of per se Legislation in Switzerland: Prevalence of Drugs Among Drivers in Geneva

P108 From Science and Statistics to Safer Roads

P111 The Combined 'Zero Tolerance Law' and 'Impairment Law' for Drugs and Driving in Finland

Drug Recognition Expert (DRE) Evaluations and Prevalence of Drug Impaired Drivers in Alaska

Betty J. Buchan*¹ and Steve Dunn²

¹University of Alaska Anchorage, Anchorage, AK, USA

²Anchorage Police Department, Anchorage, AK, USA

This study characterizes and describes the extent and manner of drug and alcohol impaired drivers and Drug Recognition Expert (DRE) evaluations in Alaska and the impact on traffic safety. One of the ways in which drug and alcohol use damages the larger society is the impact of use in increasing the number of dead and injured from vehicular crashes caused by or associated with the use of alcohol and drugs while driving.

Alaska implemented the Drug Recognition Expert evaluation program in 2004 as an added effort to reduce the public health impact of drug impaired drivers. This law enforcement program has identified problematic areas of drug impaired drivers that allow public health efforts to be specifically targeted to this population. Data collected from the Alaska State Troopers, the Anchorage Police Department, and the National Highway Traffic Safety Administration from 2000 to 2006 provides an overview of alcohol and drug use in reckless drivers in Alaska and the injury and loss of life caused as a result of drug impaired drivers.

RESULTS: From 2000 to 2006, approximately 47% of fatality crashes had alcohol and/or drugs involved and 48% were speed related. From January 2004 to December 2006, 61% of DRE evaluations conducted were on males aged 21-29 and 83% were white. During this time period, 33% of all drugs, DRE identified with Lab confirmation, were in the class of depressants and were represented by the 40-49 year old age group. The most common combinations were alcohol, depressants, marijuana, and methamphetamines.

CONCLUSIONS: Alaska now uses the expertise of 25 Drug Recognition Expert (DRE) law enforcement officers to help evaluate the impact of driving under the influence of alcohol and drugs on public safety on our roadways and to assist public health practitioners in identifying effective prevention programs.

Keywords: DRE evaluations, Drugged drivers, Impaired

Evaluation of the Standardised Field Sobriety Tests to Test for the Presence of Cannabis, Cannabis Combined with Alcohol, Dexamphetamine, Methamphetamine and Fatigue

Katherine Papafotiou^{*1}, Con Stough¹, Melinda Jackson¹, Beata Silber¹, Edward Ogden¹, Martin Boorman², and Phillip Swann¹

¹Drugs and Driving Research Unit, Brain Sciences Institute, Swinburne University of Technology, Victoria, Australia

²Traffic Alcohol Section, Victoria Police, Victoria, Australia

The incidence of drugs other than alcohol in road crash statistics, and evidence that the consumption of drugs is associated with an elevated accident risk, has resulted in a concentrated effort by government and law enforcement to tackle the issue of drugged driving (Drummer, 2005). The Standardised Field Sobriety Tests (SFSTs) have been demonstrated to be a sensitive measure of impairment associated with a Blood Alcohol Concentration (BAC) of up to 0.08% (Burns and Moskowitz, 1977; Burns, 1987). A number of studies have shown that performance on the SFSTs provides an accurate indicator of driving impairment associated with alcohol consumption (Burns and Moskowitz, 1981; Compton, 1985; Stuster and Burns, 1998). However, there is limited research that suggests these tests are accurate in predicting the presence of drugs, and other factors, such as fatigue.

Five studies were conducted that assessed the effects of cannabis alone, cannabis combined with alcohol, dexamphetamine, methamphetamine and 27-hours sleep deprivation, separately, on performance on the Standardised Field Sobriety Tests. The results revealed that SFSTs are moderate predictors of the presence of cannabis. When cannabis is consumed in combination with alcohol, using SFSTs results in a higher percentage of individuals classified as impaired. In contrast, SFSTs are not useful in predicting the presence of dexamphetamine or methamphetamine, where in many cases, performance on the SFSTs was better when under the influence of amphetamines, when compared to no drug (placebo). In terms of using SFSTs to predict fatigue, SFSTs were moderately accurate in predicting 27-hours sleep deprivation, with the errors observed during performance were similar to the errors observed after cannabis smoking.

These studies will help identify the accuracy of SFSTs to predict the presence of various drug classes and other factors, such as fatigue.

Keywords: SFSTs, Cannabis, Alcohol, Amphetamines, Dexamphetamine, Methamphetamine, Sleep deprivation

An Evaluation of the Standardised Field Sobriety Tests for the Detection of Impairment Associated with Cannabis with and without Alcohol

Katherine Papafotiou^{*1}, Con Stough¹, Edward Ogden¹, and Martin Boorman²

¹Drugs and Driving Research Unit, Brain Sciences Institute, Swinburne University of Technology, Victoria, Australia

²Traffic Alcohol Section, Victoria Police, Victoria, Australia

Reports indicate that in Victoria, New South Wales and Western Australia, 23.5% of drivers in fatal accidents had consumed drugs other than alcohol, and that 29.1% of drivers had a BAC level of 0.05% or higher. Alcohol has been detected in combination with drugs in almost 10% of cases. Cannabis was most prevalent among drugs other than alcohol detected in specimens (13.5%) (Drummer, et al., 2003). The combination of drugs as an influence on road traffic accidents is becoming a growing concern and research has been conducted to identify how these drugs impair performance.

The project consisted of two parts; cannabis (0% THC, 1.8% THC and 3% THC) with low dose alcohol (.03% BAC); and cannabis (0% THC, 1.8% THC and 3% THC) with high dose alcohol (.05% BAC). Each part was made up of six randomized, double-blind sessions and both utilised the same experimental design and procedure. The total sample comprised 80 individuals; 31 female and 49 male. Age varied between 21 and 35 years ($M = 26.45$, $SD = 5$). Part one was comprised of 40 participants, 15 females and 25 males. Of these participants 24 were regular cannabis users and 16 non-regular cannabis users. In part two, 40 participants included 16 females and 24 males. Of those participants 24 were regular users, and 16 were non-regular cannabis users. In each experimental session, after the administration of cannabis and alcohol, participants were asked to perform a driving simulator task and the SFSTs. Blood samples were taken throughout each session in order to determine the level of drug in plasma associated with observed impairment.

The main finding of the project was that smoking cannabis containing either 1.8% THC or 3% THC (with or without alcohol) significantly impaired driving performance and sobriety test performance. When alcohol was consumed, impairment in driving was also observed, and significantly more errors were made when the level of alcohol was .05% BAC rather than .03% BAC. When driving was impaired, the level of THC in plasma varied between 3 and 11 ng/mL. Driving variables were also impaired when BACs ranged from .03% to .05%. In addition, scores obtained using the SFSTs predicted driving performance associated with cannabis and alcohol considerably better than chance (at best in 76.3% of cases). The SFST battery is improved when HMJ (Head Movements/Jerks) is scored in the HGN test. Finally, the results revealed that when administered correctly and by a rater trained to administer SFSTs, the SFSTs are reliable tests of impairment. Overall, the results suggest that the SFSTs involve a reliable scoring procedure and that scores on the SFSTs are accurate and replicable.

Keywords: SFSTs, Cannabis, Alcohol, Driving

The Accuracy of Evaluations by Drug Recognition Experts in Canada

Douglas J. Beirness^{*1}, Erin Beasley¹, Jacques LeCavalier¹, and Evan Graham²

¹Canadian Centre on Substance Abuse, Ottawa ON, Canada

²Royal Canadian Mounted Police, Ottawa ON, Canada

The objective of this paper is to illustrate the accuracy with which police officers trained as Drug Recognition Experts (DREs) can identify the category of drug(s) ingested by persons believed to be under the influence of a drug.

In Canada, driving while one's ability to do so is impaired by alcohol or a drug is a criminal offence. Drivers are required to provide a breath sample for analysis of alcohol content or face a charge of refusal, which is equivalent to that of impaired driving. However, drivers suspected of being impaired by drugs only submit to a drug evaluation voluntarily. They can refuse to participate with consequences. Recently introduced amendments to the Criminal Code (Bill C32) would require drivers to submit to a drug evaluation by a DRE and to provide a sample of bodily fluid for analysis.

The Drug Evaluation and Classification (DEC) program was introduced into Canada in October 1995. At that time, 24 police officers from the Vancouver area of British Columbia were trained in the techniques. Twelve years later, 254 police officers across Canada have been trained as Drug Recognition Experts (DREs).

Copies of all drug evaluations completed by DREs in Canada are submitted to the Canadian DRE coordinator along with the toxicology report on the fluid sample. These reports were examined to determine the accuracy with which the category of drug(s) believed to be involved based on the evaluation by the DRE matches that found as a result of toxicological analysis of the fluid sample from the individual.

In total, 1,349 case files were available for analysis. Stimulants were the most common drug, being listed on 47% of toxicology reports. Cannabis was found in 38% of samples followed by narcotic analgesics (34%). Dissociative anaesthetics, hallucinogens, and inhalants were detected infrequently. Overall, DREs judgments about the class of drug(s) involved matched the drug(s) detected by the toxicological analysis in 96% of cases. The paper will present measures of sensitivity, specificity, the false alarm rate and miss rate for all drug categories combined as well as for the most commonly found substances.

From the analysis of DEC cases on file, it is concluded that drug evaluations conducted by DREs in Canada are extremely accurate.

Keywords: DRE, Drug impairment, Evaluation

Alcohol, Drugs, and Traffic Safety in Australia: Initiatives and Indicators

Ian J. Faulks*¹ and Julia D. Irwin²

¹Safety and Policy Analysis International, PO Box 140, Wahroonga NSW 2076, Australia

²Department of Psychology, Macquarie University NSW 2109, Australia

This paper reviews the status of alcohol, drugs and traffic safety in Australia. Australian jurisdictions have made impressive improvements in road safety since the early 1970s. Road fatalities have more than halved, while indicators of road use (population, vehicle registration, driver licensure, vehicle distance driven) have more than doubled. Enforcement and public education campaigns that specifically target drink driving, speeding, and non-use of seat belts have been successful. There has been an extensive shift in attitudes to drink driving in Australia, and success in this area is serving as a valuable guide to changing other undesirable road behaviours. Strategies to tackle drivers impaired by alcohol or other drugs are based on general deterrence and targeted operations. These actions reflect the national road safety strategy and its analogues across the Australian jurisdictions.

A recent major initiative introduced in a number of Australian jurisdictions is random roadside drug testing, which supports and extends the previous random breath test (RBT) powers for impaired driving. Police now have powers to: (a) stop drivers at random to test for alcohol and arrest drivers who test over the legal prescribed limit; (b) stop drivers at random to test for specified drugs and issue a traffic notice or court attendance notice if certain prescribed drugs are detected; (c) require a driver to undergo a sobriety test in certain circumstances, and arrest drivers they believe are impaired by drugs for the purpose of blood and urine testing. Random roadside drug testing supports an offence of drive with the presence of any of the following drugs: active THC (cannabis); methylamphetamine ('speed/ice'); or methylenedioxymethamphetamine (MDMA or 'ecstasy'), as determined by testing in oral fluid, blood or urine. As well, the presence of morphine (unless proven for medicinal use) and cocaine in the blood or urine of drivers can also constitute an offence. The usual penalties for drug driving include a substantial fine and loss of driver's license.

Other major initiatives to combat impaired driving in Australia in recent years include responsible service of alcohol programs, and the commencement of alcohol ignition interlock programs and interventions targeting repeat drink driving offenders for assessment of alcohol-dependence. Promotion of the use of personal alcohol breathalyzer devices is also occurring. Support for interventions targeting first-time drink driving and drug driving offenders is lagging, however, despite a stated need for more effective partnerships to be built between the road safety and health sectors to better address issues involving alcohol and other drug use. Some technologies, notably dataloggers and vehicle tracking through GPS, offer promise for a better dealing with impaired drivers, but there has been little policy development to date.

Across the Australian jurisdictions there are now an agreed suite of drink driving and drug driving performance indicators, including: incidence of alcohol and drug use by drivers and riders killed in crashes; crash incidence during 'high alcohol' periods; incidence of drink driving reported from RBT operations; incidence of illegal alcohol and drug levels per 1,000 tests; community perspectives of the level of RBT enforcement and likelihood of being tested; and number of offenders and non-offenders using alcohol interlocks.

Keywords: Random roadside drug testing, Trends, Indicators

Worldwide Trends in Alcohol and Drug Impaired Driving

Barry M. Sweedler*

Safety and Policy Analysis International, L.L.C., 3798 Mosswood Drive, Lafayette, CA 94549, USA

This paper will summarize the latest trends in a number of industrialized countries around the world and discuss the reasons for the changes that occurred, and review current programs designed to produce further reductions in impaired driving. In the decade of the 1980s, there were impressive declines in drinking and driving in much of the industrialized world. The declines included about 50% in the Great Britain, 28% in Canada and The Netherlands, 32% in Australia, 37% in Germany and 26% in the U.S. These declines did not continue in the early part of the 1990s. In some countries, there were actually increases. Toward the middle and latter part of the decade the increases stabilized and we again began to see some decreases. However, these decreases have been at a slower rate than the dramatic decreases in the 1980s. Toward the end of the 1990s and in the new century, the record has been mixed. Clear trends have emerged. Some countries (France and Germany) continued to reduce drinking and driving while in other countries (Australia, Canada, United Kingdom and the United States), there was stagnation and in some cases small increases or even large increase as was the case in Sweden. Trends on drug impaired driving are also beginning to emerge in some countries. These trends will also be discussed.

Keywords: Drinking driving trends, Drugged driving trends, Worldwide impaired driving trends

Drugs in Driving - The South Australian Experience

Peter Felgate* and Peter Harpas

Forensic Science South Australia, Forensic Science Centre, 21 Divett Place, Adelaide, South Australia

On the 1st of July 2006 new Road Traffic legislation came into effect in South Australia, which allowed for the random drug testing of oral fluid from drivers. It also allowed for the testing of blood samples from drivers injured in motor vehicle accidents for drugs as well as alcohol.

The random testing of drivers for alcohol and the testing of blood from all people involved in a motor vehicle accident who attend a prescribed hospital has been in force in South Australia since the early 1960's. New legislation has now allowed the random testing of drivers and the testing of injured drivers for three prescribed drugs (Δ^9 -THC), methylamphetamine and 3,4-methylenedioxymethamphetamine (MDMA).

All positive oral fluid samples from the roadside testing are submitted to the Forensic Science Centre for confirmation. This presentation will examine the number of confirmed positive samples and the proportion of each of the prescribed drugs present. This data will be compared to the proportions of these prescribed drugs found in the blood samples taken from injured drivers.

It is estimated that the South Australian Police will conduct 9,000 oral fluid tests in the 12-month period to the end of June 2007 with an expected positive rate of approximately 3.4%. It is estimated that approximately 1,000 blood samples from injured drivers will be analysed in this same period.

The methodology used for the laboratory analysis will be discussed. Solid phase extraction followed by derivatisation with PFPA and GC-MS analysis is used for the analysis of amphetamines in oral fluid and blood. Liquid-liquid extraction and derivatisation with PFPA and GC-MS analysis is used for the analysis of Δ^9 -THC in oral fluid and blood.

Keywords: Oral fluid, Drugs in driving, Roadside testing

Cognition and Motor Control as a Function of Δ^9 -THC Concentration in Serum

J. G. Ramaekers^{*1}, M. R. Moeller², E. L. Theunissen¹, and G. Kauert³

¹Department of Neuropsychology & Psychopharmacology, Faculty of Psychology, Maastricht University, The Netherlands

²Unikliniken des Saarlandes, Homburg, Germany

³Department of Forensic Toxicology, Institute of Legal Medicine, Goethe University of Frankfurt, Germany

Cannabis use has been associated with increased risk of becoming involved in traffic accidents. However the relation between THC concentration and driver impairment is relatively obscure. The present study was designed to define performance impairment as a function of THC in serum and oral fluid in order to provide a scientific framework to the development of per se limits for driving under the influence of cannabis. Twenty recreational users of cannabis participated in a double-blind, placebo controlled, 3 way cross-over study. Subjects were administered single doses of 0, 250 and 500 $\mu\text{g}/\text{Kg}$ THC by smoked route. Performance tests measuring skills related to driving were conducted at regular intervals between 15 min and 6 hrs post smoking and included measures of perceptual-motor control (Critical tracking task), motor impulsivity (Stop signal task) and cognitive function (Tower of London). Blood and oral fluid were collected throughout testing. Results showed a strong and linear relation between THC in serum and oral fluid. Linear relations between magnitude of performance impairment and THC in oral fluid and serum however were low. A more promising way to define threshold levels of impairment was found by comparing the proportion of observations showing impairment or no impairment as a function of THC concentration. The proportion of observations showing impairment progressively increased as a function of serum THC in every performance task. Binomial tests showed an initial and significant shift toward impairment in the Critical tracking task for serum THC concentrations between 2 - 5 ng/mL. At concentrations between 5 - 10 ng/mL approximately 75 - 90% of the observations were indicative of significant impairment in every performance test. At THC concentrations > 30 ng/mL the proportion of observations indicative of significant impairment increased to a full 100% in every performance tests. It is concluded that serum THC concentrations between 2 - 5 ng/mL establish the lower and upper range of a legal THC limit.

Keywords: Cannabis, Cognition, Impairment limit

Cannabis Intoxication and Fatal Road Crashes in France: Population Based Case-Control Study - Results and Comparison with the Alcohol

Jean-Michel Costes^{*1}, Blandine Gadegbeku², Jean-Louis Martin², Marie-Berthe Biecheler², Bernard Laumon², and the SAM Group³

¹OFDT, Saint-Denis, France

²INRETS/UCBL/InVS UMRESTTE, Bron, France

³CEESAR, INSERM, INRETS, LAB, OFDT

OBJECTIVE: To evaluate the relative risk of being responsible for a fatal crash while driving under the influence of cannabis and/or alcohol and the fraction of fatal crash related deaths attributable to cannabis and alcohol.

METHODS: Population based case-control study. 10,748 drivers involved in fatal crashes in France from October 2001 to September 2003 are included in the study. The blood alcohol and cannabis (Δ^9 -tetrahydrocannabinol concentration) are known.

The cases (6,766) are drivers responsible for the fatal crashes. The controls (3,006) have been selected from drivers not at fault. Cannabis and alcohol prevalence is standardised on drivers not at fault who are involved in crashes resulting in slight injuries.

RESULTS: After adjustment for different factors, the relative risk of being responsible for a fatal crash while driving under the influence of cannabis alone (THC > 0) is 1.8, 8.5 with alcohol alone (BAC > 0) and 14.0 when both cannabis and alcohol are positive. A significant dose effect is found for cannabis like for alcohol.

The adjusted fraction of fatal crashes attributable to cannabis is 2.5% and 28.6% for alcohol. In addition to these numbers linked to the responsibility of drivers under influence, an estimation of fatal crashes attributable to the greater vulnerability of drivers under influence of cannabis (1.5%) and alcohol (11.0%) are estimated.

The prevalence of cannabis (2.9%) estimated for the driving population in France is lower than that for alcohol (5.3%) but higher (2.7%) than for alcohol concentration over legal threshold (≥ 0.5 g/L).

Drivers under influence of cannabis are mainly young men. Half the fatalities for at fault crashes involving drivers who tested positive for cannabis are younger than 25; they represent 17.9% of the total of dead people under 25 on crashes. Alcohol related fatal crashes affect older people nevertheless, because of its high levels of prevalence and risk, there are more deaths of young people (< 25 years) related to crashes with drivers at fault positive to alcohol (38.5%).

Fatal crashes with drivers under influence of cannabis or, for the most part, alcohol are very frequent at the night, especially on Saturday. On Saturday night, they are responsible for 3 fatal crashes out of 4.

CONCLUSIONS: Driving under influence of cannabis increases the risk of being responsible of a fatal crash. However, this risk and its share in fatal crashes are much lower than those, well known, associated with alcohol.

Keywords: Fatal crash, Epidemiology, Cannabis, Alcohol

Assessment of Driving Capability Through the Use of Clinical and Psychomotor Tests in Relation to Blood Cannabinoids Levels Following Oral Administration of 20 mg Dronabinol or of a Cannabis Decoction Made With 20 or 60 mg Δ^9 -Tetrahydrocannabinol

Marc Augsburger^{*1}, Annick Ménétrey¹, Christian Giroud¹, Marie A. Pin¹, Bernard Favrat¹, Laura E. Rothuizen², Monique Appenzeller², Thierry Buclin², and Patrice Mangin¹

¹Institute of Forensic Medicine, University Hospital and University of Lausanne, Lausanne, Switzerland

²Division of clinical pharmacology and toxicology, University Hospital and University of Lausanne, Lausanne, Switzerland

THC (Δ^9 -Tetrahydrocannabinol) is the most frequently detected drug in blood of drivers suspected of driving under the influence of drugs. In experimental studies using driving simulators and on-the-road driving tests, cannabis impairs cognition, psychomotor function, and actual driving performances. However, the simultaneous measurement of blood cannabinoids concentrations, of psychomotor performances, and of driving capability, especially after oral ingestion, has rarely been determined. Furthermore, most of these studies have been performed with low to medium doses of THC. The present study used a double-blind crossover design to compare the effects of medium (16.5 mg THC) and high doses (45.7 mg THC) of hemp milk decoctions, of a medium dose of dronabinol (20 mg synthetic THC, Marinol[®]) and of a placebo on several skills required for driving. Objective signs such as conjunctive reddening, pulse rate and arterial pressure were also recorded. Time concentration-profiles of THC, 11-hydroxy- Δ^9 -tetrahydrocannabinol (11-OH-THC), and 11-nor-9-carboxy- Δ^9 -tetrahydrocannabinol (THCCOOH) in whole blood were determined by gas chromatography-mass spectrometry- negative ion chemical ionization. Compared to smoking studies, relatively low concentrations were measured in blood. The highest mean THC concentration (8.4 ng/mL) was achieved 1 hour after ingestion of the highest dose of THC (hemp milk decoction). Moreover, individual blood levels showed important intersubject variability.

Eight male subjects aged 22 to 30 years, all occasional cannabis smokers, were enrolled. Two subjects were withdrawn from the study after administration of dronabinol or hemp milk decoction containing the medium dose of THC because of development of transient psychotic symptoms (depersonalization, paranoid feelings and derealisation). The willingness to drive was influenced by the importance of the requested task. For example, under significant cannabinoids influence, the participants refused to drive when they were asked whether they would agree to accomplish several unimportant tasks (e.g., driving a friend to a party). Most of the participants reported a significant feeling of intoxication and did not appreciate the effects, notably those felt after dinking the strongest decoction. Nausea was often reported and vomiting was also observed. These adverse effects are aggravating factor for several subjects. A slight to moderate conjunctive reddening was consistently observed, which was more intense after the highest dose of THC. Road sign and tracking testing revealed obvious and statistically significant differences between placebo and treatments. A marked impairment was observed after ingestion of high dose of THC (hemp milk decoction).

This controlled clinical study points out the negative influence on fitness to drive after medium or high dose oral THC. Moreover, this study shows that although large doses of THC were ingested and obvious psychoactive effects observed and performance impairments monitored, whole blood levels of THC remained lower than 13 ng/mL.

Keywords: DUID, Cannabis, Driving simulator testing

Validation of a Model for Estimating Time of Last Cannabis Use from Known Concentrations of Tetrahydrocannabinol and the Major Metabolite

Edward Ogden*, Katherine Papafotiou, and Con Stough
Brain Sciences Institute, Swinburne University of Technology, John Street, Hawthorn, Victoria, Australia

BACKGROUND: The incidence of driving while affected by cannabis is rising in parallel with increased cannabis use in the community. As the impairing effect of cannabis on driving is better understood, knowing the time cannabis was last used becomes important for determining impairment in accident investigations and clinical evaluations. Two models for predicting time of last cannabis use from single plasma cannabinoid concentrations—model I, using Δ^9 -tetrahydrocannabinol (THC), and model II, using the concentration ratio of 11-nor-9-carboxy-THC (THCCOOH) to THC—were developed and validated from controlled drug administration studies by Huestis et al in 1992 and re-evaluated in 2005. The current study seeks to extend that validation by use of a large number of plasma samples collected after administration of single doses of THC to subjects in driving impairment studies and to examine the effectiveness of the models to predict time elapsed since administration of THC.

METHODS: The aggregated data of experiments involved administration of THC with and without alcohol. One data set comes from forty cannabis users who each smoked a cigarette containing either 1.74% THC or 2.93% THC. Blood samples were drawn at 25 minute intervals and THC was measured using gas chromatography-mass spectrometry. Allowing for missing data, 214 THC/time pairs were available for analysis. No measurement was made of THC-COOH. The second data set comes from another project in which subjects smoked cigarettes containing 0% THC, 1.8% THC or 3% THC with low dose alcohol (.03% BAC) or cannabis (0% THC, 1.8% THC and 3% THC) with high dose alcohol (.05% BAC). Each part was made up of six randomized, double-blind sessions. Blood was drawn at 20 minutes and 60 minutes for both THC and THC-COOH. Allowing for missing data and the placebo condition 814 data points were available. Predicted times of cannabis smoking, based on the Huestis models, were compared with actual smoking times.

RESULTS: The results validate the Huestis model for predicting time of last use of cannabis use, especially when both THC and THC-COOH levels are known.

Keywords: Marijuana, THC, Pharmacokinetics

A Comparison of Drugged-Driving Laws and Their Roadside Enforcement Procedures Across the European Union

Brendan Hughes*

European Monitoring Centre for Drugs and Drug Addiction, Rua da Cruz de Santa Apolonia 23-25, 1149-045 Lisboa, Portugal

The EMCDDA provides objective, reliable and comparable information on the drug situation and responses across the 27 European Member States and Norway. As well as reporting on standardised data, its network of National Focal Points (NFPs) submits supplementary data on three Selected Issues each year. In 2006, the NFPs reported on the situation and responses in their countries regarding driving after taking cannabis or benzodiazepines. This Selected Issue will be published in November 2007.

The EMCDDA also manages the European Legal Database on Drugs (ELDD), a public website giving information on various aspects of the countries' and the Union's drug laws. In 2006, the ELDD's network of national legal experts gave information on their basic laws and penalties addressing drugged driving.

This article describes and compares the various legal restrictions and penalties in the different European countries on driving after taking drugs - whether provisions exist in drug control laws or road traffic laws, the substances addressed, the status and levels of penalties (licence suspension, fines, prison terms), and whether the laws are of zero-tolerance or impairment type, with or without a blood-drug concentration threshold. It also outlines the differing procedures binding the law enforcement officers in the countries during a traffic stop: whether drivers can be stopped at random or if the police require some form of suspicion beforehand; when testing is obligatory, such as after fatal injuries or accidents; whether DRE training is compulsory, optional, or basic; and what tests are performed by the officers before the driver is presented to medical staff.

The article finds that there are few commonalities beyond the basic concept of penalising drugged driving in Europe. Not all controlled drugs in the blood are prohibited. It may be a civil or a criminal offence, with possible penalties such as licence suspension ranging from a minimum of a few weeks to a maximum of a year. DRE training for traffic officers is the exception rather than the rule, as are standardised procedures for screening impaired drivers. Harmonised European legislation on the subject, though perhaps wanted by some, is unlikely in the near future. The article is not only an illustration of the diversity of the different responses across Europe, but serves to contextualise the difficulties faced in applying scientific standards of comparability to cross-national epidemiological studies - which in turn aim to shape the policies and laws of those countries.

Keywords: Legislation, Europe, Drugs

ROSITA II Project: Evaluation of Point of Collection (POC) Oral Fluid Drug Testing Devices at Four Sites in the U.S.A. and Six Sites in Europe (includes 5 presentations)

J. Michael Walsh*¹ Ph.D., Jayne Thatcher*², Laura Liddicoat*³, Leo Cangianelli*¹, Denny Crouch*⁴, and Professor Alain Verstraete*⁵

¹The Walsh Group, Bethesda, MD, USA

²Washington State Toxicology Laboratory, Seattle, WA, USA

³Wisconsin State Laboratory of Hygiene, Madison, WI, USA

⁴Center for Human Toxicology, University of Utah, Salt Lake City, UT, USA

⁵Ghent University, Gent, Belgium

Presenters and Titles of Individual Presentations: J. Michael Walsh, Ph.D., Moderator

- 1) Jayne Thatcher, "Evaluation of On-Site Saliva Drug Testing Devices in Washington State"
- 2) Laura Liddicoat, "Evaluation of On-Site Saliva Drug Testing Devices in Wisconsin"
- 3) Leo Cangianelli, "Evaluation of On-Site Saliva Drug Testing Devices in Hillsborough County FL"
- 4) Denny Crouch, "Evaluation of On-Site Saliva Drug Testing Devices in Salt Lake City, Utah"
- 5) Alain Verstraete, "Review of EU Partner sites participating in Rosita II, Belgium, Finland, France, Germany, Norway, and Spain"

This collaborative US/EU international effort was carried out from 2003 - 2006 to evaluate the feasibility of using POC oral fluid drug testing devices in the enforcement of drugged driving laws. The ROSITA II project was conducted in major cities in the US and Western Europe by teams of scientists working in collaboration with local police. This session will present specific data from the U.S. sites and a comparison summary of the European partner sites. Six POC oral fluid drug testing devices were evaluated in the U.S. field study [Drugwipe® (Securetec), OralLab® (Varian), Oratect® (Branan Medical), RapiScan® (Cozart), SalivaScreen® (UltiMed) and Uplink® (Orasure Technologies)]. The devices were randomly assigned to the partner sites.

Standardized training of all research and police teams was conducted prior to the field evaluation to ensure that the protocol was carried out uniformly across sites. Standard police measures were used to identify drivers suspected to be under the influence of drugs. Two oral fluid specimens were collected from each DUI suspect. One specimen was used with the POC device, and the other was shipped to a reference laboratory for comparison analysis. Depending on specific State laws, blood and or urine specimens were also collected from the suspect.

The evaluation focused on the performance of the devices [specificity, sensitivity, accuracy] as well as the user friendliness for police in field operations. In general, most of the devices detected methamphetamine, amphetamines, and opiates well and detected those drugs in the range of the cutoff concentrations proposed by SAMHSA. The ability to accurately and reliably detect cocaine was device dependent. None of the devices performed well in detecting marijuana use. This remains a key concern with the use of POC OF devices because marijuana is the most commonly abused illegal drug and of primary concern for drugged driving cases. Of the six devices evaluated in the U.S field study only the Drugwipe was considered acceptable for roadside testing based on its ease of use and the willingness of the donors to provide specimens. However, the Drugwipe device was not sufficiently sensitive to detect the two primary drugs of abuse commonly detected in DUI arrests, i.e. marijuana and cocaine.

Keywords: Oral fluid, Point of collection, DUI

Frequency of Illegal Drugs and Medicines in a Norwegian Road-Side Survey

Per T. Normann^{*1}, Bjørg S. Pettersen¹, Terje Assum², Unni Johansen¹, Lena Krisoffersen¹, Asbjørg S. Christophersen¹, and Jørg Mørland¹

¹Norwegian Institute of Public Health, Division of Forensic Toxicology and Drug Abuse, Oslo, Norway

²Institute of Transport Economics - TØI, Oslo, Norway

BACKGROUND: Traffic safety is one of the main goals of the World Health Organization. One of the major research areas of the Norwegian Public Health Institute is the relation between abuse of drugs and traffic safety in Norway. The aim of this study was to investigate the use of alcohol, illegal drugs and psychoactive medicines among ordinary drivers. The project was performed in collaboration with the Institute of Transport Economics with the assistance from the Mobile Police Force.

METHOD: To obtain a high percentage of participation of the drivers, a saliva sample was selected as biological specimen for analyses of drugs and medicines from at least 10,000 randomly selected drivers during a 12-month period in the South-East part of Norway. The drivers were informed both orally and with a leaflet before they gave an informed consent to participate anonymously in the study. The saliva samples were analysed for the use of morphine, heroin, codeine, methadone, buprenorphine, amphetamine, metamphetamine, MDMA, MDA, MDEA, cocaine, THC, LSD, diazepam, flunitrazepam, clonazepam, nitrazepam, oxazepam, alprazolam, lorazepam, bromazepam, fenazepam, zopiclone, zolpidem, carisoprodol and some metabolites by LC-MS/MS and alcohol by an ADH-method.

RESULTS: Close to 11,000 drivers were included in the study and 89% of all drivers asked, were willing to participate. Drivers of private cars made up some 80% of the survey samples, and vans, trucks and motorcycles made up 15%, 2% and 1%, respectively. The average age of all included drivers was 45 years. 30% of the drivers were women.

The medicines diazepam, flunitrazepam, clonazepam, nitrazepam, oxazepam, alprazolam, zopiclone, zolpidem or carisoprodol was detected in saliva from about 4% of the drivers and whereas morphine, heroin, codeine, methadone, buprenorphine, amphetamine, metamphetamine, MDA, cocaine, THC was found in saliva from about 1% of the drivers. The most common medicine was the hypnotic zopiclone, and THC was the most common illegal drug. Alcohol was detected in about 0.5% of the drivers.

CONCLUSIONS: This study shows that most Norwegian drivers are willing to deliver anonymously a saliva sample for testing of illegal drugs and medicines. During a period of 12 months about 11000 randomly selected drivers were included in a study where the frequency of drugs and medicines with a potential to reduce driving skill was investigated using saliva. About 4% of the drivers had at least one medicine in the body and about 1% of the drivers had at least one illegal drug in the body. The frequency of medicines among the drivers is comparable to the frequency of the sale statistics of these medicines.

This study was financed by the Norwegian Directorate for Health and Social Affairs and the Norwegian Ministry of Transport and Communication.

Keywords: Drugs, Saliva, Road-side survey

Driving Under the Influence of Psychoactive Substances

Miran Scheers¹, Alain Verstraete^{*2}, Myriam Adriaensen¹, Elke Raes², and Mark Tant¹

¹Belgian Road Safety Institute, Belgium

²University of Ghent, Belgium

In 1999, Belgium introduced a law on driving under the influence of illegal drugs. In 2005 the Belgian Science Policy has taken the initiative to support a survey intended to draw up recommendations for a more efficient enforcement policy.

An exhaustive literature study on the influence of drugs on fitness to drive and a survey about the legislation and enforcement in a number of European and non-European countries were conducted. Various initiatives such as surveys among police forces, police schools, accredited laboratories and public prosecutors were taken to evaluate the application of the law in Belgium. The research team observed also targeted controls organized by the police.

The results of the study revealed the problems of the current procedure. Based on these observations, preliminary recommendations were formulated. These recommendations were discussed with national experts and adapted to be presented for comments to six international experts and a Belgian expert on penal law. The therefore used method was the Delphi-method. Finally, the preliminary recommendations were transposed into final recommendations.

The recommendations described in the report can be subdivided in five themes. Covered topics are the lack of data, practical problems for the police, problems with regard to the prosecution, legislation and analysis of blood samples.

In Belgium there are no recent data on the number of drug-related accidents. Therefore, a toxicological analysis should be carried out on all drivers involved in a fatal accident.

The problems the police are faced with are multiple. Most important is the fact that the procedure is time-consuming and complicated and that only 18% of the officers have had the required training. The researchers propose that efforts should be made to simplify the procedure by introducing new, reliable, quicker and easier-to-use tests.

The study of the prosecution shows that the different public prosecutors give different instructions to the police. The researchers recommend that all public prosecutors work in a uniform way.

The research also reveals a number of problems with regards to legislation. These problems concern among others the possibilities to withdrawn the driving licence, inexperienced drivers and persons who are dependent on psychoactive substances.

During the research, some problems with regards to the blood sampling and the analysis of the sample were revealed and propositions were made.

In the last part of the report some suggestions with regard to awareness-raising, communication and further research are made.

Keywords: Illegal drugs, Driving under the influence of drugs, Enforcement

Studies on Drugs and Driving Realised in European Countries: Focus on Cannabis and Benzodiazepines

Dominique Lopez* and Brendan Hughes

European Monitoring Center on Drugs and Drug Addiction (EMCDDA), Rua da Cruz de Santa Apolonia, 23-25, 1149-045 Lisboa, Portugal

The EMCDDA decided to look into the topic of cannabis and benzodiazepines in European drivers, to support or correct the findings of earlier studies that these were the two most prevalent substances in this particular population.

In 2006, the EMCDDA requested each of its national partners (REITOX network of national focal points) to supply information available concerning the issue of drugs and driving with a specific focus on the above mentioned substances. This presentation aims at providing an insight on the main conclusions of the prevalence studies submitted.

Though a large number of prevalence studies on drivers have been carried out at national level in European countries during the last 10 to 15 years, not all included equal focus on cannabis and benzodiazepines. Furthermore, the major limitation in drawing a picture of the prevalence of drugs in drivers is the problem of comparability of results. The reasons for this include differences in sampling methodology, choice of drugs to screen, specimens collected, screening devices, and cut-off levels for forensic analysis. On a cross-national level, different legislative frameworks add further complexity.

This study of roadside surveys (random or on suspicion), hospital or accident studies, confirms that cannabis and benzodiazepines, besides alcohol, are the two psychoactive substances most prevalent among drivers in Europe, although a few exceptions can be pointed out. In Finland, Sweden and Latvia amphetamines were frequently found, opiates seemed to feature in Greece and Germany, and cocaine was the most prevalent substance in drivers in Spain. Concerning benzodiazepines, limited reports of blood concentrations showed levels both therapeutic and clearly above. Finally, polydrug use cannot be ignored.

It appears from this European overview that better national drugged-driving estimates are needed, based on reliable epidemiological studies of drivers, particularly when drug prevalence estimates among drivers do not always match those of the general population. This would then enable design of more effective policy responses for each psychoactive substance.

Keywords: Europe, Cannabis, Benzodiazepines

Investigations on Driving Under the Influence of Drugs in Vienna: Experiences from 1996 to 2006

R. Fous¹, G. Gmeiner^{*2}, and W. Vycudilik³

¹Police Headquarters, Schottenring 7-9, A-1010 Vienna, Austria

²Austrian Research Centers Seibersdorf GmbH - ARC, A-2444 Seibersdorf a.d. Leitha, Austria

³Knödelhüttenstrasse 25/1/3, A-1140 Vienna, Austria

With effect from 1994, §5 of the Austrian road traffic regulations 1960 (StVO) has legalized blood sampling for the use of chemical analysis whenever a driver is suspected to use illicit drugs. Since its amendment in 2002 the sampling of blood by an authorized physician is mandatory and the driver has to give his consent to the procedure, in case any impairment is suspected; otherwise the impairment by the use of narcotic drugs is taken for granted.

In contrast to the legal regulations of the neighbouring countries (The Federal Republic of Germany and Switzerland), where analytical detection limits are taken as evidence for impairment, Austria did not follow this procedure, as only impairment due to recent drug use can be detected, but any impairment in the course of withdrawal symptoms is not reflected by this approach. Moreover the implementation of §24 StVG in Germany in 1997 restricted the number of target analytes to 6 active substances or their metabolites, which justify an administrative offence. According to the Austrian StVO the consumption of all narcotic drugs, defined in the Single Convention and the Austrian SMG respectively, are prohibited, leading to a far larger number of target substances.

After the introduction of immunological testing of urine samples in 1994 to serve internal purposes of the Police Headquarter in Vienna, such urine tests have been applied to drivers under the influence of drugs since 1996. In case of positive results the samples were submitted to an authorized laboratory for confirmation by gas chromatography - mass spectrometry. In 1996 about 100 impaired drivers could be diagnosed. Until 1999 this number increased to about 600 positively identified cases.

Since another amendment in effect from 2002, blood sampling has become obligatory, the analysis of urine samples is possible. Since 2005 such investigations have been performed in ISO 17025 certified laboratories by means of gas chromatography - mass spectrometry, as well as by using liquid chromatography and tandem mass spectrometry.

The presented data compare the number of impaired drivers in Vienna between 1996 and 2000 on the one hand, with those between 2005 and 2006 on the other. For the first time a collective representing more than 1,000 individuals was accessible, with the chemical analysis including quantification of the substances. It turned out that most of the impaired drivers consume more than one substance only and the prevalence of Ecstasy has increased significantly. The investigations prove that the pattern of drug abuse follows their local availability.

Keywords: DIUD, Impairment, Quantification

Prevalence of Drug Impaired Driving Fatalities in Canada 2000 - 2004

Sherilyn Palmer*¹ and Paul Boase²

¹Justice Canada, 284 Wellington Street, East Memorial Bldg, Ottawa, ON, K1A 0H8

²Transport Canada, 330 Sparks Street, Tower C, Ottawa, ON, K1A 0N5

In Canada, information on fatally injured impaired drivers has been collected over the past 30 plus years. These data have been useful in monitoring the challenge of alcohol impaired driving in Canada and are presented nationally and for each provincial/territorial jurisdiction. In order to track the incidence of drug impaired driving, the Strategy to Reduce Impaired Driving (STRID) fatality database, collected by the Traffic Injury Research Foundation on behalf of Transport Canada and the Canadian Council of Motor Transport Administrators was modified to collect drug related information. The STRID alcohol database is based on a very high testing rate of alcohol among fatally injured drivers, the STRID drug database represents two models of testing. In the first, the testing rate is high, defined as above 70% while in the second model the testing rate is based on a suspicion of drug involvement and averages 35% of all eligible drivers.

This current research is important to learn more about the magnitude of drug-impaired driving at the national and jurisdictional levels. The aim of this study is to elucidate the current situation of drug impaired driving in Canada. A unique feature of the study is that it contains quantitative information on the presence of drugs among fatally injured drivers. To date, the mechanism by which various drugs might contribute to vehicle crashes is not well understood. The results of this study provide information on the testing rate for drugs among fatally injured drivers in Canada, and separately by jurisdiction. In addition, aggregate analysis will identify the frequency of drug classes. Separate breakdowns will be provided differentiating between jurisdictions with low-testing rates and those with high-testing rates.

Results are based on 9,158 fatally injured drivers and looks at rates by types of drugs by jurisdiction in Canada. The period of the study is from 2000 to 2004.

Keywords: Drug impaired driving, Drug use, Data systems

Blood Drug Concentrations of Frequently Encountered Drugs in Impaired and Fatally Injured Drivers

Barry K. Logan^{*1}, Ann Marie Gordon¹, and Simone Loew^{1,2}

¹Washington State Toxicology Laboratory, Washington State Patrol, 2203 Airport Way S., Seattle WA 98134, USA

²Bundeswehr

This presentation will review blood drug concentrations of drivers in DUID arrests, vehicular assault and homicide cases, and fatally injured drivers, and present these as a basis for assessing future blood concentrations in suspected impaired drivers.

The Washington State Toxicology Laboratory compiled data for the most frequently encountered drugs in three impaired driving populations. The first was a group of drivers arrested for suspected impaired driving. There were 182 different drugs and metabolites detected in 9,772 cases from whom blood samples were submitted for drug testing. A total of 17,213 positive results. The most frequently encountered drugs, with their frequency, mean, median and range of concentrations are shown in Table 1.

Table 1. Blood drug concentrations of 12 most frequently encountered centrally acting drugs and metabolites in impaired driving cases

DRUG	Frequency	Concentration (mg/L)*			
		Mean	Median	range (lo)	Range (hi)
THC*	926	6.26	5	3	48
<i>Carboxy-THC*</i>	3102	27.75	18	10	838
Methamphetamine	1159	0.30	0.21	0.010	9.46
<i>Amphetamine</i>	539	0.07	0.05	0.005	5.09
Cocaine	702	0.08	0.03	0.005	2.39
<i>Benzoyllecgonine</i>	906	1.24	0.86	0.005	17.60
Diazepam	764	0.25	0.12	0.005	3.20
<i>Nordiazepam</i>	737	0.27	0.11	0.010	3.67
Morphine	676	0.05	0.03	0.001	1.29
Carisoprodol	514	4.77	3.90	0.050	25.10
<i>Meprobamate</i>	627	14.5	12.30	0.500	77.60
Hydrocodone	289	0.05	0.02	0.005	0.56

* All concentrations in mg/L, except where indicated (*) ng/mL

A recent report describing the concentrations of drugs in fatally injured drivers (1) found many of the same drugs with similar concentrations, including the same top three. These drivers tested positive for THC (mean 8 ng/mL, median 6ng/mL, range 2 - 32 ng/mL); Cocaine (mean 0.72 mg/L, median 0.31 mg/L, range 0.03 - 3.30mg/L); and Methamphetamine (mean 0.73 mg/L, median 0.26 mg/L, range <0.01 - 1.08 mg/L). Having a large reference population of other drug affected drivers helps to assess concentrations in future cases, where a subject may seek to minimize the degree of drug use, or the significance of the concentrations.

Keywords: Toxicology, Blood drug concentrations, Guidelines

1. Schwilke EW, Sampaio dos Santos MI, Logan BK. Changing patterns of drug and alcohol use in fatally injured drivers in Washington State. *J Forensic Sci.* 2006 Sep;51(5):1191-8.

Recommendations for Toxicological Investigation of Drug Impaired Driving

Laurel J. Farrell¹, Sarah Kerrigan², and Barry K. Logan³

¹Colorado Bureau of Investigation, 690 Kipling St., Suite 4000, Denver, CO 80215, USA

²College of Criminal Justice, Sam Houston State University, Huntsville, TX 77341, USA

³Washington State Patrol, Forensic Laboratory Services Bureau, 2203 Airport Way S., Suite 360, Seattle, WA 98134, USA

Investigation of a suspected alcohol or drug impaired driving (DUID) case ideally contains several key elements, including a trained officer documenting observations of driving and subject behavior, and collection of a biological specimen for comprehensive toxicology testing. There currently is no common standard of practice among forensic toxicology laboratories in the United States as to which drugs should be tested for, and at what analytical cutoff. Having some uniformity of practice among laboratories would ensure that drugs most frequently associated with driving impairment were consistently evaluated, that appropriate methods were used to screen and confirm the presence of drugs, and that more accurate data were collected on the extent of drug use among drivers. A survey of United States laboratories actively involved in providing analytical support to the Drug Evaluation and Classification Program identified Marijuana, Benzodiazepines, Cocaine, Hydrocodone, Morphine/Codeine, Methamphetamine, Carisoprodol/Meprobamate, Oxycodone, Methadone, Antidepressants, Zolpidem, PCP, Butalbital/Barbiturates, Diphenhydramine, MDMA, Propoxyphene, Ephedrine/Pseudoephedrine, Cyclobenzaprine, Dextromethorphan, Gamma-hydroxybutyrate, Ketamine, Phenothiazines, and Tramadol as being the most frequently encountered drugs in these cases. Based on these findings, we present recommendations as to what specific members of these drug classes should at a minimum be tested for in the investigation of suspected DUID cases. Additionally we include recommendations for analytical cutoffs for screening and confirmation of drugs in blood and urine. Adopting these guidelines would ensure that the most common drugs would be detected, that laboratories could compare epidemiological findings between jurisdictions, and that aggregate national statistics on alcohol and drug use in drivers involved in fatal injury collisions would be representative of the true rates of drug use in the driving population.

Keywords: Drug, Impaired, Driving, DUID

An Overview of the Existing Drugs and Driving Categorisations

Thomas Van den Neste* and Alain Verstraete

Department of Clinical Chemistry, Microbiology and Immunology, Ghent University, Policlinic 8, 2nd floor, De Pintelaan 185, 9000 Ghent, Belgium

One of the tasks (WP 4.1) of the DRUID research project is to review the existing classifications of drugs, known to produce driving impairment. Eventually, a consensus and synthesis will have to be drawn within this work package, as to find a uniform classification system.

An inventory of existing categorization systems was made. Eleven systems have been found, involving in between 33 to 570 different drugs/formulations. In Belgium, the categorisation of substances is done according to Wolschrijn et al. These are expert ratings that categorize in 7 classes, from no impairment to severe impairment. Over 570 molecules were evaluated. Germany applied the same categorisation system. In Italy a literature review was done for 44 molecules. The Nordic countries, Norway and Finland, apply a red warning label, when a substance is dangerous. These are marked in their list as positive. The Netherlands also apply a positive list (with a yellow warning label). All of these categorisations existed already before 1999. However, since then, new countries and substances were added. Denmark has a positive list of 70 different substances. At the moment Spain has 2 systems: one by the DGT (Dirección Gral. De Tráfico) with 3 categories, and one by the SemFYC (Sociedad Española de Medicina de Familia y Comunitaria) with 4 categories. France, also has 2 systems. The first one by the CERMT (Centre d'Études et de Recherches en Médecine du Trafic) contains 4 categories, the other one, published in 2005 in the 'Journal officiel de la République Française' consists of 3 kinds of warning labels. The ICADTS system is a categorisation system which combines the lists of Belgium, France (list of 2005) and Spain (DGT). Through a questionnaire, sent to DRUID and non-DRUID partners, an assessment of the validity of the classification systems of every country is made. As in the ICADTS system, the drugs are grouped according to the ATC. This way about 9 large groups with several subgroups can be identified. In total over 700 different substances and their combinations are reviewed.

In general, substances in the different classifications are classified in the same category of impairment, although sometimes opinions differ. The mean goal is to find a consensus for each substance and a correct and practical classification, easy to access and to use for health care professionals. All substances, available in Europe, should be evaluated according to the new standards developed. New substances should be easily classified within the new system.

As for this, WP 4 will contribute to another DRUID work package (WP 7) to help formulate guidelines and booklets.

Keywords: Medicinal drugs, Driving impairment, Classification system

A Data Driven Approach to Addressing Impaired Driving Enforcement

Brian Ursino*

Field Operations Bureau, Washington State Patrol, General Administration Building, PO Box 42600, Olympia, WA 98504-2600, USA

The National Highway Traffic Safety Administration (NHTSA) represents the federal mission to save lives, prevent injuries, and reduce economic costs due to traffic crashes through education, research, safety standards, and enforcement activity. NHTSA accomplishes their mission, in part, through funding which is passed on to the states. In addition, the Federal Highway Administration (FHWA) requires states to have a Strategic Highway Safety Plan (SHSP). Each SHSP must focus on goals and objectives that, through education, engineering, enforcement, and emergency medical services (4E's), save lives, prevent injuries, and reduce economic costs.

A core group of Washington State traffic safety agencies, which include the Washington State Patrol (WSP), the Department of Transportation, and the Traffic Safety Commission (TSC), came together in 2006 to develop the Washington SHSP. The Washington SHSP describes the goal of eliminating fatal collisions in Washington by the year 2030. Called "Target Zero", the Washington SHSP outlines 22 emphasis areas organized into Priorities One through Four. The emphasis areas, and their assigned priority, are designed to close the performance gap between current trends and reaching zero deaths by 2030. Impaired driving is one of only two emphasis areas listed under Priority One.

The WSP strategic plan ties directly to the SHSP giving the WSP a continuity of purpose with other traffic safety agencies to ensure a common focus toward traffic safety. The Field Operations Bureau (FOB) strategic plan ties into the agency plan. The 2006 FOB plan set aggressive enforcement performance measures to reach its number one goal to reduce fatal and injury collisions on interstate and state routes.

In 2000, the WSP began utilizing a model of accountability driven leadership called the Strategic Advancement Forum (SAF). The purpose of the SAF is for executive managers of the agency to meet weekly with the agency commanders to address areas of concern and success stories related to meeting the agency's strategic goals. Through the use of extensive data collection, agency leaders are able to determine where traffic safety issues exist and how best to address those issues.

In 2006, the WSP hired a Research and Data Analyst to move the SAF process into the realm of Geographical Information Systems (GIS) and strategic forecasting. Now, when commanders meet to discuss traffic safety performance, they are better informed in the details of who, when, where, why, and how collisions occur and are armed with predictions for the upcoming months to better direct their resources in addressing the agency goal to save lives, prevent injuries, and reduce economic costs due to traffic collisions.

Strategic forecasting of enforcement activity and DUI collisions each month by district allows us to examine long-range problems and projects increases and decreases in trends. This process allows for improved goal setting, allows more influence over outcomes, and wiser utilization of staffing resources. GIS mapping allows the department to 'do more with less' by focusing on the locations that need attention and to focus less on the locations where the data shows no problems exist.

Keywords: DUI, Enforcement, Mapping

Characteristics of Fatal Crashes Involving Drugs in Victoria and Associated Contributory Factors

Michael Fitzharris, Michael G. Lenné*, and Nicola Fotheringham
Monash University Accident Research Centre, Monash University, Victoria, Australia

It is well established that alcohol and illicit drugs impair key psychomotor and cognitive functions necessary for safe movement within the road transport system. While the success of random-breath test operations with respect to the apprehension of DWI offenders and reductions in alcohol-related crashes has been well documented, only until recently has it been possible to undertake roadside testing for illicit drugs. It is within this context that this research aimed to determine both the extent of illicit drug use and situations in which drug use is associated with road fatalities in Victoria, Australia, with a view to informing the enforcement process.

In Victoria, the State Coroner is notified of all road deaths, with findings being made after consideration of a range of evidence. Using the National Coroners Information System (NCIS), all drivers, pedestrians, cyclists and motorcyclists aged over 16 with a positive toxicological result were identified, with details extracted and entered into a custom-built database. The NCIS database contains details of coronial files from 1 July 2000, with demographic and contextual data being available, along with the medical cause of death, mechanism of injury, and text reports of circumstances as interpreted by the police, toxicology findings, autopsy findings, and the Coroners finding. Additional crash information was obtained from the VicRoads police-reported casualty crash database, with cases linked by means of probabilistic matching.

For the year 2004, 97 drivers, pedestrians, motorcyclists and cyclists aged 16 and older were identified as having alcohol or a licit or illicit drug present at the time of death. Data from 2004 was used as the closure rate was higher than more recent years at the time the project commenced. Of these 97 cases, drivers of passenger cars represented the highest proportion (56.7%), followed by pedestrians (14.4%), motorcycle riders (11.3%), pick-up truck / van drivers (10.3%), drivers of heavy transport vehicles (5%) and cyclists (2%). Approximately 40% were persons under 30 years of age, 68% were single vehicle crashes, and two-thirds of deaths occurred at the roadside.

Apart from alcohol (49.5% of cases), the most commonly detected drugs were: narcotic analgesics (22.7%); Δ^9 -THC (19.5%); anti-depressants (18.5%), anaesthetics (15.4%, 93% hospitalized); benzodiazepines (13.4%), amphetamines (9.2%), heroin metabolites (7%). Only 2 cases were detected with MDA/MDMA and 1 case for cocaine metabolites. High levels of ethanol and THC were detected. Polydrug use was relatively common.

The strength of the NCIS database is that information concerning contributory factors (e.g., vehicle or environment-related factors) to the crash is frequently noted, as well as prior drug use, traffic violations, and crash history. In addition, the narrative information provides rich details of the pre-crash and drug use behaviors, thus enabling targeted and refined enforcement strategies to be developed. Differences in crash characteristics were evident across variables including intersection type and speed zone. These factors will be explored in the written paper and potential implications for enforcement will be discussed.

Keywords: Crash characteristics, Prevalence, Contributory factors

Driving Under the Influence of Cannabis. Incidence in Fatal Road Traffic Accidents

Carmen Jurado*, M^a Paz Gimenez, Rosario Garcia-Repetto, and M^a Luisa Soria
National Institute of Toxicology and Forensic Sciences, Department of Sevilla Avda. Dr. Fedriani s/n.
41009 Sevilla, SPAIN

Cannabis is one of the most frequently used illicit drugs in the world and its consumption has been maintained more or less homogeneous over time. Consequently, it is frequently found when performing forensic toxicological analyses, including those related to road traffic accidents.

This study has two main objectives: firstly to determine the incidence of cannabis consumption in drivers involved in fatal road traffic accidents, and secondly, to assess if the driver was under the influence of this drug when the accident took place.

A total of 810 fatally injured drivers were included in the study. All blood samples were subjected to a broad toxicological analysis. This includes ethanol analysis by headspace gas chromatography, screening analysis by immunoassay method (CEDIA) and confirmation and quantification by gas chromatography-NPD and gas chromatography-mass spectrometry (GC-MS). Cannabis compounds (THC and THC-COOH) were analyzed by GC-MS with deuterium labeled internal standards. The limit of quantifications were 0.25 ng/mL and 0.50 ng/mL for THC-COOH and THC, respectively. THC-COOH and THC concentrations were evaluated, using Model II from Huestis et al. (1) in order to estimate the time of cannabis exposure.

The results showed that ethanol was the most prevalent substance, since around 50% of the samples tested positive for it. In addition, a high prevalence of cannabis was also noticeable in around 7.5% of the cases. Concentrations ranged from 0.8 to 33.3 ng/mL (mean 8.1 ng/mL) and from 4.4 to 60.5 ng/mL (mean 16.81 ng/mL) for THC and THC-COOH, respectively. By applying Model II calculations, based on THC: THC-COOH ratio, the estimated time of exposure ranged from 18 to 246 minutes (mean 57 minutes). Looking at the frequency distribution of the time, in the majority of the cases (58%) the time was lower than 60 minutes; while times from 1 to 2 hours and from 2 to 3 hours had an incidence of 28% and 8%, respectively, and in only 3% of the cases was the time higher than 3 hours. If we consider that peak effect is experienced about 15-30 minutes after smoking and that the pharmacological effects often last for 2-4 hours, we can deduce that more than 90% of the killed drivers who had deceased cannabis were under this influence during the accident.

From this study it is possible to conclude that cannabis consumption plays an important role in fatal road traffic accidents because there is a high prevalence of this drug among deceased drivers and because they were driving under the influence of cannabis when the accident took place.

Keywords: Driving under the influence, Fatal traffic accidents, Cannabis

1. Huestis MA, Henningfield JE, Cone EJ. Blood cannabinoids. II. Models for the prediction of time of marijuana exposure from plasma concentration of delta 9-tetrahydrocannabinol (THC) and 11-nor-9-delta-tetrahydrocannabinol (THCCOOH). *J. Anal. Toxicol.* 16:283-290, 1992

Cannabis Among Fatally Injured Drivers: Circumstances Surrounding the Accident

Maxime Brault*

Highway Safety Research and Strategies, Société de l'assurance automobile du Québec, Québec (Québec), Canada

Of all illicit drugs, cannabis has always been of particular focus due to its prevalence within the general population, especially among young people. Over the years, research has attempted to shed additional light on the possible threat cannabis poses to road safety. Although prior studies did not establish evidence of an increased risk of crashes, recent studies using more refined methods provide a better understanding of the actual effects cannabis has on driving.

However knowledge on behavioral impairment is still limited [1]. The information contained in the reports of the coroners on circumstances surrounding the accident can lead to interesting conclusions on the type of behavior observed for consumers of cannabis. Besides, the concomitant consumption of cannabis and one or several other drugs (often the alcohol) can bring an escalation of the bad behavior among drivers.

Under the Quebec study on the role of drugs in fatal road accidents, the Coroner's office took blood and urine samples from deceased drivers. Cannabis was detected in 18.5% of the urine samples (n = 541) of deceased drivers. The presence of cannabis was more detected frequently at the young drivers (approximately 50% of the cases were drivers of less than 25 years) and at the men (90%). Accidents were more frequent on weekend days (60%) and equally on night period (9:00 p.m. to 9:00 a.m.) vs day period. Alcohol (> 80 mg%) was also present almost 50% of the cases and we found another drug other than alcohol for 35% of the cases.

Overall results will be presented on the basis of the various components of cannabis (THC and/or metabolites) and the concentrations found. Combined use (cannabis/alcohol and cannabis/other drugs) will be examined along with the circumstances surrounding each accident (type of collision, period, etc.) and the characteristics of the deceased driver (age, sex, responsible/non-responsible).

At the moment, the analysis is in progress. The analysis will be completed by the end of April.

Keywords: Cannabis, Behavior impairment, Accident circumstances

1. Walsh, J.M. *Drugs other than Alcohol, research needs and priorities, Transportation research circular no 502, Transportations research board, Jan 2001.*

Fatal Accident Drivers with Earlier Arrests Due to Drugged Driving

Asbjørg S. Christophersen*, Terje Hammer, and Jørg Mørland
Norwegian Institute of Public Health, Division of Forensic Toxicology and Drug Abuse, P.O. Box 4404
Nydalén, 0403 Oslo, Norway

OBJECTIVE: To investigate the frequency of earlier arrests due to alcohol or other drugs related driving among fatal accident drivers, comparing the group of drivers with and without alcohol or drugs detected in their blood samples collected after the crashes.

METHODS: All investigated fatal accident drivers who died during 2001- 2002 (n = 243) were followed retrospectively back to 1985, to record the frequency of earlier arrests due to alcohol or other drugs related driving. The group of fatal accident drivers was divided in two different groups: 1) Those with alcohol and/or other drugs detected in their blood samples collected after the accident (n = 106), 2) Those with no alcohol/or drugs detected after the accident (n = 137). The frequency and number of earlier arrests were compared between the two groups of fatal accident drivers.

RESULTS: Group 1) Approximately 30% (n = 32) of the fatal accident drivers who died during 2001-2002 with alcohol or drugs detected in their blood samples, had earlier been recorded for at least one arrests due to alcohol or other drugs related driving. The number of earlier arrests varied from 1 - 22.

For drivers with no alcohol or drugs detected in samples collected after the crashes, less than 3% (n = 4) had earlier been arrested due to alcohol or drugs related driving. The number of earlier arrests varied from 1 - 5. The drugs most frequently detected in samples collected after the accident besides alcohol, were benzodiazepines, tetrahydrocannabinol and amphetamines. Multi-drug detections were frequently found. This pattern of drugs detections was similar to findings in samples collected during the earlier arrests.

CONCLUSIONS: Drivers who die in drugs related crashes have a high probability to have earlier arrests recorded due to alcohol or drug related driving (approximately 1 out of 3), compared with those with no alcohol/drugs detected in samples collected after the accident (approximately 1 of 33). Multi-drug use is frequently found in samples collected after the accident which is similar to drug pattern detected during earlier arrests, indicating drug misuse or abuse. A drug treatment program seems necessary for drivers with frequent arrests and alcohol/drugs detected in their blood samples, in particularly those with more than one drug detected.

Keywords: Fatal accidents, Alcohol/Drugs, Earlier arrests

Driving Behaviour Under the Influence of Cannabis and Cocaine

S. Macdonald*, R. Mann, M. Chipman, B. Pakula, P. Erickson, A. Hathaway, and P. MacIntyre
Centre for Addictions Research and School of Health Information Science, University of Victoria,
Victoria, BC, Canada

INTRODUCTION: The purpose of this study is to describe experiences of driving under the influence (DUI) of cannabis and cocaine among clients in treatment.

METHODS: A questionnaire was administered to clients in treatment for abuse of either cocaine or cannabis, many of whom also had a problem with alcohol; additional groups of clients consisted of those in smoking cessation and gambling programs (N = 1,021). Open-ended and close-ended questions were asked on how cannabis or cocaine affected the clients' driving, collision history, and frequency of DUI of various drugs and combinations.

RESULTS: Two patterns of driving behaviour were found in both qualitative and quantitative analyses for those who drove under the influence of cocaine or cannabis: reduced driving capabilities and more reckless styles of driving. When comparing DUI driving capabilities and reckless style with frequency of DUI of cannabis or cocaine, reduced driving capability from cannabis was inversely related to frequency of DUI of cannabis, but other relationships were not significant. Separate logistic regression analyses, controlling for age, sex, and driving exposure, showed that frequency of DUI of alcohol alone and cocaine or cannabis with alcohol were significantly related to "at fault" collisions; whereas frequency of DUI of cannabis or cocaine alone were not related.

CONCLUSIONS: The findings indicate that both cannabis and cocaine have negative, but different effects on driving. The frequency of DUI of cocaine or cannabis was a risk factor for "at fault" collisions only when these substances were combined with alcohol.

Keywords: Cannabis, Cocaine, Alcohol, Driving style, Collision

Driving Under the Influence of Drugs, Alcohol and Medicines

Dr. Horst Schulze*

Federal Highway Research Institute (Bundesanstalt für Straßenwesen), Bruederstrasse 53, D-51427 Bergisch Gladbach, Federal Republic of Germany

The Integrated Project DRUID is assigned to the 6th European Framework Programme and deals with the scourge of impaired-driving. The project aims to gain new insights to the degree of impairment caused by psychoactive substances and their impact on road safety. The objective of DRUID is to give scientific support to the EU transport policy to reach the 2010th road safety target objective of a 50% reduction in the number of road deaths in the EU by establishing guidelines and measures to combat impaired driving. The DRUID consortium consists of 37 scientific institutions from 19 European countries to unite the international expertise of this research area.

DRUID will:

- conduct reference studies of the impact on fitness to drive for alcohol, illicit drugs and medicines and give new insights to the degree of impairment caused by psychoactive substances and their impact on road safety.
- generate recommendations for the definition of analytical and risk thresholds.
- analyse the prevalence of alcohol and other psychoactive substances in accidents and in general driving, set up a comprehensive epidemiological database.
- evaluate "good practice" for detection and training measures for road traffic police allowing a legal monitoring of drivers.
- establish an appropriate classification system of medicines affecting the fitness to drive, give recommendations for its implementation and create a framework to position medicines according to a labelling system.
- evaluate the efficiency of prevention, penalisation and rehabilitation strategies, considering the difficulties of appropriate evaluation schemes for combined substance use and recommend "good practice".
- define driving ban strategies, combining road safety objectives with the need for mobility.
- define the responsibility of health care professionals with respect to patients' consumption of psychoactive substances and its impact on road safety, elaborate guidelines and make information available and applicable for all European countries.

To guarantee a sound and efficient research progress, a comprehensive quality assurance system was implemented within the DRUID project. A joint Quality Assurance Plan will facilitate and assure a unified deployment of internationally acknowledged scientific standards and procedures to provide a thorough empirical basis for European transport policy makers.

Keywords: Traffic safety, Drugs, Alcohol, Medicines

A Meta-Analysis of Alcohol Studies: An Attempt to Multi-Dimensional Risk Functions.

Eva Schnabel*, Volker Hargutt, and Hans-Peter Krüger
Center For Traffic Sciences, University of Wuerzburg, Germany

One main objective of DRUID is to establish thresholds for psychoactive substances in traffic. For alcohol, the scientific knowledge about substance concentrations, behavioural effects and driving safety is extremely large. This holds true for experimental as well as for epidemiological studies. Based on this knowledge about behavioural effects and accident risk, the idea is to use alcohol as reference substance for other psychoactive substances like medicines and illegal drugs. For these substances normally quite a lot of experimental results in the lab are available, but only few epidemiological studies with a direct estimation of accident risk. Therefore, an extended meta-analysis for experimental studies with alcohol has been conducted, giving detailed information about the alcohol-induced behavioural impairment. Since for alcohol also a lot of epidemiological studies are available, the linkage between behavioural impairment and accident risk can be determined. Therefore, the ultimate goal is to introduce alcohol as a "gold standard", allowing to estimate the accident risk of a given substance and its concentration by looking at its behavioural effects in controlled experimental studies.

A key problem is to classify the different performance and effect measures used by the experimenters into a conceptual framework, which then allows to link these effects to traffic scenarios. Therefore, the driving task also has to be classified into the same conceptual framework. A new multi-dimensional classification system is established to describe the relevant features of an experimental task (kind of attention, motor complexity, level of processing, etc.), which then can be linked to different aspects of the driving task. A first application will be demonstrated.

For the meta-analysis over 10,000 publications are sighted. From these, about 300 publications are selected by applying certain in- and exclusion criteria. Because each publication contains several findings concerning the effects of alcohol (e.g. effects on different performance dimensions or performance under different blood alcohol concentrations), the meta-analysis deals with more than 3.000 reported results.

Keywords: Meta-analysis, Risk function, Classification system

This abstract refers to Work Package 1, Methodology, of the project DRUID - Driving under the influence of Drugs, Alcohol and Medicines, duration 15 October 2006-14 October 2010, see www.druid-project.eu

Experimental Drug-driving Studies in DRUID

J.G. Ramaekers*

Department of Neuropsychology & Psychopharmacology, Maastricht University, Maastricht, The Netherlands

Task 1.2 of the DRUID program is designed to assess the effects of illicit and licit drugs on driving performance under experimental, placebo-controlled conditions. The drugs under study will include medicinal drugs and illicit drugs that have been frequently implied in epidemiological research to potentially increase crash risk; as well as “novel” or “recent” drugs that are suspected to pose a potential hazard to driver safety. The experimental studies constitute a concerted effort to elucidate drug effect on driving performance with respect to 2 major drug categories: i.e. stimulant drugs and hypnotics. The major aims of the studies are:

- 1) to provide tolerance levels for each individual drug under study;
- 2) to assess potential drug-alcohol or drug-drug interactions;
- 3) to assess the effects of drugs on driving as a function of workload ;
- 4) to cross-validate data obtained from driving simulators and actual driving tests.

Driving performance will be assessed using psychomotor and cognitive tests measuring skills related to driving, driving simulators and on-the-road driving tests. Over-the-road tests will include combined city driving and highways driving test in order to measure performance under varying workload conditions, and will involve the fundamental aspects of driver vehicle interactions (i.e. standard deviation of lateral position, speed, brake reaction time, time to speed adaptation, headway, time to collision). Tests in advanced driving simulators will be developed to assess similar fundamental driving skills, but in addition include tests of reactions on traffic signals, compliance with traffic control devices, risk taking behavior and situation awareness as well. In the current proposal, the effects of stimulants and hypnotics will be assessed both in driving simulators and on-the-road driving tests in order to cross-validate both experimental approaches. For more information on DRUID, see www.druid-project.de

Keywords: DRUID, Experimental, Driving parameters

Protocols for Road Side Surveys and Hospital Studies

Inger Marie Bernhoft*¹, Tove Hels¹, Terje Assum², René Mathijssen³, and Alain Verstraete⁴

¹Danish Transport Research Institute, Technical University of Denmark, Denmark

²Institute of Transport Economics, Norway

³SWOV Institute for Road Safety Research, The Netherlands

⁴Ghent University, Belgium

OBJECTIVES: Joint guidelines for road side surveys and hospital studies have been set up for the DRUID project (1). One of the purposes of DRUID is to calculate the prevalence of drink and/or drug driving in the general driving population (13 European countries), the prevalence of alcohol and drugs in drivers who have been seriously injured in a road accident (eight European countries), as well as the relative risk of being injured in a road accident while impaired (the same eight European countries).

METHODS: In road side surveys randomly selected vehicles are stopped by the police. The sample locations and hours must be systematically selected for the resulting samples to be representative of all drivers in a country, if necessary after weighting. The prevalence of drink and drug driving vary between week days and weekend days and between day time and night time. Thus, these periods should be sufficiently covered, with the highest compliance of the police with the planned activities. Drivers of passenger cars and small vans will be asked to deliver a sample. By systematic selection of sites and times and random sampling of vehicles e.g. age and gender of the drivers will be represented by their proportion in the driving population.

The same type of drivers as in the road side surveys will be included in the hospital studies, originating from road accidents on public roads from the same areas as for road side surveys. This will enable us to calculate the relative risk of drink and drug driving. Injured drivers will only be included if the hospital is the primary admission. It is recommended to select the drivers for inclusion if the severity of injuries results in maximal abbreviated injury score (MAIS) 2 or higher, however deviations may occur in some of the countries.

Drink and drug driving will be based on confirmation analysis of samples from all included drivers, either saliva or whole blood in the road side surveys, depending on the possibilities in each country, and whole blood in all hospital studies, collected less than three hours after the accident. The same 23 substances, including alcohol, will be analysed for in both road side surveys and hospital studies. The following core data will be collected for each driver. For road side surveys: Age, gender, time, date, vehicle type, professional use of car, road type and sample analysis result. Especially in countries where only saliva is collected, it is recommended to record self-reported drug use and time of use, in order to compensate for negative analyses in case of a positive self-report. For hospital studies: Age, gender, time, date, vehicle type, professional use of car, single or multi vehicle accident, severity of injury (preferably MAIS), medication, fluids, alcohol and drugs taken or administered between accident and sample taking and sample analysis result.

EXPECTED RESULTS: The prevalence of drink and/or drug driving in the general driving population will be calculated in 13 European countries. The prevalence of alcohol and drugs in drivers who have been seriously injured in a road accident will be calculated in eight European countries, as well as the relative risk of being injured in a road accident while impaired.

Keywords: Design, Drink and drug driving, Prevalence

(1) This abstract refers to Work Package 2, *Epidemiology of DRUID - Driving under the influence of Drugs, Alcohol and Medicines*, duration 15 October 2006-14 October 2010, see www.druid-project.de

Selection of an Oral Fluid Collection Device for EU-project DRUID

Anna Pehrsson*, Charlotta Engblom, Kaarina Langel, Teemu Gunnar, Kari Ariniemi, and Pirjo Lillsunde
National Public Health Institute, Drug Research Unit, Helsinki, Finland

The suitability of different oral fluid (OF) collection devices for EU-project DRUID (Driving Under the Influence of Drugs, Alcohol and Medicines) was tested. The investigated devices were Greiner Bio-One, Orasure Intercept®, Immunalysis Quantisal™, Statsure Saliva Sampler™, Cozart®, Sarstedt Salivette®, Malvern Medical OraCol, Acro Biotech Salicule, Varian OraTube™ and an ordinary plastic tube (Sarstedt). Volume of collected oral fluid, collection time, drug recovery from the devices and stability of the drugs in the collectors in storage were tested.

1 ml of OF spiked with different drugs (amphetamine, MDMA, cocaine, Δ^9 -THC, morphine, codeine, diazepam and alprazolam, all 1000 ng/mL in OF) was added to each device and stored according to the instructions of the manufacturer. The calibration standards and samples were extracted with ethyl acetate at pH 10. The solvent was separated and evaporated. The residue was derivatised with ACN-MSTFA and analysed with GC-MS.

All devices collected over 1 mL of OF, except for Orasure Intercept (mean volume 0.86 mL). As a result, the devices were divided into three classes (Table 1).

Table 1. The results of the study.

Parameter	Best	In between	Worst
Collection time	Quantisal	Oratube	rest
Best: < 2 min	Statsure	Intercept	
In between 2 - 4 min	OraCol	Tube	
Worst > 4 min	Salivette		
Recovery	Statsure	Quantisal	rest
Best: > 80%		Intercept	
In between: THC < 80%		Greiner	
Worst: THC and other(s) < 80%		Salicule	
		Tube	
Stability (28 days storage at -20°C)	Cozart (alprazolam failed)	rest	Quantisal
Best: < 15% units decrease			Greiner
In between 15 - 29% units decrease			
Worst: > 30% units decrease			

The results of the study emphasize the impact of the selection of the OF collection device on the whole toxicological procedure. Considerable differences in the overall reliability of OF collection devices were noted. For the DRUID project, Statsure was selected for the OF collection device. However, the plastic tube was also regarded as an acceptable choice for collection.

Keywords: Oral fluid collection, Drugs of abuse, Sampling devices

Drug-Related Crash Risk Calculation in the DRUID Project

Sjoerd Houwing and René Mathijssen*

SWOV Institute for Road Safety Research, PO Box 1090, 2260 BB Leidschendam, The Netherlands

A main objective of the EU research project DRUID (Driving Under the Influence of Drugs, alcohol and medicines) is to assess relative risks associated with the use of a number of legal and illegal psychoactive substances by motorists. These risks will be calculated in eight European countries based on a case-control design of the studies. Cases consist of drivers admitted to hospitals' Emergency Departments who have a MAIS (Maximum Abbreviated Injury Scale) score of 2 or higher. The use of this inclusion criterion guarantees a homogeneous group of cases in all participating countries. Controls consist of a representative sample of drivers from the hospitals' catchment areas. In order to obtain a representative control sample from each catchment area, a random sample of drivers will be drawn from moving traffic at a systematic sample of research locations and research times. This kind of epidemiological case-control study was previously used in EU research project IMMORTAL.

Relative risk factors of various psychoactive substances and combinations of substances will be calculated by computing Odds Ratios. In order to be able to adjust for confounding factors, statistical analysis will be performed by using a logistic regression model, which allows to include covariates like gender, age, road type, season, time of day, and day of the week.

With regard to the case-control study, two major sources of potential bias have to be considered. The first one results from the fact that, in most countries, cases will be blood-tested while controls will be saliva-tested. Drug concentrations found in saliva (or oral fluid), however, cannot be converted into blood concentrations by using a fixed factor. Furthermore, with respect to some frequently used drugs like benzodiazepines and cannabis, saliva analysis is less sensitive than blood analysis. In order to get a better insight into the different outcomes of both methods of analysis, some countries will try to obtain an additional blood sample from drivers who are suspected of being positive for one or more of the drugs under scrutiny. Suspicion can be based on subjects' self-reported drug use, including time of consumption, and/or clinical signs of impairment displayed by them. Another important source of potential bias may be subjects' refusal to be tested. This problem, too, can at least partially be overcome by recording their self-reported drug use and signs of impairment.

The method of the DRUID case-control studies and the associated methodological problems, advantages and disadvantages are discussed, e.g. in comparison with the more classic case-control study method introduced by Borkenstein and still used in the USA, and with case-crossover studies also known as culpability studies.

Keywords: Driver, Drug, Risk

An Attempt to Integrate Data from Different Methodological Approaches to Estimate Traffic Risk for Substances - Some Theoretical Considerations

Volker Hargutt* and Hans-Peter Krueger
Center for Traffic Sciences at the University of Wuerzburg, Germany

DRUID is an integrated project with 36 institutes from 18 European countries doing research on the problem of drugs, alcohol and medicaments in traffic. One of the major objects is to make further proceedings in defining thresholds for drugs and medicaments. Therefore a large number of different studies using different methodological approaches are necessary. Within DRUID the empirical basis to define thresholds is established by three different methodologies.

Epidemiological research is done by several countries in order to obtain information about prevalence rates and risks. Experimental studies are conducted by the partners focusing on the effects of different psychoactive substances on different groups of subjects (including patients) in driving tasks. Different meta-analyses are carried out in order to summarize the effects of drugs, alcohol and medicaments on various aspects of performance in a structured way, which are reported in experimental research literature.

Within the epidemiological approach, roadside studies will provide information about the frequency of driving under the influence, case-control studies will provide information about the risk of having an accident or of being injured under the influence, whereas culpability studies will provide information about the risk of causing an accident. If sufficient information is provided, dose-dependent risks for events of different severity can be calculated (accident, injury, fatality). Experimental studies conducted in driving simulations or at a test track usually do not give information about traffic risks but about the change of the distributions of different driving parameters or errors in different experimental groups. In order to compare experimental results with epidemiological risk information, these distributions of driving parameters have to be transferred to risk measures. One possible procedure will be introduced as an attempt to integrate these both data types. Regarding meta-analytic data some kind of risk estimations can be done by using the vote-counting method. If sufficient publications exist for one substance group significant results of performance impairment can be treated as a probability of a drop-out regarding performance at a certain substance concentration.

Risks originating from the estimations based on these different methodologies will probably not be at the same level, which means that the risk of having an accident in the experimental setting of a driving simulation will be different from the risk of having an accident calculated from case-control studies. Relating e.g. the risk for an alcohol accident based on experimental research to the risk calculated from epidemiological research may lead to appropriate weighting factors to transfer results from one methodological approach to the other. These weighting factors may also be applied for drugs and medicaments to transfer "experimental" risks to "epidemiological" risks. Methodological considerations regarding the integration of these different approaches and data types will be presented.

Keywords: Data integration, Risk thresholds, Methodology

This abstract refers to Work Package 1, Methodology, of the project DRUID - Driving under the influence of Drugs, Alcohol and Medicines, duration 15 October 2006-14 October 2010, see www.druid-project.eu

Analytical Versus Risk Thresholds for Psychoactive Substances - Synopsis of the DRUID Results

Anja Knoche* and Kerstin Auerbach
Federal Highway Research Institute, Bergisch Gladbach, Germany

Within the Integrated Project DRUID different methodologies (for example epidemiological, experimental research) will be applied using a wide variety of observational parameters, for example experimental variables measuring performance and activation state, accident data based on case control studies or from medical records, experimental on-road data under varying conditions. In order to combine the results from all different studies conducted in DRUID, a theoretical framework and an integration methodology will be established using the results of alcohol research as reference base.

Beside the conduction of experimental research the relevant literature about the effects of those substances on human performance and driving behaviour will be evaluated for their impact on traffic safety. This meta-analysis is weighted for methodological standards of studies and for a quantitative estimation of driving related skill-parameters (for example attention, reaction time, lane keeping). The results of the meta-analysis will be included in the threshold calculation for psychoactive substances together with the outcome of the experimental and epidemiological research.

A total of 15 experimental studies will be designed to assess the effects of drugs, alcohol and medicines on driving performance under experimental, placebo-controlled conditions. Driving performance will be assessed using psychomotor and cognitive tests measuring skills related to driving, driving simulators and on-road driving tests. The studies will include drugs and medicines that have been frequently implied in epidemiological research to potentially increase crash risk; as well as "novel" or "recent" drugs which are supposed to affect driving performance but where not enough knowledge exists. The studies will be conducted with the psychoactive substances alone and in combination. To preserve as much as possible the driver's mobility under medical treatment the experimental studies will compare the driver fitness of ill persons which have to take their medicines with and without these medical treatments.

Based on the results of epidemiological research, odds ratios regarding the accident risk for various drugs and medicines can be computed for different substance concentrations and thus contribute to setting concentration thresholds.

Taking into account the consumption-driving patterns of substance users, the prevalence of substances among road users in general traffic and in accident causation, the experimental studies results and the results of relative risk calculation from epidemiological studies will be integrated in the established theoretical framework. Recommendations for thresholds for the substances under investigation as a proper indicator of impaired driving comparable to the promille thresholds for alcohol (alcohol per se limits) will be formulated according to the results.

The last step in this work package will be a synopsis of the different results and the knowledge which was collected and summarised in this IP concerning the recommendation for further regulations. This synopsis also implies a comparison of the results with respect to the different legal conditions in the European Member States. This includes the prevalence of substances as well as the adequacy of recommended thresholds.

Keywords: Psychoactive substances, Risk thresholds, Analytical thresholds

This abstract refers to the project DRUID - Driving under the influence of Drugs, Alcohol and Medicines, Sixth Framework Programme, contract No TREN-05-FP6TR-S07.61320-518404-DRUID, see <http://www.druid-project.eu>.

Analytical Evaluation of a New Oral Fluid Sample Drugs of Abuse Diagnostic System

Andreas Manns^{*1}, Björn Lange¹, Ingo Kaneblei¹, Alexander Slomian¹, Stefan Steinmeyer¹, Rainer Polzius², Jessika Mahn², and Arthur Reiter³

¹Dräger Safety AG and Co KgaA

²Drägerwerk AG

³Inst. Legal Medicine, University of Schleswig-Holstein; Lübeck, Germany

AIMS: For on-site testing, e.g. roadside testing, the desire to perform a drug test has been hampered by the inability to collect an adequate test specimen. As a potential alternative to urine screening, oral fluids can be tested to reveal the presence of pharmacologically active drugs in an individual at the time of testing. Significant correlation has been found between oral fluid concentrations of drugs of abuse and behavioral and physiological effects. Results indicated that oral fluid screening can provide valuable diagnostic information in various situations, including testing at the roadside. This publication describes the development of the new Dräger DrugTest[®] 5000 System.

METHODS: The point of collection testing system (POCT) comprises a rapid on-site immunoassay (IA), intended for use with an opto-electronic analyzer for the qualitative detection of substance abuse such as cocaine metabolites, opiates, amphetamines, methamphetamine, benzodiazepines and, specifically, Δ 9THC in oral fluid samples. The test-kit combines a sampling system, immunochemical assays and a test-cassette as a "multitask- item", minimizing the user interaction and increasing the overall system performance. Parameters as sampling time and sample amount were evaluated by collecting 117 individual samples from patients in drug treatment centers. The POCT-assay sensitivity, specificity and accuracy were defined by analysis and evaluating up to 503 individual patients oral fluid specimens collected with the new device. The confirmation was performed by laboratory GCMS-analysis of parallel oral fluid samples from the same individuals; *Benzodiazepines verified by commercial ELISA test.

RESULTS AND CONCLUSIONS: This 1st evaluation showed a median sampling time of 64 sec and a median sample volume of 318 μ L Oral Fluid (CV: 16%). The following table summarizes the analytical performance compared to the GCMS-data:

Individuals screened	POCT - IA	Cutoff [ng/mL]	Sensitivity [%]	Specificity [%]	Accuracy [%]
503	COC	20	86	99	98
441	OPI	40	90	98	97
341	Δ 9THC	25	76	99	93
155	AMP	50	n.a.	99	99
155	METAMP	25	n.a.	99	99
194	*BENZO	15	74	98	97

The results achieved and exceed target values e.g. for collection precision, sampling time, assay sensitivity, specificity and accuracy, as set by state-of-the-art oral fluid DOA screening devices. The 74% sensitivity for BENZO is directly related to the broad spectrum of this drug consumed in the screened population; the cross-reactivity of the evaluated POCT-test and the commercial ELISA varied. There is no prevalence for AMP and METAMP in the screened population.

Keywords: Drug detection, Oral fluid, Analytical evaluation

Concern about Drinking and Driving and Drugs and Driving

Ward Vanlaar*, Robyn Robertson, Herb Simpson, and Dan Mayhew
Traffic Injury Research Foundation (TIRF), 171 Nepean Street, Suite 200, Ottawa, ON, K2P 0B4, Canada

CONTEXT: Concern about such issues as drinking and driving and drugs and driving may affect more people than the issue itself. Relevant questions in this context are whether the level of concern adds to, or detracts from the level of traffic safety; and, whether the level of concern can and should be controlled.

OBJECTIVE: This paper describes the results from a study on concern about a variety of road safety issues. Special attention is given to the findings regarding drinking and driving and drugs and driving.

METHODS: Data from two independent random samples were used. Both samples come from a telephone survey; one was administered to a random sample of 750 Ontario residents, the other to a random sample of 1,201 Canadians. Respondents were asked to indicate their level of concern about a variety of traffic safety issues using a six-point ordinal scale, as well as their perception of risk; prevalence; seriousness of consequences; and, other people's level of concern about each of the probed issues. Logistic regression analyses and multi-dimensional scaling (MDS) were used to analyze the data.

RESULTS: Using both samples MDS produced two perceptual maps that showed a very high degree of similarity; both maps can be considered almost exact copies of one another, illustrating the robustness and stability of the MDS solution. According to this solution the level of concern about traffic safety issues can be explained as a function of risk perception and perception of others' level of concern. Other dimensions such as prevalence perception and perception of severity of consequences were less useful to explain concern. With regard to drinking and driving and drugs and driving this means that, generally speaking, people seem to be so concerned about it because they believe it is very risky and because they believe others are concerned about it as well.

CONCLUSIONS: Level of concern about a variety of traffic safety issues can be explained by several relevant dimensions. These dimensions according to the results in this research are risk perception and perception of other people's level of concern. Prevalence perception, which was found to be relevant in previous research, and perception of severity of consequences were found not to be relevant. Relationships between these dimensions should be further investigated and can serve as a looking glass on the public's level of concern and reasons for concern. As such, this may serve as a tool to establish evidence-based practices.

Keywords: Drinking and driving, Drugs and driving, Concern

Screening for Drugs in Oral Fluid: Illicit Drug Use and Drug Driving in a Sample of Queensland Motorists

Jeremy Davey* and James Freeman

Centre for Accident Research and Road Safety - Queensland (CARRS-Q), Queensland University of Technology (QUT), Carseldine Campus, Beams Rd, Carseldine, 4034, Australia

OBJECTIVE: Police Services in a number of Australian states and overseas jurisdictions have begun to implement or consider random road-side drug testing of drivers. This paper outlines research conducted to provide an estimate of the extent of drug driving in a sample of Queensland drivers in regional, rural and metropolitan areas.

DESIGN AND METHODS: Oral fluid samples were collected from 2,657 Queensland motorists who volunteered to participate in the study after proceeding from a Random Breath Test site (RBT). Illicit substances were screened using the Cozart® RapiScan oral fluid drug test device and included cannabis (Δ^9 -tetrahydrocannabinol [THC]), amphetamine type substances, heroin and cocaine. Drivers also completed a self-report questionnaire regarding their drug-related driving behaviour.

RESULTS: Overall, 3% of the sample ($n = 80$) screened positive for at least one illicit substance, although multiple drugs were identified in a sample of 29 respondents. The most common drugs detected in oral fluid were methamphetamine ($n = 43$), cannabis (delta 9 THC) ($n = 36$) followed by amphetamine ($n = 26$). A key finding was that cannabis was confirmed as the most common self-reported drug combined with driving and that individuals who tested positive to any drug through oral fluid analysis were also more likely to report the highest frequency of drug driving. Furthermore, a comparison between drug vs drink driving detection rates for the study revealed a higher detection rate for drug driving (3%) vs drink driving (0.8%).

CONCLUSIONS: This research provides evidence that drug driving is relatively prevalent on Queensland roads, and may in fact be more common than drink driving. The paper will further outline the study findings and present possible directions for future drug driving research.

Keywords: Drug driving, Oral fluid, Roadside drug screening

Roadside Detection of Drugs in Drivers

Olaf H. Drummer*, D. Gerostamoulos, K. Crump, C. Wort, and M. Chu
Forensic and Scientific Services, Victorian Institute of Forensic Medicine, Department of Forensic
Medicine, Monash University, 57-83 Kavanagh Street, Southbank 3006, Australia

Roadside detection of drugs has been conducted in Victoria since late 2004. The drugs targeted have been cannabis (THC), methamphetamine (MA) and more recently methylenedioxymethamphetamine (MDMA). The procedure has been published previously [Drummer et al, 2007]. A preliminary test for drugs was conducted on randomly selected drivers stopped at a road block using the DrugWipe II® (Securetec) from a tongue wipe while the driver was still in the vehicle. The presence of a clear positive band for either THC or methamphetamines, or both, resulted in a second test conducted in a specially designed "Drug Bus" using a specimen of oral fluid (OF) collected by the Cozart Collector. An aliquot of oral fluid collected was tested on the Rapiscan®. The methamphetamines test strip has cross-reactivity to MA and MDMA. Oral fluid on presumptive positive cases was sent to the laboratory for confirmation using GC-MS with limits of quantification of 5, 5 and 2 ng/mL for MA, MDMA and THC, respectively. In cases where oral fluid could not be taken blood was collected and analyzed by similar methods.

There have been almost 30,000 road-side drug tests performed in 2 years of the program. There were 507 oral fluid specimens submitted for confirmation and these gave 414, 228 and 140 cases positive to MA, MDMA and THC, respectively. The median oral fluid concentrations (undiluted) of MA, MDMA and THC were 1194, 2733 and 64 ng/mL. The drug positive rate (to both drug types) has remained largely unchanged since the program started at a little over 2% of screened drivers which was over twice the random breath alcohol rate (legal limit $\leq 0.05\%$).

There were two false oral fluid positives to cannabis when the results of both on-site devices were considered and ten to methamphetamines, or a false positive rate of 0.04% per screened drivers. However, the false positive rate of the Rapiscan device used alone was 8-fold higher at 0.32% (14 cases for methamphetamines and 85 cases for THC).

There were 70 blood samples submitted. These produced positive drug results in all but one case. Median concentrations for MA, MDMA and THC were 106, 280 and 6 ng/mL, respectively.

The OF false negative rate could not be evaluated since oral fluid is not obtained from screened negative drivers. However, the lowest concentrations of MA and MDMA when only one of these methamphetamines was present and the Rapiscan gave a presumed positive result, was 57 and 66 ng/mL, respectively. The lowest concentration THC in OF was 11 ng/mL from a median of 108 ng/mL.

This reinforces the value of using two devices in series in a roadside setting rather than one device alone to achieve a low false positive rate. The data also indicates the high prevalence of methamphetamines and cannabis in persons driving motor vehicles and indicate the continued need to modify driver attitudes to impairing substance use.

Keywords: Drugs, Drivers, On-site testing

Drummer, O. H., Gerostamoulos, D., Chu, M., P., S., Boorman, M., Cairns, I., Drugs in oral fluid in randomly selected drivers. Forensic Sci Int. (in press).

Mandatory Random Roadside Drug Testing of Truck Drivers, Nightclub Patrons and the General Driving Population in Victoria, Australia

Narelle Haworth*¹ and Michael Lenné²

¹Queensland University of Technology, Brisbane, Queensland, Australia

²Monash University, Melbourne, Victoria, Australia

In December 2003, the Parliament of Victoria passed the Road Safety (Drug Driving) Act 2003 to provide for random drug testing of drivers and to create new offences for failing a drug test. The Act made it illegal to drive with any concentration of methamphetamine or Δ^9 -tetrahydrocannabinol present in the blood or oral fluid. Testing commenced on 13 December 2004, with three target drug user groups: truck drivers, nightclub or 'rave party' attendees, and the general driving population. This paper presents the results collected during the first six months of the program as part of a process evaluation conducted to allow reporting to Government before the sunset clause of the legislation expired.

The roadside procedure commenced with random breath testing for alcohol, followed by a preliminary oral fluid test. If positive, a second oral fluid test or blood test was taken. Confirmatory tests on positive roadside samples were conducted in the laboratory. For the evaluation, Victoria Police provided de-identified data on number, location, time and outcomes of random drug tests. Outcomes of the laboratory confirmatory analyses were provided by the Victorian Institute of Forensic Medicine.

Of the 6,657 preliminary oral fluid tests conducted in the first six months, 2.5% were positive to one or both drugs. Laboratory analyses found that 142 oral fluid and blood samples were positive for one or more drugs (2.1% of roadside tests). Drug prevalence was higher in the sessions targeting nightclub attendees (4.7%) than truck drivers (1.6%) or the general public (0.9%). MDMA (ecstasy) was detected in the laboratory analysis of 1.2% of drivers. Sessions targeting nightclub attendees also resulted in a higher prevalence of drivers exceeding the legal blood alcohol limit (0.05% BAC or 0.02% for novice and professional drivers). These drivers were not drug tested, which may have reduced the overall estimates of prevalence of drug driving. These results confirm the findings of previous studies that show nightclub attendees have a high prevalence of drug driving but conflict with other studies that would predict higher levels of methamphetamine among truck drivers.

Keywords: Drug testing, Law enforcement, Oral fluid testing

Saliva as a Possible Second Sample Matrix

Nancy L. Mobile* and Dr. Michael Wagner
New Hampshire State Police Forensic Lab, Toxicology Unit, Concord, NH, USA

Since 1985, the state of New Hampshire (NH) has captured breath samples for reanalysis by defendants in Driving Under the Influence of Alcohol cases. NH collects breath samples on silica gel using the Intoxilyzer 5000EN. Because breath capturing is a blind action and can be influenced by many unseen elements, we are looking for a better representation for second sample analysis.

Saliva is a matrix that is being used more and more to test for drugs as well as alcohol. It has been documented that saliva reflects blood and breath when direct samples of saliva were tested. For this initial phase we are using "Quantisaltm, saliva collection device with a volume adequacy indicator" to collect our saliva samples as well as analyzing breath samples on an Intoxilyzer 5000EN. The saliva collection device is a cottony paddle with a plastic handle containing a window which changes from white to blue when enough saliva is trapped in the cotton. There is a slice in the cotton just below the plastic handle. This slice is a focal point weakening the whole paddle structure and causing the paddle to completely separate from handle when wet.

27 samples of saliva and breath were collected from 4 subjects at a controlled drinking session over a 6 hour period. One male subject (#2) - age 41, weight 192 lbs, consumed 4 mixed drinks containing vodka, Kahlua and Bailey's. Three female subjects (#1, #3 and #4) - ages 28, 39 and 48, weight 155 lbs, 170 lbs and 125 lbs respectively. Subject #1 consumed 4 vodka drinks with various mixes. Subject #3 consumed 6 beers and #4 consumed 4 glasses of white wine.

All Intoxilyzer (breath) readings were collected prior to the saliva samples and were individually followed by a 0.10 g/210L external standard. The analysis protocol for the saliva samples is the same used for blood alcohol. Saliva samples were analyzed on a Perkin Elmer (PE) Clarus Gas Chromatograph with HS 40 headspace autosampler using PE BAC1 and BAC2 dual capillary column at isothermal conditions (40°C). N-propanol was used as an internal standard.

The mean peak breath value is 0.122 g/210L. The mean peak saliva value was 0.146 g/100mL. The saliva values tended to be about 20% higher than the breath values. Possible contributions to the variance are: saliva/breath partitioning and saliva sampling inconsistencies. For example, the separation of the paddle from the handle caused the indicator to appear too soon and short samples were obtained. The largest deviation between a breath sample and a saliva sample was 0.054.

Future studies will include a larger population of controlled drinking subjects as well as additional collection devices.

Keywords: Saliva, Quantisaltm, Second sample

Pilot Study for the US National Roadside Survey, 2007

John Lacey*¹, Tara Kelley-Baker¹, Debra Furr-Holden¹, Christine Moore², and Richard Compton³

¹Pacific Institute for Research and Evaluation, Calverton, MD, USA

²Immunalysis Corporation, Pomona, CA, USA

³National Highway Traffic Safety Administration, Washington, DC, USA

The preliminary fieldwork for the 2007 National Highway Traffic Safety Administration National Roadside Survey (NRS) was the NRS pilot program conducted in 2005 and 2006. This Pilot Study developed and tested techniques to enhance previous NRS Program methods and included the collection and analysis of oral fluid and blood samples from the nighttime weekend driving population. Breath and oral fluid samples were successfully collected from more than 600 drivers at 6 locations across the U.S. Blood samples were obtained from approximately half of those subjects. Laboratory analyses for alcohol and other drugs were conducted on both the oral fluid and blood samples. Procedures and results from this pilot work formed the basis of the plans for the upcoming 2007 survey.

This pilot program demonstrated a possible relationship between impaired nighttime weekend driving, AUD status, and drug use. The drug results from the 2005 Pilot Study indicated 15% of the nighttime weekend driving population tested positive for drug use and 9.4% tested positive for alcohol based on blood and oral fluid testing. Summarized, 22.7% of all drivers were positive for drugs and/or alcohol. This preliminary evidence based on a relatively small sample size forms the basis for the proposed effort that seeks to expand the scope of work carried out in the pilot, to include augmentation of the upcoming 2007 NRS. This large-scale study offers the unique opportunity to measure the prevalence of ATOD use using multiple methods. Data collection for the upcoming NRS is scheduled to begin in July 2007 and will culminate in the collection of data from at least 100 weekend nighttime drivers at 60 sites nationwide (n=6,000 nighttime drivers) and 1,500 daytime drivers. This presentation will highlight the salient features of the data collection methodology and discuss the preliminary drug and alcohol results from the pilot study.

Keywords: Roadside survey, Oral fluid, Drug impairment

Plans for the US National Roadside Survey, 2007

Richard Compton*¹ and John Lacey²

¹National Highway Traffic Safety Administration, Washington, DC, USA

²Pacific Institute for Research and Evaluation, Calverton, MD, USA

In the summer and fall of 2007, a US national effort will be mounted to survey over 6,000 weekend nighttime and 1500 daytime motorists in the U.S. to determine the prevalence of alcohol and drug use by drivers and the proportion of this population that can be identified as having alcohol use disorders and drug use disorders. This is the fourth in the series of National Roadside Surveys that have been conducted every decade since 1973. However, this is the first to take advantage of the emerging technology of oral fluid analysis to collect information on drug use by drivers and it will be the first to conduct interviews to identify drivers with DSM IV alcohol and drug use disorders. Thus, this will be the first time that a full picture of AOD use and resulting problems will be available for vehicle operators on the road during high risk weekend periods. This talk will describe the plans for the survey, which will for the first time include a sample of daytime drivers to clarify drug and alcohol impaired driving in this population. The project is funded and sponsored by the National Highway Traffic Safety Administration with the assistance of the National Institute on Alcohol Abuse and Alcoholism, the National Institute on Drug Abuse and the National Institute of Justice.

Based on the data to be collected we will for the first time be able to extensively relate measured BACs and drug assays of and both oral fluid and blood of drivers with their self-reported drug use and their reported lifetime and recent alcohol and drug consumption levels and drinking and drug problems. The survey will shed considerable light on the extent to which DSM IV dependence and abuse indicators are associated with driving, measured blood alcohol concentration and measured blood drug concentration.

Keywords: Roadside survey, Oral fluid, Drug impairment

Adolescent Marijuana- and Alcohol-Impaired Driving Behaviours

Amy J. Porath-Waller* and Peter A. Fried
Carleton University, Ottawa, ON, Canada

Marijuana- and alcohol-impaired driving behaviours were investigated among 307 Grade 9 to 12 students from predominantly rural areas of Eastern Ontario, Canada. Students were administered a questionnaire that asked about their past year marijuana and alcohol use, driving history, past year frequency of driving within an hour of using marijuana, drinking two or more drinks of alcohol, and using both substances, and how often in the previous 12 months they rode as a passenger with someone who drove under these same conditions. Similar rates of driving at least once within an hour of using marijuana (21%) and alcohol (20%) were observed among the 162 youth with a driver's license. Six percent of licensed drivers reported driving at least once within an hour of using both substances. Among licensed drivers, non- and infrequent users of marijuana and alcohol, respectively, drove less often within an hour of using each respective substance as compared to frequent users who smoke or drank more than once per month ($p < .01$). Non-users of marijuana also drove less often within an hour of using both substances than did frequent users ($p < .01$). Forty-six percent of the sample reported riding at least once as a passenger with someone who drove within an hour of drinking alcohol, whereas 40% reported doing so with a driver who drove within an hour of using marijuana. Nearly a quarter (24%) of the adolescents indicated that they had ridden at least once with someone who drove within an hour of consuming both drugs. A unique aspect of this work was the investigation of differences in rates of riding as a passenger with an impaired driver according to youth's frequency of marijuana and alcohol use. Results revealed that non- and infrequent users of marijuana reported riding less often with someone who drove within an hour of using marijuana as compared to frequent users ($p < .0001$). Non-users of marijuana also indicated that they rode less often with someone under the influence of both marijuana and alcohol than did frequent users ($p < .01$). Infrequent drinkers were found to ride less often with drivers who drove within an hour of drinking alcohol ($p < .01$), using marijuana ($p < .0001$), and both drugs ($p < .0001$) than were frequent drinkers. Overall, the findings from this study suggest that frequent users of marijuana and alcohol are not only more likely to drive while under the influence of these substances, but they are also more apt to ride as a passenger with someone who is under the influence. This work also extends previous inquiry on youth impaired driving by providing data on driving behaviours following the combined use of marijuana and alcohol. Implications for public policy and program development are discussed.

Keywords: Marijuana, Alcohol, Driving

Driving Under the Influence of Cannabis, Reckless Driving and Accident Involvement

Isabelle Richer*, M.Sc., and Jacques Bergeron, Ph.D.

Département de psychologie, Université de Montréal, C.P. 6128, succursale Centre-ville Montréal, QC, H3C 3J7, Canada

Cannabis use is an increasingly common phenomenon among youth; as such, the detrimental social consequences related to cannabis consumption deserve serious considerations. The incidence of driving under the influence of cannabis (DUIC) is exceedingly high among cannabis users. Studies investigating the impact of DUIC on traffic safety concluded, that in the acute period of intoxication, cannabis reduces specific driving faculties and increases responsibility for traffic crashes. However, individuals driving under the influence of cannabis seem to exhibit a general reckless driving style contributing to an over-estimation of collisions among DUIC drivers. The study's aim was to investigate the reckless driving habits of DUIC drivers by means of self-reports and observations in a driving simulator. DUIC was further associated with the probability of being involved in a collision while controlling for potential confounding variables (age, driving exposure, reckless driving and driving under the influence of alcohol). For intervention purposes, personality traits were studied in relation to DUIC.

Participants ($n = 85$) were men aged between 17 and 50 years of age (mean = 27.31) recruited by Internet advertisements. They completed self-report questionnaires including personality traits (Sensation seeking scale Zuckerman-V and NEO-PI-R), reckless driving habits (Dula Dangerous Driving Index), the number of on-road collisions over the previous three years, DUIC and driving under the influence of alcohol. Thereafter, participants completed a task consisting of a car pursuit in a dynamic driving simulator. Measures observed were collisions, mean and maximum speed.

In total, 30 participants were cannabis users 80% of whom reported at least one incidence of DUIC in the previous 12 months. DUIC was significantly associated with deliberate risky driving ($r = 0.32$) and negative emotion while driving ($r = 0.3$), but not with aggressive driving ($r = 0.1$). Hierarchical logistic regression analyses demonstrated that after controlling for age, exposure to driving (km/year), driving under the influence of alcohol and reckless driving, DUIC increased the probability (odds ratio: 3.24, confidence intervals: 1.02 - 10.3) of having been involved in an on-road collision. After controlling for age and driving exposure, multiple analyses of variance indicated that cannabis users ($M = 8.61$, $SD = 7.37$) have significantly ($p < 0.01$; $\eta^2 = 0.092$) more crashes in a driving pursuit task than do non-cannabis users ($M = 5.79$, $SD = 4.48$). Maximum speed in the driving simulator was higher for DUIC drivers; however, statistical analyses did not reveal a significant difference. Multiple regression analyses indicated that sensation seeking ($\beta = 0.49$) and impulsivity ($\beta = 0.26$) account for 30% of variance of DUIC.

The results suggest that DUIC is associated with a general reckless driving style. However, DUIC drivers do not seem to directly express their anger while driving. It seems that DUIC is associated with an increased probability to be involved in self-reported car accidents, even after controlling for confounding factors. These results were supported by the observations made in the driving simulator. Finally, DUIC is associated with specific personality traits (i.e. sensation seeking and impulsivity). Interventions strategies should be adapted accordingly.

Keywords: Driving under the Influence of cannabis, Reckless driving, Driving simulation

Simulator Test Bed for Testing Effects of Alcohol and MDMA on Driving Performance

J. L. Veldstra^{*1}, K. A. Brookhuis^{1,2}, and D. de Waard^{1,2}

¹Groningen University¹, Grote Kruisstraat 2/1, 9712TS Groningen, Netherlands

²Delft University of Technology

The number of accidents that can be attributed to psychoactive substances is constantly at a high level. Since drug- and medicine use is proportionally increasing over the years, special efforts have to be directed towards gaining better knowledge of the various aspects of this problem and developing appropriate solutions. The objective of the recently started EU-project DRUID (Driving under the Influence of Drugs, Alcohol and Medicines) is to give scientific support to the EU transport policy (White Paper) by establishing guidelines and measures to combat impaired driving. In the framework of DRUID, a series of experiments will be carried out in driving simulators, in various places to assess the effects of alcohol and Methylenedioxymethamphetamine (MDMA) on driving performance. In order to standardize the experiments across laboratories, a standard virtual world including relevant scenarios for testing effects of alcohol and MDMA is proposed.

Driving simulator:

Participants in the experiments will be required to complete test-rides in a (fixed-base) driving simulator consisting of a mock-up car with original controls linked to a dedicated graphics computer, registering driver behaviour while computing the road environment and dynamic traffic at high rate. Participants have a 180° view of the road environment. Other vehicles in the simulated world interact with the simulator car autonomously and behave according to hierarchically structured decision rules that are based on human driving behaviour. Four types of measures will be registered during the experiment: performance, physiology, self-reports, and control measures.

Performance measures:

Performance will be assessed by measuring speed or accuracy, reflecting skills at the operational and tactical levels. Speed of lead- and following during car-following are analysed on coherence, resulting in a measure of delay in response to speed changes. In addition lateral and longitudinal vehicle control, frequently used measures for vehicle handling, are analysed. Both measures have shown to be sensitive to medicinal drugs. Theories of drug use have proposed links with risk taking and impulsivity, particularly among polydrug users. To pre-empt the effects of risk taking on driver performance, gap acceptance will be assessed. Additionally, participants' response to a traffic light turning yellow will be assessed. Impulsivity will be pre-empted by assessing the reaction to critical events, for example an abruptly appearing car in a city driving scenario.

On the motorway, participants' reaction time will be measured in a situation in which traffic intensity will gradually increase until lead traffic has to brake to a standstill. This scenario arises a few times and can lead to crashes, i.e. the ultimate measure of unsafe driving.

Keywords: Alcohol, MDMA, Simulated driving

“Can a Positive THC Metabolite (THC-COOH) in Urine Be Used to Prove Impairment in a Driving Under the Influence (DUI) of Cannabis Case?”

J. Robert Zettl*, BS, MPA, DABFE

A 21-year-old male was stopped for speeding at 12 a.m. midnight on Interstate 70 in Colorado, USA at Floyd Hill, which has a very steep - 6% - grade. Arresting officer observed that the subject’s “speech was slow and thick tongued and that he had a brown-green coating on his tongue”. Due to some dental surgery the subject stated he had taken a Vicodin earlier in the day. His right hand was in a very heavy plaster cast and indeed he had had recent oral surgery. Subject voluntarily agreed to perform Standardized Field Sobriety Tests (SFSTs), and according to the arresting officer’s notes the subject “failed to perform them as a sober person would have” and arrested him for Driving Under the Influence.

During a search of the subject’s vehicle the officer found a partially opened 24 pack of beer with an opened can in the center console, and a glass pipe. A Drug Recognition Expert was not called to do any additional testing.

A single BREATH Alcohol test was conducted using an Intoxilyzer Model 5000EN at 1:26 a.m. with a result of 0.034%. A reading of 0.034% in Colorado is under the statutory limit for DUI. A URINE sample was then collected which screened positive for Cannabinoids (Detection Limit 25 ng/mL) and confirmed for Delta-9-THC-COOH (Detection Limit 5 ng/mL) with a Cannabinoids Semi-Quant of 84 ng/mL. The urine also screened positive for Opiates (Detection Limit) 300 ng/mL) - confirmed positive for Hydrocodone.

The subject and persons he spent the day with confirmed he had consumed a MINIMAL amount of beer prior to the stop but had not consumed any other drugs than the Vicodin within the prior 6 hours. The Vicodin was provided by his dentist for pain.

Question - Should a Toxicologist be allowed to give expert testimony that the drug and drug metabolite found in the subject’s urine substantiated that he was impaired to such a degree that he could not safely operate a motor vehicle?

From a Prosecution Perspective - the combination of the alcohol, failure to pass the SFSTs, speeding and drugs in his system from consumption some time prior to the event would be cause to conclude that his driving ability was affected to such a degree that he could not safely operate a motor vehicle. Urine drug concentrations can be used to infer that ones driving ability was affected.

From a Defense Perspective - Positive Urine Drug Concentrations only infer that a drug was ingested at some prior time (See DOT HS publication 809 642) and as such should never be used to attempt to show subject impairment at time of driving. Further the SFSTs were conducted on a 6% incline with cars whizzing very close by and with a heavy cast and other pain. From a purely toxicology standpoint is it generally accepted that drugs found in urine have no impairing affects on a person’s Central Nervous System or ability to safely operate a motor vehicle.

Note: Drug(s) in a person’s blood at or above a certain concentration can generally be used to show impairment.

Keywords: Marijuana, THC, Impairment

Using Responsibility Analysis to Evaluate Fatal Accident Risk for Drivers in Québec Who Used Drugs

Maxime Brault*

Highway Safety Research and Strategies, Société de l'assurance automobile du Québec, Québec (Québec) Canada

In studying how alcohol and drugs contribute to road accident risk, researchers are often confronted with a lack of exposure data for accidents. Case-control analysis is appropriate for evaluating accident risks based on exposure to various drugs. However, obtaining a biological sample that is comparable between the case group and the control group is a major problem. Other problems are precisely identifying the drugs used by an individual and evaluating the effects of various drugs on the ability to drive a vehicle.

Methods to analyze responsibility have been developed to circumvent these problems, but accident risk does not seem to be estimated correctly using these methods. The present study, carried out using a sample of driver deaths from 1999 through 2002, concludes that the estimated odds ratio corresponds to the risk of being responsible for an accident rather than to the accident risk itself. Responsibility was analyzed by both a panel of judges and by using an evaluation grid. There were some differences between the two methods used, but the estimated risks are almost the same for each method, although the odds ratios are generally slightly higher for the panel of judges, without being statistically significant.

Both analysis methods often come to the same conclusion as to the level of responsibility, that is, in 80% of the cases, but the grid method indicates a larger proportion of cases that only partially contributed. The panel of judges' method generally shows the same cases to be responsible. However, the proportion of cases judged to be responsible is very high regardless of the method used, which causes difficulties in estimating risk. Risk estimation is also difficult because of the large number of sub-groups of drugs.

Still, this methodology is a very interesting approach for analyzing road safety problems. Thus, in the present study, we note that the risk of being responsible for an accident increases for drivers in which alcohol, cannabis, benzodiazepines (tranquillizers and sleeping pills) and cocaine were detected. However, when cannabis and benzodiazepines were detected alone, the estimated odds ratios were not significantly different from nil.

The drug most frequently detected is alcohol, but cannabis, benzodiazepines and cocaine were also found in the deceased drivers. Using more than one drug seems to be very frequent in the population studied. Finally, and somewhat surprisingly, results from urine samples or blood samples are comparable.

Keywords: Responsibility analysis, Risk estimate, Biological samples comparison

A Short Series of Toluene Impaired Drivers

Brian Capron^{*1}, Ann Marie Gordon¹, and Barry K. Logan¹

¹Washington State Toxicology Laboratory, Forensic Laboratory Services Bureau, Washington State Patrol, 2203 Airport Way South, Seattle, WA 98134, USA

The abuse of volatile compounds is commonly referred to as “huffing”. Often the subject saturates a rag with solvent, places it over the mouth, or inhales or sprays the volatile substance directly into the mouth resulting in altered consciousness. Toluene is among the most frequently abused inhalants, found in solvents, paints and other products. Onset of symptoms occurs within seconds to minutes following inhalation and produces an intense euphoria followed by sedation and unconsciousness.

We report here a series of six toluene impaired drivers who were evaluated by Drug Recognition Evaluation (DRE) officers. Blood toluene concentrations were determined by headspace GC, with headspace GC-MS confirmation. The relative retention time (RRT) of toluene to the n-propanol internal standard of 3.77 and 2.84 on 2 different systems, (ethanol RRT is 0.61 and 0.57, respectively). In each case toluene was the only impairing substance identified. All six subjects were males and their ages ranged from 25 - 55 (mean 36 years) and had the blood toluene concentrations ranged from 12 - 45 mg/L (mean 24 mg/L). The half-life of toluene in blood is 13 - 68 hours. A 1979 study of toluene abusers described significant signs of intoxication in subjects with blood concentrations of 1 - 2.5 mg/L. Half of those with blood concentrations between 2.5 - 10 mg/L were hospitalized for marked intoxication.

Two of the subjects we encountered were contacted after motor vehicle crashes. Three were stopped for severe erratic driving, and one for failing to stop at a red light. In all cases, impairment was very obvious; subjects had slurred speech, red, bloodshot watery eyes, appeared severely intoxicated. Solvent abuse was suspected due to an obvious chemical odor. One subject had gold paint all over his face. All but one subject were candid as to their methods and frequency of abusing the inhalant. For those who performed the DRE evaluation, there were inconsistencies on performance. Subjects generally did poorly on the walk and turn test. One subject was unable to keep his head still long enough to complete the HGN test, however the remaining five subjects had six of six clues present. Four subjects attempted the convergence test and all exhibited a lack of convergence. The results on the remaining tests were not consistent, for example 4 of 6 subjects completed the Romberg Balance test and of these, 2 exhibited fast internal clock, while 2 were very slow. Similarly, there were inconsistent observations on heart rate, blood pressure, pupil size and muscle tone. All subjects admitted to huffing in the car, and made statements which indicated that it was their practice to do so while driving, because the effects wore off rapidly.

This group is older than the stereotypical young adult inhalant abuser. The blood concentrations of these cases were much higher than earlier reports. This is consistent with longer term inhalant abuse and several of these subjects did indicate they had been huffing for years. From the treatment literature inhalant dependent adults have the poorest prognosis for recovery.

Keywords: Impaired driving, Toluene, Inhalants

The Effect of Sleep Deprivation, and Acute *d*-amphetamine and *d*-methamphetamine Administration on Visual Field Function: An Event-Related Potential Study

Rodney J. Croft¹, Beata Silber^{1,2}, Melinda Jackson^{*1}, Katherine Papafotiou¹, and Con Stough¹
¹Drugs and Driving Research Unit, Brain Sciences Institute, Swinburne University of Technology, Victoria, Australia
²Institut des Sciences Cognitives, Cedex, France

INTRODUCTION: While the epidemiology literature highlights an association between road crashes and both amphetamine use and sleepiness, the mechanisms responsible for this association are yet to be determined. This uncertainty is particularly important in relation to amphetamines, where experimental cognitive research indicates that amphetamines generally have cognitive enhancing properties. A possible mechanism may relate to the effect that both amphetamine use and sleepiness have on peripheral visual field functioning. The present research examined the acute effects of low-level *d*-amphetamine and *d*-methamphetamine, as well as the effects of 27 hours sleep deprivation (SD), on aspects of visual field processing using a sensitive measure of brain functioning, event-related potentials (ERPs).

METHODS: Two, double-blind, placebo-controlled, counterbalanced cross-over studies were performed where twenty healthy participants attended two testing sessions separated by one week, and were administered i) placebo, and ii) 0.42 mg/Kg amphetamine (*d*-amphetamine in the first and *d*-methamphetamine in the second study). A third, counterbalanced, crossover design was performed where twenty healthy participants attended two testing sessions, separated by one week, where they either had a normal night sleep or 27 hours SD. In each session of each study, participants completed a simple visual discrimination task (in which the location of target and non-target stimuli was manipulated to activate central and peripheral visual field processing separately), while behavioural and ERP data were recorded.

RESULTS: Across the visual field, accuracy and reaction time measures were not affected by low-level *d*-amphetamine or *d*-methamphetamine, but they were impaired by 27 hours SD. ERP measures of early sensory (posterior P1/N1) and attentional processing (vertex N100, frontal N200) were not affected by either amphetamine or SD. ERP measures of later cognitive processing (P300) were not affected by amphetamine, but were reduced with SD. The above results were not related to visual field position.

CONCLUSIONS: This study suggests that low-level amphetamine does not affect simple sensory or cognitive processing, regardless of visual field position. Further research is required to determine whether these results are generalisable to the moderate to high levels typically encountered in impaired drivers. Conversely, SD impaired higher cognitive function and resultant performance measures, with no effect on early sensory or cognitive processing detected. These results were not related to visual field position, which suggests that the SD impairment seen in sleep deprived drivers is not due to a specific peripheral impairment, but may represent a more general impairment of higher cognitive processing.

Keywords: Amphetamines, Sleep deprivation, Driving, Visual field, ERP

Observations on Pupil Sizes of Drug Users and its Applicability to the Drug Evaluation and Classification Criterion

Melissa Kramer*

California State University, Los Angeles, CA, USA

In this study, optometric values from proprietary data were used to examine one of twelve factors that is examined during the DEC (Drug Evaluation and Classification), the pupil size of the suspect. While pupillary size has been established as a parameter that can be affected by drug usage, currently the training officers are taught that pupils are "normal" irrespective of the lighting condition. Further, the DRE (Drug Recognition Experts) are taught that pupils are "generally normal" with presence of certain drug classes such as PCP. This subjective blanketed description taught to officers is deceptive, as there are other factors such as age and iris color that may affect pupil size possibly skewing the now predicted pupil size. The purpose of this study to examine the following: (1) determine whether objective optometric values obtained from DRE can be a predictor of a specific drug classification, (2) determine the affects of poly-drug combinations on optometric values, and (3) examine age and iris color on the prediction of drug classification.

Six hundred and fifty six cases were examined from various police departments; however, much of the data could not be used due to discrepancies with the paperwork. Pupillary measurements and toxicology results from casework that could be used in the study were put into a statistical database, SPSS. ANOVA and chi-square analysis were performed on the single drug cases to reflect whether arrestees positive for a single drug pupil sizes were different from a negative population that was generated from the data. Further, to reflect if poly-drug users had a distinctive pupil size compared to the negative population ANOVA analysis was performed on combination drug arrestees.

The limited data used did corroborate with the predicted pupil size for THC, CNS depressant, narcotic analgesic, and PCP positive cases. However the data did not support the DEC predicted pupil size in CNS stimulant users, but this can be due to the limited amount of data and among other factors, such as toxicology issues, limiting this study. The data also did not allow a study on age or iris color due to the heavily biased data to ages under thirty and brown iris population. Certain drug combinations such as THC with PCP (called "sherm's"), CNS stimulant with narcotic analgesic (often called "speed balling"), CNS stimulant with depressant, and THC with CNS stimulant were also examined in this study. The statistical analysis indicated that drug combinations yield pupil sizes that are not distinct from single drug cases, thus polydrug combinations could be problematic for the DRE to predict.

It should be mentioned that DREs make their decisions based on the totality of the tests given as part of the DEC protocol. Pupil sizes or any one aspect of the DEC alone doesn't enable the officer to discern impairment or drug classification. However, by examining this study it can be inferred whether other sections of the DEC can be corroborated with objective values collected from the field.

Keywords: Drug, Pupil, DEC

Alcohol, Illicit and Medicinal Drugs Involved in Fatal Accidents in the North West of Spain

Marta Concheiro, Ana de Castro*, Óscar Quintela, Angelines Cruz, and Manuel López-Rivadulla
Forensic Toxicology Service, Institute of Legal Medicine, University of Santiago de Compostela, Spain

The results of epidemiological studies and statistics indicate that the trend of drug use and drug abuse is increasing among drivers in Spain. In our country male drivers up to the age 22 are more than twice as likely to be involved in automobile accidents compared to their percentage of the driving population. One of the major goals in traffic safety is, to prevent or reduce the risk of causing accidents, by this group of drivers. Use of alcohol and illegal drugs by young drivers are the most important additional causes of accidents. It will be interesting to observe the development of traffic safety among young male drivers relating it with rules and laws developed in different countries to punish the influence (Zero tolerance, value limits).

MATERIAL AND METHODS: In total 253 deceased drivers were undergoing a forensic autopsy. Femoral blood was sent to the Forensic Toxicology Service of the Institute of Legal Medicine for a determination of the blood-alcohol concentration (BAC). In order to study the epidemiology of illicit and medicinal drug use, we selected these samples to analyze the presence of the most relevant substances with standard methods in use at the laboratory. In order to analyze these samples for cannabinoids, opiates, cocaine, amphetamines, benzodiazepines and antidepressants, validated LC-MS/MS technique was used after solid phase extraction.

RESULTS: Of the samples analyzed between 2004 and 2006, 76% represented males and 24% females between 19 and 74 years. Cocaine, cannabis and amphetamines were, in this order, the illicit drugs most frequently detected. Among medicinal drugs, benzodiazepines were the medications most often used. Alcohol was found in 43%. Of the samples analyzed, 84% represented males and 16% females (23 - 64 years). The alcohol levels varied from 0.1 to 3.2 g/L. The detected levels of drugs were correlated with the degree of impairment. The frequencies for multidrug use were very high. The frequencies for combined use of drugs and alcohol were 89%. Only 3.4% of drivers with positive drug findings were women.

CONCLUSIONS: In more than a third of drivers deceased in traffic accidents in Spain, alcohol and/or drugs (illegal and legal) were found. Alcohol was the commonest finding. The data presented reveal that licit and illicit substances are regularly found in drivers or victims of road accidents in Spain.

Keywords: Drivers, Alcohol, Drugs

Use of Drugs of Abuse and Alcohol in Less than 30-year-old Drivers Killed in a Road Crash in France. Cannabis and Alcohol Shoulder to Shoulder

Patrick Mura*

Service de Toxicologie et Pharmacocinétique, Centre Hospitalier Universitaire, Poitiers, France

OBJECTIVE: On February 2003, a law passed in France that punishes driving under influence of drugs of abuse with a zero-tolerance limit together with a penalty of up to € 4500. The aim of this study was to determine the prevalence of cannabinoids, opiates, cocaine metabolites, amphetamines and alcohol in blood samples obtained from drivers killed in road accidents in France in 2005 and 2006.

METHODS: Sixteen French toxicology laboratories participated in the study. All these laboratories satisfy an annual external quality control program. In the protocol, we included blood samples provided by law enforcement officers, from less than 30-year-old drivers killed in a road accident. Drugs of abuse and ethanol were analysed by GC-MS and GC-FID, respectively.

RESULTS: 951 blood samples were included in this study. The results are listed below:

Compound (positivity threshold)	Number of determinations	Positive cases	Prevalence (%)
THC-COOH (> 2 ng/mL)	945	330	34.9
THC (> 0.5 ng/mL)	945	259	27.4
Morphine (> 20 ng/mL)	932	24	2.6
Amphetamines (> 20 ng/mL)	928	10	1.1
Benzoylecgonine (> 20 ng/mL)	932	24	2.6
Ethanol (> 0.1 g/L)	585	216	36.9
Ethanol (> 0.5 g/L)	585	184	31.4

The highest prevalences were observed for cannabis and alcohol. 34.9% of drivers had consumed cannabis as documented by the presence of THC-COOH in blood. 27.4% of drivers could be considered under influence of cannabis at the moment of the accident because THC, the most active of the principle constituents in marijuana, was detected in blood. Among drivers positive for cannabis, THC was detected as a single drug of abuse in 92.7%, associated with cocaine, amphetamines, opiates and alcohol in 5.0, 1.6, 1.4 and 26.5% respectively. In France the tolerance-limit for alcohol is 0.5 g/L in opposite to the zero-tolerance limit for drugs of abuse. Therefore, in our study, the highest prevalence of drivers committing an offence was observed for cannabis use.

CONCLUSIONS: A previous epidemiological study performed in France had reported a lower prevalence of cannabis use (8.8%) among drivers involved in a road crash. The reasons of such a difference may be because in our study we included only less than 30-year-old drivers and above all because our protocol study concerned only killed drivers, avoiding the problem of time delay between the moment of accident and blood sampling. Our results demonstrate that the efforts of information and roadside testing should be as important for drugs of abuse as for alcohol.

Keywords: Collision, Alcohol, Cannabis

Young Adult Driving After Using Drugs

C. Raymond Bingham*, Jean T. Shope, Trivellore E. Raghunathan, and Jian Zhu
University of Michigan, Ann Arbor, MI, USA

The objectives of this paper were to understand 1) the extent of self-reported drug-driving among a population of young adults, 2) the relationships of drug-driving to offense outcomes in traffic data, and 3) the characteristics of those who report drug-driving.

A longitudinal study of high-risk drinking and drink-driving surveyed by telephone the substance use, driving behaviors, and psychosocial characteristics of 5,464 young adults. The averaged age was 24 years, with 49% male and 86% white respondents. Respondents' state driving records were used to identify offenses during the 18 months before and after (three-year total) the telephone survey. Offenses were categorized as none or at least one, and logistic regression models were used to identify the characteristics of male and female drug-drivers.

Eighty-five percent of respondents drank and 51% drank and drove in the past year ($n = 2815$). Lifetime marijuana use was reported by 58%, past year use by 26%, and marijuana-driving by 13% ($n = 726$) of respondents, with an average frequency of 21 times. Use of other drugs (uppers, downers, tranquilizers, psychedelics, crack, heroin, and other drugs) was reported. Lifetime psychedelic use was highest (16%), and heroin use was lowest (3%). Similarly, 191 used psychedelics and 38 used heroin in the past year. Among respondents reporting other drug use ($n = 442$) in the past year, 200 (46%) reported drug-driving an average of 16 times. There was considerable overlap among drink-driving, marijuana-driving, and other drug-driving, with 116 reporting all three in the past year.

Individual characteristics were explored as predictors of drug-driving, including high-risk driving (HRD) (20-item scale), hostility (7-item scale), aggression (4-item scale), risk-taking (4-item scale), and tolerance of deviance (ToD) (10-item scale). Logistic regression models showed that more drink-driving, marijuana-driving, and drug-driving significantly predicted driving offenses for both sexes. When adjusted for psychosocial covariates, drink-driving was no longer significant for men and more HRD and hostility predicted offenses, while for women drink-driving remained significant and more HRD and hostility also predicted offenses. Marijuana-driving remained significant for men and women, and more HRD, hostility, and less ToD predicted offenses for men, while for women, more HRD predicted offenses. Drug-driving remained significant for men and women, and more HRD and hostility predicted offenses for both sexes. Further analyses will be reported.

In conclusion, it is apparent that a number of young adults drive after using drugs, and are more likely to have offenses than those who do not. Also, several psychosocial and behavioral measures predict drug-driving. This information could be useful in prevention and intervention programs.

Keywords: Drugs, Traffic offenses, Predictors

Fatal Traffic Accidents in Which No Alcohol is Detected: Are Drugs Related?

Rosario García-Repetto*, M^a Luisa Soria, M^a Paz Giménez, and Carmen Jurado
National Institute of Toxicology and Forensic Sciences, Department of Seville Avda. Dr. Fedriani s/n
41015 Seville, Spain

One of the issues that arises higher concern in our society is death due to road accidents, because of its high incidence in Spain. Driving under the influence of drugs that affect the central nervous system is one issue of concern in road safety. For many years, attention has primarily focused on alcohol and legal limits for blood alcohol concentration during driving have been established. However during the last years drugs other than alcohol have attracted increasing attention, due to a dramatic increase of use.

The objective of this study was to get an insight into the prevalence of medicinal and illegal drugs among car drivers, in which alcohol was not detected, killed in road accidents in Southern Spain over a 2-year period (2004-2005). During this period, the Department of Seville of the Spanish National Institute of Toxicology received a total of 952 blood samples from drivers dead in road accidents; in 491 of them no alcohol was detected. These cases are the aim of the present study.

Toxicological analyses were performed in all samples received following our laboratory normal procedures. Ethanol was analysed by means of headspace GC-FID. Screening of drugs of abuse was performed by means of homogeneous enzyme immunoassay CEDIA[®]. Then SPE (Bond-Elut, certified) was performed in all the samples and the extracts were analysed by gas chromatography with NPD, high performance liquid chromatography (HPLC-DAD) and gas chromatography-mass spectrometry (GC-MS). Although the majority of the 491 cases studied, tested also negative for the presence of drugs, 120 (24.44%) cases yielded positive results for illegal drugs and medicinal substances. The illegal drugs most frequently found were cannabis (THC) (n = 21), cocaine and its metabolites (n = 20). Among psychoactive drugs, benzodiazepines were the most common (n = 53). Other psychoactive drugs found were citalopram, venlafaxine, mirtazapine and zolpidem. It is interesting to point out that midazolam (n = 29) represented approximately one half of the cases positives for benzodiazepines.

The present study shows that a significant proportion of drivers dead in road accidents were under the influence of psychoactive drugs while they have not drunk alcohol. Therefore, it confirms the need of establishing the presence or not of psychoactive drugs in all specimens received from fatal traffic accidents in order to explain, if possible, their influence on the accident's causes.

Keywords: Ethanol non detected, Presence of drugs, Road accidents

Roadside Survey of Alcohol and Drugs in Norway - Data Collection and Analysis

T. Assum^{*1}, P. T. Normann², B. Pettersen², A. Christophersen², and J. Mørland²

¹Institute of Transport Economics - TØI, Oslo, Norway

²Norwegian Institute of Public Health, Oslo, Norway

BACKGROUND: The prevalence of alcohol among car drivers in Norway was surveyed in 1981-82, but the prevalence of other psycho-active substances among drivers was not known until a roadside survey was carried out in 2005-2006 by the Norwegian Institute of Public Health -FHI - in cooperation with the Institute of Transport Economics - TØI, and the Central Mobile Police Service - CMPS. The objective of this paper is to present the data collection and statistical analysis methods and problems of this roadside survey as well as some preliminary results.

METHODS: 10,000 drivers would be sufficient to achieve reasonably precise estimates of prevalence, but breaking down into subgroups would have required a much larger sample. A team from FHI collected saliva samples and asked a set of questions to a random sample of drivers on the highways in South-Eastern Norway from April 2005 through March 2006. 360 data collection sessions were planned, with a target number of drivers varying from 15 to 60 roughly in proportion to the traffic volume at each point of time and road section. All days of the week and all hours of the day were covered. The CMPS stopped the drivers, tested them for alcohol and asked them to participate anonymously in the study. In total 26 psycho-active substances, including alcohol, medical and illicit drugs were checked. The data will be weighted in proportion to traffic volumes in each road section, time of year, week and day.

DATA OBTAINED: 349 data collection sessions or 97% were carried out as planned. The number of drivers in most sessions was close to the target, but varied from 20% to 320% of the target. In total 12,194 drivers were asked to participate in the study. 1,359 drivers, 11.1%, refused to participate, i.e. 11,835 drivers or 88.9% gave their informed consent to participate. The non-response rate was varied from 2% to 16% between police districts and periods of the year.

RESULTS: About 5% (unweighted) of the drivers providing a specimen had at least one of the drugs in their saliva. This figure showed no correlation with the non-response rate. Prevalence estimates weighted for traffic volumes will be presented in the full paper.

CONCLUSIONS: The data collection plan and procedures worked as intended, and saliva samples from almost 11,000 drivers were obtained. The non-response rate of 11% is comparable to or lower than in most previous studies. In the planning of road-side surveys all issues that can influence the number of non-responses should be carefully considered to keep this rate as low as possible. Prevalence results will provide useful information for policy makers in road safety.

The study was financed by the Norwegian Directorate for Health and Social Affairs and the Norwegian Ministry of Transport and Communications

Keywords: Roadside survey, Psychoactive substances, Norway

After Two Years of *per se* Legislation in Switzerland: Prevalence of Drugs Among Drivers in Geneva

Olivier Plaut* and Christian Staub
Institut Universitaire de Médecine Légale, Genève, Switzerland

Switzerland has introduced in 2005 a so called "per se" traffic safety law with a zero tolerance for major illicit drugs (THC, cocaine, morphine, and amphetamines). This law states that "a driver is considered unable to drive each time it is proved that his blood contains" one of the above-mentioned substances. The Swiss Society of Legal Medicine has proposed cut-offs at 1.5 ng/mL for THC and 15 ng/mL for the other substances in whole blood, in order to have equity all over Switzerland. Although the previous law included enough rules to punish intoxicated drivers, this new regulation encouraged police forces to ask for more toxicological analyses. At the same time, the blood alcohol concentration limit has been reduced from 0.8 to 0.5 g/Kg. However, only cases above 0.8 g/Kg are considered as a major traffic offense.

In DUI cases urine is analyzed by immunological and chromatographic methods in order to assess the substances consumed by the driver. Identified substances are then quantitated in blood in order to determine if the driver was under the influence at the time he/she was driving. The analyses focus on drugs-of-abuse.

The total number of DUI cases analyzed by our Institute increased from 450 in 2003-2004 to 997 in 2005-2006. DUI cases included only drivers suspected to be under the influence of other drugs than alcohol. In those cases a urine sample is taken in addition to blood sample. The average age of drivers was stable at 34 ± 14 and blood alcohol concentration (BAC) remained exactly the same at 1.28 ± 0.61 g/Kg. During the first period (2003-2004), 55% of the drivers (62% during the second period) had BAC above 0.8 g/kg whereas 9% (5%) were between 0.5 and 0.8 g/kg. 69% (57%) of the drivers were positive for drug(s) other than alcohol. Cannabis was the most detected substance in urine with 53% (38%) of the cases being positive. Cocaine was present in 22% (17%), benzodiazepines in 14% (13%), opiates in 8% (12%), methadone in 7% (6%) and amphetamines in 2% (4%). Other detected substances included barbiturates, methaqualone, dextropropoxyphene, tricyclic antidepressants, and other psychoactive drugs.

Among the drivers positive for cannabis in urine, 69% were found positive also in blood during the first period (75% during the second period). For cocaine, 64% were positive (57%), for amphetamines 75% (50%), and for morphine 31% (49%). When drugs-of-abuse were positive, other drugs were not determined in blood. The total number of BAC determinations increased by 23% whereas the percentage of positive cases (82%) remained stable. Cases with low BAC (between 0.5 and 0.8 g/Kg) also remained stable, because the breathalyzer result is evidential if the driver accepts the value.

The comparison of the data obtained along those two periods, before and after the new law came into force, shows that the number of cases increased as the police could more easily prosecute intoxicated drivers and because their attention was focused on this issue. The higher number of cases did not provide more positive results. The reduction of the BAC limit did not provide more cases because the driver who accepts the breathalyzer result is not submitted to any blood sampling.

Keywords: Drugs and driving, Per se legislation, Toxicology

From Science and Statistics to Safer Roads

Anne Leonard*

Ontario Community Council on Impaired Driving (OCCID), Toronto, ON, Canada

OBJECTIVE: To build on the knowledge provided through research, science and statistics and translate that knowledge into safer roads. To create an environment within which impaired driving will not be tolerated. To change driver behavior and affect a reduction in impaired driving and the subsequent injury and death caused.

METHODS: Build a base of awareness of the consequences for impaired driving; these consequences would include harm to others, and real costs to individual drivers for the offence of impaired driving (licence suspension, costs, impoundment, ignition interlock). Increase the likelihood of apprehension and the perception of same - for all drivers and road users; encourage police services and government to allocate more resources to the summer months. Use the science of the positive (social norm marketing) to motivate drivers to do the right thing: call home, take a cab, stay overnight, or designate a driver. Incorporate research that shows "everyone knows you're not supposed to drink and drive" (Atkins and DeJong) and create messaging that addresses how to plan ahead and drive sober. Work with government, police, public health, business, community groups and victims to saturate communities with this information about the right way to get home.

RESULTS: In Ontario, the arrive alive DRIVE SOBER® campaign has been built on these fundamental components for almost 20 years by Ontario Community Council on Impaired Driving (OCCID). Our marketing committee oversees focus testing and reviews messaging and liaises with others when necessary to get the job done to the very best of our capacity. Targeting the summer months, OCCID has achieved remarkable reductions in the high numbers of fatalities that used to occur all through the summer months. One example is the month of July where we once (1988) saw 61 alcohol-involved fatalities whereas in 2003 the same statistic was down to 19; August for the same time period dropped from 51 to 15. These are great reductions especially when you adjust for the 40% increase in the number of drivers licensed in Ontario during the 16-year time span. With a changed social climate towards impaired driving, OCCID has been able to secure support from high profile contacts including NHL players and musicians to enhance our public awareness messages and incorporate the findings as laid out in the DeJong Atkins study. The campaign continues to grow and is in a position to expand to address evolving areas of concern link to off-road vehicle fatalities.

CONCLUSIONS: Working with a limited budget for materials and resources (\$100,000) OCCID has built the arrive alive DRIVE SOBER campaign to an amazing level and driver behavior has changed especially during the summer months. The campaign leverages just shy of \$2 million annually in donated airtime and boasts the involvement of almost 400 groups, police services, schools and businesses province-wide. In Ontario, driver behavior has changed and the attitudes towards impaired driving have changed. "Friends don't let friends drink and drive" in Ontario and even other road users and passers-by will take a stand to prevent impaired driving by intervening or reporting an impaired driver.

Keywords: Driver behavior, Prevention, Awareness

The Combined 'Zero Tolerance Law' and 'Impairment Law' for Drugs and Driving in Finland

Pirjo Lillsunde¹, Anna Pehrsoo, Charlotta Engblom¹, Teemu Gunnar¹, Sirpa Mykkänen¹ and Heikki Seppä²

¹National Public Health Institute, Drug Research Unit, Helsinki, Finland

²Helsinki Police, Helsinki, Finland

In February 2003, zero tolerance law for illicit drugs and driving was introduced into the drunken driving legislation in Finland. The amended law is applied to the scheduled drugs (Narcotic act 1289/93; Penal code 50). The scheduled drugs in Finland include the drugs that are listed in the UN conventions on narcotics and psychotropic substances.

The zero tolerance is applied if the controlled drugs or their (active) metabolites are found in blood. The zero tolerance law is not applied if the driver has a right to use the controlled substance, e.g. a benzodiazepine by prescription of a physician.

The impairment law stays still in the background in the legislation. A driver will be convicted for driving while intoxicated if the driving ability is impaired by the use of drugs. This applies to any substance, and a driver can be convicted for the intake of any drug (of medicinal drugs, too) if he/she is intoxicated to the extent that he/she may be dangerous to traffic safety (Penal code 23). The impairment has to be proven in court. Symptoms of drug use have to be shown by documentation of a policeman and/or by a clinical sobriety test also known as clinical performance test by a physician. The impairment has to be proven also when the driver is prosecuted for 'severe drunken driving' because of drugs. The driver can be convicted for severe drunken driving because of drugs if he/she is intoxicated to the extent that he/she may be severely dangerous to traffic safety. The statutory limit for drinking and driving in Finland is 0.50% (w/w). The limit for severe drunken driving is 1.2%. The corresponding breath alcohol control limits are 0.22 mg/L and 0.53 mg/L (Law on amending no. 23 of the penal code 655/1994).

Following the introduction of the 'zero tolerance law', the total number of samples in suspected drugs and driving cases increased 118% from 2002 to 2006. Increase in the positive findings of amphetamine was 255% at the national level during the same time. In the cases of illicit drugs and driving, the impairment in driving ability has not to be proven in the court anymore. Confirmation of the presence of illicit drug(s) in blood is enough for prosecuting for drugs and driving, because of drunken driving. After introducing the zero tolerance law the authorities have better means to prosecute an intoxicated driver. The police are satisfied with the zero tolerance law. Early intervention is meant to be beneficial for both the traffic safety as well as for the health and the future of the drug user.

Keywords: Zero tolerance, Driving impairment, Drug impairment