Under the Influence
Emerging Issues on Drug Impaired Driving

July 28, 2014
Felix J. E. Comeau
Drug Testing

Various approaches for detection

Blood
• qualified medical practitioner
• blood test kit
• little chance of subterfuge
• laboratory analysis
• primary and secondary drug components

Urine
• trained personnel
• urine collection kit
• significant chance of subterfuge
• laboratory analysis
• drug metabolites

Saliva
• trained personnel
• saliva test kit
• little chance of subterfuge
• immediate analysis
• parent compounds
Drug Testing

Incidence of Drug Use
A growing problem

• In 2008, 10.4% of night time drivers showed evidence of drug use while only 8.1% tested positive for alcohol (9.9 and 7.2, respectively in 2010) (CCSA)

• In 89% of the cases, the level of THC was above 5 ng/mL the impairment level from various scientific studies

• In 2008, 40.8% of fatally injured drivers tested positive for alcohol, whereas 36.7% tested positive for one or more psychoactive drugs

• Prevalence in order: CNS depressant, THC, CNS stimulant, narcotic

• Trends indicate stimulants are most prevalent with younger population while depressants are more often associated with increasing age

Detection limits

• Generally recognized limit of 5 ng/mL for THC in blood

• Not well defined for other drugs
Enforcement of Drug Impaired Driving

Drug Recognition Experts

• The 2008 Criminal Code amendments authorized the use of standardized field sobriety tests (SFST) and formal procedure for gathering evidence by drug recognition evaluation (DRE) experts.
• Studies indicate that DRE is good at classifying the drug, but not in establishing impairment, constituting only 1.4% of total impaired driving charges.
• A two hour process without statutory relevance.
• Cost of training > $17,000 per officer.

Per se laws

• Set limits associated with impairment of driving ability.
• No clear evidence for all drugs.
• Questions as to analytical methodology: blood, urine or saliva.
• Metabolite or parent compound.

Zero tolerance

• Clear and unambiguous, but perhaps convictions without impairment.
• Adopted by some US States, but may be considered an alternative action to drug use.
Drug Testing

Technology for Drug Testing in Humans

Blood
- Historic forensic medium to determine active drug concentration
- Requiring qualified toxicology laboratory
- Expensive process

Urine
- Often used post mortem
- Detecting drug metabolites with time based significance
- Requiring qualified toxicology laboratory
- Expensive process

Saliva
- Developed over the past 10 years to detect drugs in the body
- Confusion over parent compound or metabolites
- Development of significant antibodies for selective detection
- Refined analytical thresholds
- Ease of use by trained personnel
- Simplified analysis and quick results
Dräger DT 5000
- Desktop detection device with detection, reporting, data storage
- Collection kits for saliva
- Top rated

Securetec Drugwipe
- Disposable cassette
- Self contained collection, detection, reporting
- Second rated

Alere DDS2
- Handheld detection device with detection, reporting, data storage
- Collection kit for saliva
- Third rated
Drug Testing

Dräger DT 5000

- Robust transportable unit
- Well validated
- Automatic operation
- Ease of use
- Electronic readout
- Print out
- Seven (7) drug panel
  (THC, Amp, Meth, Coc, Benz, Opiates, Methadone)
Drug Testing

Securetec Drugwipe

- Robust disposable unit
- Lateral flow cassette
- Proven technology
- Manual test
- Ease of use
- Operator readout
- Optional print out device
- Five (5) or six (6) drug panel
  (THC, Amp, Meth, Coc, Benz, Opiates)
Drug Testing

Alere DDS2

- Robust portable unit
- New to market
- Automatic test
- Ease of use
- Electronic readout
- Print out
- Six (6) drug panel
  (THC, Amp, Meth, Coc, Benz, Opiates)
Drug Testing

Why Oral Fluid?

- Mixture of fluids from oral glands
- Plasma ultra-filtrate
- Drugs partition from blood by diffusion
- Timely sampling
- Ease of collection
- Gender neutral
- Field compatible
- Cost effective
Drug Testing

Sample Collection

Dräger DT 5000
• 400 µ/L of saliva
• Several minutes to collect

Alere
• 600 µ/L of saliva
• Several minutes to collect

Securetec Drugwipe
• 10 µ/L of saliva
• Simple swipe of tongue
Drug Testing

Cut Off Limits

THC (cannabis)
• 10 ng/mL in saliva
  • equivalent to 1 ng/mL in blood

Amphetamine
• 300 ng/mL in saliva

Cocaine
• 20 ng/mL in saliva

Benzodiazepine
• 200 ng/mL in saliva

Opiates
• 100 ng/mL in saliva
Cannabis, Driving and Collisions
July 28, 1014
Robert E. Mann
Centre for Addiction and Mental Health;
University of Toronto
CAMH Drugs and Driving Research Collaborators

- Bruna Brands, Bernard Le Foll, Gillian Sayer, Gina Stoduto, Christine Wickens, Rosely Flam-Zalcman, Reg Smart, Angela Paglia-Boak, Anca Ialomiteanu, Ed Adlaf, Jennifer Butters, Jürgen Rehm, Rita Thomas, Chloe Docherty, Tony George
- Academic partners include Evelyn Vingilis (UWO), Mark Asbridge (Dalhousie), Scott Macdonald (UVic)
Topics covered:

CAMH drugs and driving research focusing on:

- a) prevalence of driving after cannabis use in the student and adult populations;
- b) effects of cannabis use on collision risk, and
- c) effects of cannabis use on driving skills
Some terms:

- **DUIC** – driving under the influence of cannabis
- **DUIA** – driving under the influence of alcohol
- **OSDUHS** – Ontario Student Drug Use and Health Survey – CAMH survey of Ontario students in grades 7-12
- **CAMH Monitor** – CAMH survey of the Ontario adult population aged 18 and older
“We’ve been after that one for 15 years.”
Does cannabis increase collision risk?

- In comparison to effects of alcohol on collision risk, much less information is available!
- A main reason – the difficulties involved in conducting the research
• Marijuana safer than drink, says crash study, *The Advertiser* 6/8/95 p 6
• Smiley, 1998 – experienced cannabis users don’t seem to be at increased collision risk because they seem to be aware of and can compensate for the effects of cannabis

• Longo et al, 2000 – cannabis does not significantly increase collision risk
Impact of cannabis on injury collision risk in Australia: Longo et al, 2000

Table 5
Culpability of injured drivers and THC concentration: alone/in combination with other drugs

<table>
<thead>
<tr>
<th>THC concentration (ng/ml)</th>
<th>Percentage culpable</th>
<th>THC alone(^a)</th>
<th>THC in combination with other drugs(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug-free</td>
<td>52.8 ((n = 1887))</td>
<td>52.8 ((n = 1887))</td>
<td></td>
</tr>
<tr>
<td>1.0 or less</td>
<td>28.6 ((n = 7)) (0.36)</td>
<td>60.0 ((n = 5)) (1.3)</td>
<td></td>
</tr>
<tr>
<td>1.1–2.0</td>
<td>36.8 ((n = 19)) (0.52)</td>
<td>100.0 ((n = 8)) (–)</td>
<td></td>
</tr>
<tr>
<td>2.1 or more</td>
<td>66.7 ((n = 18)) (1.8)</td>
<td>100.0 ((n = 4)) (–)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Drivers judged contributory or drivers for whom culpability was unknown were excluded. Odds-ratios for the THC groups compared with the drug-free group are included in brackets.

\(^b\) Note that these drivers also had THC-acid detected.
Does cannabis increase collision risk?

- What we knew in 1999 (Bates and Blakey; Role of cannabis in motor vehicle crashes. Epidemiologic Reviews, 21, 222-232)
- “There is no evidence that consumption of cannabis alone increases the risk of culpability for traffic crash fatalities or injuries for which hospitalization occurs, and may reduce those risks”.
What users tell us....

• It makes me drive slower and more carefully, because I know my judgement is not as sharp.
• Made me more at ease, and paid more attention to my surroundings.
• More careful, paranoid. Worried more about driving erratically.
• I drive good!
The end of the story?
Quebec study: Dussault et al, 2002

- Examined drugs detected in the blood and urine of 482 Quebec drivers fatally injured between April 1999 and November 2001
- Drugs found: Cannabis, 19.5%; cocaine, 6.5%; benzodiazepines, 8.5%; opiates, 1.4%; amphetamines, 0.8%; barbiturates, 0.3%
- Alcohol was also found in 41.1% of all drug cases
CAMH Research on prevalence of driving after cannabis use

- Very little information available
- Most is from recent years
- Most deals with driving after cannabis use (driving under the influence of cannabis or DUIC)
Walsh and Mann, 1998

• Data from the CAMH Monitor survey - representative population survey of Ontario adults (aged 18 and over) in 1996/97
• 1.9% reported DUIC in the past 12 months
• DUIC was more common among younger respondents, males, and those never married
• DUIC among cannabis users was 22.8%
• DUIC and drinking-driving were also strongly related
Driving after alcohol and after cannabis use among students; Adlaf et al, 2003

- Examined DUIC among Ontario high school students (grades 10-13) in the Ontario Student Drug Use and Health Survey (OSDUHS)

- Among those with a drivers license, 15.0% reported driving after drinking at least once in the previous year

- Proportion reporting DUIC - 19.3%
Driving after drinking (DUIA) and driving after cannabis (DUIC) by age group, Ontario adults 2011

<table>
<thead>
<tr>
<th>Age Group</th>
<th>DUIA</th>
<th>DUIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29</td>
<td>5.6%</td>
<td>8.6%</td>
</tr>
<tr>
<td>30-39</td>
<td>5.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>40-49</td>
<td>7.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>50-64</td>
<td>6.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>65+</td>
<td>3.6%</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
CAMH studies of cannabis use and collision risk

- “Driving after cannabis use and collision risk in the Ontario adult population” (Mann et al, 2010)
- Examined the impact of self-reported DUIC use in the past year on self-reported collision involvement in the past year
- Sample included 6907 drivers between 2002 and 2007
- After controlling for demographic factors, cannabis use and drinking driving, DUIC was associated with significantly increased odds of collision involvement (OR = 1.84)
- Interestingly, the odds of collision involvement for DUIC was higher than the odds for collision involvement for drinking and driving (OR = 1.34)
What about cannabis and alcohol together? Sayer et al, 2014

- Alcohol and cannabis together are often found in injured and dead drivers
- Drug interactions could affect collision risk substantially
- We examined whether people who report DUIA and DUIC have higher collision risk than people who report DUIA or DUIC only, or no driving after substance use
Examined collision rates among 16,224 respondents to the CAMH Monitor adult survey between 2002 and 2010
- 91.0% reported no driving after drinking or after using cannabis
- 6.1% reported driving after drinking only
- 1.2% reported driving after cannabis use only
- 0.8% reported both driving after drinking and driving after cannabis use
Figure 1. Percentage of respondents involved in collisions by substance(s) used while driving (CAMH Monitor, 2002-2010)

Vertical bars represent 95% confidence intervals. Neither DUIA nor DUIC = No driving after alcohol and no driving after cannabis use; DUIA or DUIC = driving after reported use of cannabis or alcohol only; DUIA and DUIC = reported driving after alcohol and driving after cannabis use.
Can we control for factors that might influence collision risk?

- Several factors have been suggested to influence collision risk after cannabis use, such as risk taking propensities.
- Cook et al (submitted) examined factors that predict DUIA and DUIC among student drivers in the Ontario Student Drug Use and Health Survey.
• The OSDUHS included questions related to the risk taking attitudes of students, specifically they were asked
  ▪ If they prefer to have friends who are exciting and unpredictable
  ▪ If they like to explore strange places
  ▪ If they do frightening things

• Students were also asked about their risky driving behaviours, specifically street racing and joy riding
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Drinking and Driving Model</th>
<th>Cannabis and Driving Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>Age</td>
<td>1.19</td>
<td>1.15</td>
</tr>
<tr>
<td>Male</td>
<td>.94</td>
<td>1.33</td>
</tr>
<tr>
<td>G2 License</td>
<td>4.20***</td>
<td>6.98***</td>
</tr>
<tr>
<td>Risk Taking</td>
<td>1.18**</td>
<td>1.11</td>
</tr>
<tr>
<td>Street Racing</td>
<td>2.08*</td>
<td>.82</td>
</tr>
<tr>
<td>Joy Riding</td>
<td>3.44**</td>
<td>1.63</td>
</tr>
<tr>
<td>Hazardous Drinking</td>
<td>3.30***</td>
<td>1.78</td>
</tr>
<tr>
<td>Drug Use Problem</td>
<td>1.29</td>
<td>11.20***</td>
</tr>
<tr>
<td>Cannabis Dependency</td>
<td>1.70</td>
<td>8.62**</td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01, ***p<0.001
Case-crossover study of injured drivers:
Asbridge et al, 2014

• Case-crossover design is a variant of the case-control design that tries to answer the question: “Was this event triggered by something unusual that happened just before?” (Maclure & Mittleman, 2000)
• Cases serve as their own controls
• We conducted a case-crossover study of the effects of cannabis use on collision risk
• 860 injured drivers admitted to 3 major urban EDs – 2 in Toronto and 1 in Halifax
• Results

• Cannabis use alone – OR = 3.42 (95% CI – 1.79-6.50)

• Cannabis plus other drugs (alcohol, cocaine, benzodiazepines) – OR = 5.17 (95% CI – 2.79-9.59)
What else can we learn from this study?

- Can we be safer if we ride our bicycle rather than driving a car?
- Effects of cannabis on bicycle injury risk: OR = 2.38 (95% CI – 1.04-5.03; self-report plus blood) or OR = 9.0 (95% CI – 2.09-38.8; blood alone)
Meta-analyses are now confirming that cannabis increases collision risk

- Meta-analyses are reviews where results of several studies are statistically combined
- Li et al, 2012 and Asbridge et al, 2012 both conclude that cannabis use results in significant increase in collision risk
Important issues remain to be resolved, and we have initiated a line of research to study cannabis effects in the laboratory

Study Goals:
1. Assess acute and residual effects on driving performance 24 and 48 hours following a single dose of smoked cannabis
2. Examine acute effects of cannabis on simulated driving skills and related blood levels of THC and metabolites to pharmacodynamic outcomes
3. Explore the effects of driving history, driving attitudes, and individual factors (e.g., demographics, drug and alcohol use, etc.) on the acute and residual effects of cannabis
Double-blind, placebo-controlled, between-subjects design:

- 19 - 25 year old drivers, n = 114, males and females
- G2 or G licensed driver (12 months +)
- Occasional cannabis users (1 to 4x/week)
- Using cigarettes of 12.5% THC, or placebo
VIRAGE VS300M

Programmable scenarios (rain, night driving, unexpected events)

Surround sound, rear view and side mirrors

Measurement of lane deviation, headway, speed, etc
## Study procedures

<table>
<thead>
<tr>
<th>Time pre/post smoking</th>
<th>Day 0</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-24 hr</td>
<td>-30 min</td>
<td>5 min</td>
<td>15 min</td>
</tr>
<tr>
<td>Driving Trial</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>THC and metabolites in urine</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THC and metabolites in blood</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Vital Signs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>DSST</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLT-R</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRT</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARCI</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>POMS</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: X indicates the presence of the procedure at the specified time.
• Current status – about 30 subjects completed
• Currently analysing data from 5 pilot subjects
• Data collection will likely continue for another 12-18 months
• Future studies planned – cannabis and alcohol interaction effects, “tolerance” effects, dose response effects, other drugs (e.g., prescription opioids)
Next steps?
IF IT DOESN'T MAKE SENSE HERE, WHY DOES IT MAKE SENSE WHEN YOU DRIVE?

Visit [www.potanddriving.cpha.ca](http://www.potanddriving.cpha.ca) to find out more about driving high.
Next steps?

- We now have a much clearer idea of the effects of cannabis on driving risks
- We have had a chance to watch the evolution of science in this area over the past 15-20 years
- Important challenges remain for research and policy
Thank you!
Understanding a Complex Issue: Undertaking Research to Address Drug Impaired Driving in Ontario

July 28, 2014
Lloyd W. Robertson
Safety Policy & Education Branch, Ministry of Transportation
Drug impaired driving is becoming as significant a problem as alcohol impaired driving.

<table>
<thead>
<tr>
<th>Driver Condition</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol-impaired</td>
<td>117</td>
<td>83</td>
</tr>
<tr>
<td>Drug-impaired</td>
<td>3</td>
<td>57</td>
</tr>
<tr>
<td>(Increased drug testing of drivers killed began in February 2011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inattentive</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Medical/Mobility impairment</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>Fatigue</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

Drug impaired driving is different and more complex than drinking and driving:
- Many drugs have different effects on driving (dose/response)
- No roadside screening device or approved instrument as in case of alcohol
Percentage of Drug Impaired Drivers Killed by Driver Sex and Age Group, 2011 (N = 57)
VALIDATING ROADSIDE DRUG SCREENING DEVICES
Past Reviews

- **ROSITA (Roadside Testing Assessment), Europe, 2001**
  - Urine samples, several devices tested. Limited applicability.

- **ROSITA-2, 2006**
  - 9 oral fluid devices; none reliable enough to be recommended for roadside use

- **DRUID, Europe, 2009**
  - 8 oral fluid tests: better than ROSITA-2, but still not good enough

- **Since 2009: Growing body of research shows further improvements**
Goals

Short Term
Contributing to the growing literature on the efficacy of roadside screening devices to detect individuals impaired by drugs. Positioning provinces and territories to develop administrative sanctions.

Medium Term
Establishing an approved device manufacturing standard for roadside screening tools in Canada. Supporting the development of administrative sanctions.

Long Term
Providing a reliable and easy to use tool that can be used by enforcement at roadside.
Membership

- Established by Canadian Society of Forensic Science.
- Will lead data collection and analysis.
- Will develop standards and final report.

- Contributed $100k in funding
- Will provide support to project staff as needed

- Contributed $100k in funding
- Provided senior staff in-kind to work on project
Methodology

Phase 1
Field/Lab Work
Gather samples from U.S. inmates and volunteers (Spring and Fall 2014)
Test samples for specific drug types (2014-15)

Phase 2
Report Results
Sensitivity, specificity & reliability of devices
Expected March 2015

Phase 3
Develop Standards and Final Report
Guidance for Validating oral fluid devices in future
Expected October 2015
Timeline

March 2014
- MTO provided $100k to match funding from RCMP

March - Oct 2014
- Collect 600 samples from inmates and test 4000 lab samples

March 2015
- Report on Phase 1
- Focus group testing with law enforcement

Oct 2015
- Draft standards and final report
• Testing three devices:
  – Alere DDS2
  – Securetec DrugWipe 6S
  – Dräger DrugTest 5000

• Researchers are testing for the following: cannabis, cocaine, amphetamines, opiates, methamphetamines, and benzodiazepines.

• The project is targeting a sample size of 750 - 800 people.

• Even with logistical difficulties, timing is still on track
  – Researchers have collected about 20% of the required samples for validation.
Several projects (oral screening) on-going or completed in different states:

- **Gardena, CA** (published 2013)
- **Miami, FL** (accepted for publication) (DrugWipe and Dräger)
- **California – Office of Traffic Safety**: Fullerton, Sacramento, Bakersfield & Los Angeles (ongoing with Alere DDS 2 and Dräger)
- **Tulsa, OK** (ongoing with Alere DDS 2)

ROADSIDE ALCOHOL & DRUG SURVEY
Why a Survey

• Provides a clearer picture of the prevalence of drug impaired driving, including the most-used drugs among drivers and the characteristics, attitudes and behaviours of drug impaired drivers.

• Ontario last conducted a roadside survey in 1986 – more than 25 years ago and collected information about alcohol use only.
Roadside surveys have been conducted throughout North America:
- (1973) National Highway Traffic Safety Administration (NHTSA)
- (1986) Insurance Institute for Highway Safety (IIHS)
- (1996) NHTSA and IIHS
- (2005) Pilot study (NHTSA and NIAAA)
- (2010) British Colombia Roadside Survey
- (2010) California Survey
- (2012) British Columbia Roadside Survey
- (2012) California Survey
- (2013) U.S. National Roadside Survey (Blood and oral fluid)
- (2014) Ontario Roadside Survey (Oral fluid)

The purposes of the project are:

- To provide an objective and reliable estimate of the prevalence of alcohol and drugs used by Ontario drivers on the road at night;
- To determine the types of substances most commonly used by drivers - both licit and illicit;
- To determine the characteristics of drivers who test positive for alcohol and/or drugs;
- To provide a baseline for future comparisons and evaluation of countermeasures, including public education campaigns.
The Numbers

- The survey will be carried out in five municipalities at a total of 80 sites.
- It is expected that 2,500 interviews will be completed.

Selecting Drivers

- Vehicles are selected randomly from the traffic flow at pre-selected locations on Wednesday, Thursday, Friday, and Saturday nights.
- A police officer directs vehicles into the survey site as requested by the survey team.
- Interviewers make every effort to ensure that selected drivers understand that their participation is completely voluntarily.
The Interview

The interview process, administered by the survey team (not by police), consists of four parts:

- the introduction;
- the survey questions;
- a breath test; and
- the collection of an oral fluid sample.

A voluntary breath sample is collected to determine blood alcohol concentration (BAC) and a sample of oral fluid that will be sent to a laboratory for an analysis of drug content.

Drivers who agree to provide oral fluid will be given a $10 gas card.

Drivers found to have a BAC over 50 mg/dL or display obvious signs of alcohol and/or drug impairment will be provided with safe transportation home.
The survey took place in London on June 25, and Renfrew County on July 9. Further locations and times TBD.

A final report is expected by the end of December.