Tools & Technologies

What is the Drug-Impaired Driving Learning Centre (DIDLC)?

The Drug Impaired Driving Learning Centre (DIDLC) is a fully bilingual, web-based educational resource that was developed by the Traffic Injury Research Foundation, in partnership with Desjardins Insurance.

This comprehensive, accessible tool was created to inform the development of an evidence-based drug-impaired driving strategy. It was designed to meet the needs of a wide spectrum of diverse stakeholders who are seeking more information about priority issues.

The objective of the DIDLC is to support the work of governments and road safety partners by sharing current knowledge about research and practice, and increasing awareness about drug-impaired driving. A consolidated base of knowledge is essential to build a common understanding of the drug-impaired driving problem, inform discussion, and achieve progress in reducing it.

The DIDLC contains several modules that are structured in a question and answer format, similar to other TIRF educational programs. Module topics include:

- magnitude and characteristics of the problem;

- effects of drugs on driving;

- legislation and penalties; and,

- tools and technologies.

To view more fact sheets, or to get more information about drug-impaired driving, visit http://druggeddriving.tirf.ca

When can police officers stop a driver and conduct tests to determine impairment due to drug(s)?

In jurisdictions across North America, law enforcement officers are required to have reasonable suspicion that a driver is impaired before initiating a traffic stop and conducting tests to determine impairment. Reasonable suspicion can include observing the driver weaving, drifting, or displaying reckless or aggressive behaviour (e.g., speeding, failing to stop at stop signs or traffic lights, following too close to other cars, etc.). If police officers observe these or similar behaviours, they can stop a driver and conduct an impaired driving investigation. As part of the investigation, officers may observe additional signs of impairment during their interaction with a driver (e.g., slurred speech, inability to follow directions, impeded motor skills, odour of alcohol and/or drugs), and they can make a demand to drivers to exit their vehicle and submit to further testing which may include Standardized Field Sobriety Tests (SFSTs) and/or a demand for a bodily fluid sample.[1]

[1] Dupont et al. 2012; Jonah, 2014

Similarly, in fourteen[2] European countries, police officers require reasonable suspicion, or assumption of impairment before stopping drivers to test them for drugs and alcohol.

Conversely, in eleven[3] European countries as well as Australian states, police officers are able to stop drivers at random and test for the presence of alcohol and drugs[4] using roadside screening devices and behavioural assessments.[5]

What are sobriety checkpoints and how are they useful to detect both alcohol and drug-impaired drivers?

Sobriety checkpoints offer another opportunity for law enforcement officers to interact with drivers and determine if impairment is suspected. These checkpoints are typically set up at designated places and/or at designated times. Traffic cones or other traffic calming measures can be set up to funnel cars into a single line, and require them to stop at a certain point so that law enforcement officers can interact with drivers, however these interactions are fairly brief. Questions about possible drug and/or alcohol use are asked and law enforcement officers observe drivers for possible signs of impairment. Based on these interactions, drivers may be asked to pull to the side of the road. Officers may ask drivers to accompany them to the cruiser for further testing and to participate in behavioural tests or provide a breath or bodily fluid sample.

An example of a roadside sobriety checkpoint is the Reduce Impaired Driving Everywhere (R.I.D.E.) Checks program which is used by police agencies across Canada. This program began in 1977, and was originally implemented in local communities, but grew in popularity and was eventually applied across the country. R.I.D.E. checkpoints most commonly occur during the winter holiday season, but are also conducted year-round, often during long weekends or in conjunction with events where alcohol will be consumed, such as concerts and sporting events.

In the United States, law enforcement agencies have used sobriety checkpoints for more than twenty years. There are 38 states as well as the District of Columbia, the Northern Mariana Islands, and the Virgin Islands which permit their use.[6] Twelve states prohibit the use of sobriety checkpoints because the state has no authority to conduct them (i.e., Alaska), they are considered illegal under state law (i.e., Idaho), or they violate the state's constitution (i.e., Michigan).[7] For example, Texas prohibits sobriety checkpoints based on the state's interpretation of the United States Constitution [see Brown v. Texas, 443 U.S. 47 (1979)]. However, jurisdictions that do not permit checkpoints can rely on other enforcement strategies such as saturation patrols.

Research examining the effectiveness of sobriety checkpoints has consistently demonstrated that such enforcement efforts are effective at preventing alcohol-related injury and fatalities.[8] However, the effectiveness of checkpoints on

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[2] Austria (on assumption), Bulgaria, Germany, Greece, France, Ireland, Italy, Lithuania, Luxembourg (testing at random permitted but only if ordered by the Public Prosecutor), the Netherlands, Norway, Poland, Sweden, and the United Kingdom.

[3] Belgium, Croatia, Cyrus (testing is also possible on reasonable suspicion), Czech Republic, Denmark, Estonia, Finland, Hungary (at random for alcohol), Slovakia, Slovenia, and Spain

[4] EMCDDA, 2011

[5] DuPont et al., 2012

[6] Governors Highway Safety Association 2017

[7] NHTSA 2002

[8] Shults et al. 2001

drug-impaired driving has yet to be established. Notably, whereas alcohol-impaired drivers are most commonly detected during late evening hours and on weekends, data suggest that drug-impaired drivers are present on the road also during daytime and on weekdays, as opposed to primarily during evening and weekend hours.[9]

Do police officers have tools to detect drug-impaired drivers at the roadside?

Yes, police officers have several tools that can be used to detect drug-impaired drivers at the road-side. After the initial observation of the vehicle in operation and the decision to stop the vehicle, officers gather clues about impairment during face-to-face interactions with drivers. They may decide to request that drivers exit the vehicle and submit to further testing.

After drivers exit the vehicle, officers can test them for the presence of cognitive and physical impairment using the Standardized Field Sobriety Test (SFST). Prior to the passage of drug-impaired driving legislation in Canada in 2008, police officers did not use the validated SFST battery since police officers were able to make the breath demand based on driving indicators and roadside interactions. Conversely, the SFSTs have been routinely used by all police officers in the United States to detect impaired drivers (alcohol and drug) since 1981[10] because the results of the SFSTs provide officers with probable cause to make the breath demand. The SFST battery has been scientifically validated to detect alcohol impairment, and there is some evidence that SFSTs are also effective at detecting marijuana, benzodiazepines and high doses of amphetamines.[11] However, some tests in the battery are better at detecting some categories of drugs than others.

The SFST is a three-test battery that includes the horizontal gaze nystagmus (HGN), the walk-and-

turn (WAT), and the one-leg stand (OLG) tests. Each of these tests are briefly described below.

- **HGN.** This test requires subjects subject to follow the movement of a small stimulus (such as the tip of a pen or penlight) by tracking the stimulus using only their eyes while keeping their head still. The test is completed with the left eye, followed by the right eye while officers observe each eye for clues of impairment. These clues include the lack of smooth eye movement when tracking the stimulus, the involuntary jerking of the eyes prior to reaching a 45 degree angle, and a distinct jerking of the eyes when held for four seconds at the most extreme left or right position. If officers detect four or more clues after testing both eyes, then it is likely that the BAC of the subject is at or above 0.10 g/dL. The HGN test is the most reliable indicator of impairment by alcohol in the SFST battery.

- **Walk-and-Turn.** This test consists of two stages: (1) instruction stage, and (2) walking stage. In the first stage, drivers must stand with their feet in heel-to-toe position with their arms at their sides, and listen to the instructions. This stage is designed to test divided attention, as the subject's attention is divided between

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[9]   Biecheler et al. 2008
[10] NHTSA 2011
[11] Eggett et al. 2007; Papafotiou et al. 2005; Bramness et al. 2003; Kelly et al. 1997; McCloskey et al. 2007; Silber et al. 2005; Stough et al. 2006; Hartman et al. 2016

listening to the instructions and keeping their balance. In the walking stage, drivers must take nine heel-to-toe steps, turn in a prescribed manner, and take nine heel-to-toe steps back while counting the steps out loud. Officers must watch for eight possible clues of impairment, such as not being able to maintain balance while listening to instructions, starting the task before instructions are complete, stopping while walking, stepping off the line, taking an incorrect number of steps, not touching heel-to-toe, using arms for balance and improper turning. If two or more clues are present, or subjects cannot complete the task, then it is likely that the subject is impaired with a BAC at or above 0.10 g/dL.

- **One Leg Stand.** This test consists of two stages: (1) instruction stage, and (2) balance and counting stage. In the first stage, drivers must stand with their feet together and keep their arms at their side while listening to the instructions. This stage is designed to test divided attention, as subjects must maintain the prescribed posture and listen to the instructions for the test. In the second stage, drivers must raise one foot approximately six inches off the ground, keeping it parallel to the ground, and keeping both legs straight. While looking at the elevated foot, drivers must count out loud in the following manner "one thousand one", "one thousand two" and so on until directed to stop. Officers must watch for four possible clues of impairment, such as using their arms to keep balance, swaying while balancing, hopping to maintain balance, and putting their foot down one or more times during the test.

Based on the combined results of these tests, if impairment is indicated, officers will then administer an approved screening device (ASD) to take a breath sample and determine the presence of alcohol. If the ASD does not indicate the presence of alcohol, but officers observe evidence of impairment from the results of the SFST, a specially-trained Drug Recognition Expert (DRE) officer may be summoned to further evaluate the driver for the presence of drugs. The DRE evaluation is not typically completed at the roadside, and occurs post-arrest at the local police station.

How effective are SFSTs at detecting drug-impaired drivers?

The SFST was developed to test alcohol impairment, however, the ability of the SFST to detect impairment by drugs other than alcohol is supported by various studies. Impairment on the SFST is significantly associated with cannabis, CNS (Central Nervous System) depressants, CNS stimulants and narcotic analgesics.[12] However, the specific clues of impairment for each SFST component (HGN, OLG, and WAT) vary by drug category. Laboratory studies examining specific drug categories indicate a dose-dependent relationship. Results indicate that the SFST is predictive of cannabis impairment[13] however, it is only mildly predictive in heavy users, which may be due to a higher tolerance to some of the impairing effects of cannabis. Furthermore, SFST results are predictive of impairment due to high levels of CNS stimulants, but the test battery is not sensitive enough to predict low levels of stimulants.[14]

[12] Porath-Waller et al. 2014
[13] Papafotiou et al. 2005
[14] Silber et al 2005; Downey et al 2012; Bosker et al. 2012

Do police officers have tools to detect drug-impaired drivers who are taken into police custody?

Following the roadside investigation (which may include the SFSTs), drivers who are suspected of being under the influence of drugs other than alcohol can be taken into custody and transported to the local police detachment for further evaluation by Drug Recognition Expert (DRE) officer. DRE officers are highly skilled at detecting impairment due to drugs, and identifying the category or categories of drugs that are the source of the exhibited impairment. Frequently, it is determined that drivers are under the influence of more than one drug (i.e. polydrug use), and although the combination of alcohol and another drug (illegal, prescription or over-the-counter drug) is common, drivers may have multiple drugs (other than alcohol) in their system, sometimes at very low doses.[15] Research shows that several drugs in the body, even at low concentrations, may cause substantial impairment. Therefore, DRE officers are trained to recognize the seven categories of drugs and are better able to detect lower doses of multiple drugs at concentrations that a roadside oral fluid screening device may not be able to detect.

DRE officers must successfully complete the Drug Evaluation and Classification (DEC) Program which is one of the most intensive and technical training programs offered to police officers. Certification in SFSTs and more than 152 hours of coursework are required along with two examinations and a final written endorsement from two DRE instructors. Once completed, officers are certified as a DRE, but must conduct a minimum number of drug evaluations per year and obtain re-certification every two years.

The DRE evaluation of a suspected impaired driver consists of a standardized 12-step process designed to assess physical, cognitive and medical indicators.[16] The evaluation includes: a breath alcohol test, an interview by the arresting officer, preliminary examination of the suspect, eye examinations, divided attention tests, vital signs examination, dark room examinations, examination of muscle tone, search for potential injection marks, suspect interview, an opinion by the DRE and the procurement of toxicological samples for analysis. Based on the results of a complete evaluation, DRE officers can accurately determine whether a driver is impaired, and if so, whether this impairment is related to drugs or a medical condition. If there is impairment by drugs, the DRE will determine what category or categories of drugs that are the likely source of the impairment.

Are DREs able to consistently detect drug-impaired drivers?

Canadian and U.S. evaluations of the DRE program reveal that trained officers are able to accurately detect drug impairment in 90-95% of cases.[17] Once impairment is established, the accuracy of identifying the category of drug(s) responsible for the impairment varies by drug type. For cannabis, DRE's were able to correctly identify the drug 87% of the time. DRE's correctly identified CNS stimulants at a rate of 89%, CNS depressants were correctly identified at a rate of 87%, and narcotic analgesics were correctly identified at a rate of 89%.[18]

[15] Brady 2013
[16] Hartman et al. 2016
[17] NHSTA 2010; Beirness et al. 2009; Smith et al. 2002
[18] Beirness et al. 2009

Although there has been limited research to investigate the effectiveness of the DRE program in gauging impairment due to new psychoactive substances (NPSs), there is some evidence that suggests it may be effective. In particular, DREs were able to identify impairment and correctly categorize synthetic cannabinoid drugs under the category of cannabis with 100% accuracy.[19] In a case study, a DRE evaluation correctly identified 25C-NBOMe, which is a NPS that produces effects similar to hallucinogens.[20] Of course, more research is needed before definitive conclusions may be drawn.

What is the Advanced Roadside Impaired Driving Enforcement (ARIDE) program?

The Advanced Roadside Impaired Driving Enforcement (ARIDE) program was developed in the U.S. to bridge the gap in training between the SFST and the DEC program. More recently, this program has been considered for use in Canada.

The goal of the ARIDE course is to train law enforcement officers to observe, identify, and articulate signs of impairment related to drugs, alcohol or a combination of both. The objective of this program is to increase the ability of officers to detect suspected drug-impaired drivers in order to further reduce the number of impaired driving incidents, serious injury, and fatal crashes.[21] This program is available to all U.S. police officers that are proficient in the use of SFSTs, as well as other criminal justice professionals in the area of drug impairment and traffic safety.

The ARIDE program is not deigned to replace the DEC program, and instead trains police officers to recognize when a DRE officer is needed during an investigation. This can help increase the efficiency of the DEC program and ensure DREs are correctly and consistently summoned in cases that involve drug impairment. According to a pilot study involving the implementation of the ARIDE program in four states, ARIDE-trained officers were better prepared to communicate critical roadside observations, utilize DRE officers more effectively, and were more knowledgeable about the appropriate biological test to request when DRE officers were not available. Furthermore, officers were more prepared to effectively articulate their findings in court.[22]

What are roadside oral fluid screening devices and where is the use of these devices permitted?

Oral fluid screening devices may be used by police at roadside to confirm suspected drug use. These devices are non-invasive, easy to use, and provide rapid results, although the cost of these devices is slightly greater than a breath testing instrument. In jurisdictions where such devices are approved, they are used by officers at the roadside to test drivers for the presence of drugs when impairment is suspected. Drivers are asked to provide a saliva sample which is collected from the mouth using an absorbent swab. Although there are variations between different oral fluid screening devices, they all provide an immunoassay of the saliva specimen when added to a proprietary diluent mix, and analysed by lateral flow technology for the presence of drugs at specific cut-off values. Test results are available after several minutes, and many devices include a panel for several categories of drugs. Typical drug types included in the panel are cannabis, cocaine, methamphetamines, and opioids.[23]

> **Oral fluid screening devices are non-invasive, easy to use, and provide rapid results, although the cost of these devices is slightly greater than a breath testing instrument.**

[19] Yeakel & Logan 2013
[20] Rajotte et al. 2017
[21] NHSTA 2007 ARIDE manual
[22] Walden 2005
[23] Logan et al. 2014; Scherer et al. 2017

It is important to note that using oral fluid to indicate the presence of drugs should not be regarded as a replacement for other toxicological confirmatory tests using urine or blood. Testing oral fluid has some advantages over other types of tests, which make these devices more efficient for use at roadside. In particular, these devices do not pose the same privacy concerns as a urine test, and they do not require officers to be trained as phlebotomists in order to draw blood. While some research indicates that oral fluid and blood concentrations of a drug do show a reasonable correlation[24] there are some important differences.

Most jurisdictions that have implemented oral fluid screening at the roadside use the results as a preliminary indication of drug use that requires further confirmatory lab testing. However, there are a few countries that use oral fluid for both drug screening and confirmation testing.

In total, more than two dozen countries have implemented oral fluid screening at the roadside,[25] and there are a few other countries that are in the process of testing and approving certain screening devices for use, but have not yet introduced legislation to implement roadside oral fluid testing. Countries on this list use one or more of the following devices: the DrugWipe® by Securetec, the Dräger DrugTest® 5000, the Alere DDS2®, and the RapidSTAT® from Mavand Solutions.

One of the most common devices used is the Securetec DrugWipe®,[26] which is a self-contained test cassette with visual indicators and an optional reader to store the results. To use this device, the sample collector is detached from the test cassette and is run over the tongue for five seconds to collect saliva. After this, the sample collector is re-attached to the test cassette where it is introduced to a proprietary dilutent mix. The results are presented with the use of red vertical test lines located in the read-out window of the device.

Depending on the model, the Securetec DrugWipe® can detect the presence of up to seven drug types (cannabis, opiates, cocaine, amphetamine, methamphetamines, benzodiazepines, ketamine) in five to eight minutes.

Image retreived from http://www.saturn-data.com/eng/products/586/0/537/

Another commonly used device is the Dräger DrugTest® 5000 test system,[27] which includes the Dräger DrugTest® 5000 Analyser and test kits comprised of a test cassette with an oral fluid collector. The collector is used to swab the mouth for one to four minutes, and then is inserted into the test cassette before introduction into the analyser. The analysis takes about eight minutes and the result for each drug category is displayed on the screen. The Dräger DrugTest® 5000 can detect amphetamines, methamphetamines, opiates, cocaine, benzodiazepines, cannabis, methodone and ketamine.

Other brands include the Alere DDS2® from Alere Toxicology,[28] and the RapidSTAT® from Mavand Solutions. The Alere DDS2® is a mobile, handheld analyser with a three-step testing process. First, a test cartridge is inserted into the analyser device and a sample of oral fluid is collected using a testing swab. Once the testing swab indicates

[24] Toennes et al. 2004; Toennes et al. 2005; Huestis & Cone 2004
[25] Argentina, Australia, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, United Kingdom, Iceland, Ireland, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovenia, Spain, Switzerland, Uruguay.
[26] www.securetec.net/en/saliva-drug-test-drugwipe
[27] Dräger DrugTest: https://www.draeger.com/en-us_ca/Alcohol-And-Drug-Detection/Products/Breath-Alcohol-and-Drug-Testing/Drug-Testing-Devices/DrugTest-5000
[28] https://www.aleretoxicology.co.uk/en/home/products-services/drug-testing/products/dds2.html

that a sufficient amount of oral fluid has been collected, the swab is inserted into the test cartridge that is already inserted in the analyser. After five minutes, the results are displayed on the digital screen of the analyser. The Alere DDS2® can test for amphetamines, benzodiazepines, cannabis, cocaine metabolites, methadone, methamphetamines and opiates.

The RapidSTAT® is comprised of a swab to collect a sample, a buffer bottle with a mixing solution, and a test cassette with an incubation device. Once the sample has been collected with the oral swab, the swab is mixed with a solution in a buffer bottle and four to six drops of the solution are added to the incubation container. Once the solution from the incubation container is released onto the testing strips, the test strips will display the results in approximately eight minutes. The results are presented with the use of red vertical test lines located in the read-out window of the device. The RapidSTAT® can test for the presence of amphetamines, benzodiazepines, cocaine, methadone, methamphetamines, opiates and THC.[29]

How effective are roadside oral-fluid screening devices at detecting the presence of drugs?

The first large-scale evaluation of roadside drug testing devices was the ROSITA (roadside testing assessment) study which was conducted from 1999-2001 and involved eight European counties.[30] The effectiveness of each device was scored against a criterion of sensitivity >90%, specificity >90%, and accuracy >95%. If this criterion was exceeded, then the performance of the device was deemed acceptable.

Image retreived from www.transport-research.info/sites/default/files/project/documents/rositarep.pdf

The sensitivity of a device indicates the number of true drug-positive specimens correctly identified by the device. A higher level of sensitivity indicates better performance. To measure sensitivity, the positive results of a device were compared to results from a confirmatory laboratory testing method. The specificity of a device is the number of true drug-negative specimens correctly identified by the device. A higher level of specificity indicates better performance. The specificity of a device was measured by the total number of negative results from the device compared to the negative results using a confirmatory laboratory testing method. The oral fluid screening devices tested in this study did not meet the criterion of sensitivity >90%, specificity >90%, and accuracy >95%, and none of the devices were suggested for roadside use at that time. Despite these findings, it was concluded that the use of oral fluid screening at the roadside had certain advantages over sweat or urine analysis, and that oral fluid screening was a promising method to detect drug-impaired drivers at the roadside.[31]

In 2006, the second ROSITA study examined nine oral fluid screening devices in five European countries and the United States. The criterion for acceptable device performance was the same as the ROSITA 1 study (sensitivity >90%, specificity >90%, and accuracy >95%). Once again, the results showed that no single device was able to meet the criterion for all drugs, and therefore, no specific device was suggested for roadside oral fluid screening.[32]

The most recent evaluation of 13 oral fluid screening devices was conducted from 2006-2008 in six European countries as part of the

[29] www.mavand.de/en/products/drug-tests/rapid-statr.html
[30] Maes et al. 1999; Retrieved from: www.transport-research.info/sites/default/files/project/documents/rositarep.pdf
[31] Verstraete 2000
[32] Verstraete & Raes 2006 Retreived from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.474.3379&rep=rep1&type=pdf

DRUID study (Driving Under the Influence of Drugs, Alcohol and Medicines).[33] In this study, oral fluid devices were assessed using more liberal criteria than the previous ROSITA studies (>80% sensitivity and specificity). As in the previous studies, the sensitivity and specificity of the devices varied greatly, and only three devices achieved sensitivity that surpassed the criteria. No device achieved acceptable levels of sensitivity, specificity, and accuracy. Therefore, no specific device was recommended for use by law enforcement at the roadside. However, it was noted that there were general improvements in the oral fluid screening technology since the ROSITA 2 study in 2006.

> **In the DRUID study none of the 13 oral fluid screening devices achieved acceptable levels of sensitivity, specificity, and accuracy.**

Since then, individual studies have shown a wide range of results regarding the effectiveness of different brands of oral fluid devices. There are more than 13 brands of oral fluid devices, and the sensitivity and specificity of each device may be better for detecting certain drugs over others. Historically, oral fluid devices tend to have low sensitivity and specificity to effectively detect THC when present at lower levels in the body. However, the Dräger DrugTest® 5000 and latest Securetec DrugWipe® 5S have demonstrated higher levels of sensitivity and specificity for THC at 5ng/ml in oral fluid.[34] Other factors affecting the detection of THC in oral fluid include the recency of smoking, and whether individuals are occasional or frequent smokers.[35]

An evaluation of oral fluid devices has been conducted in Canada to examine the suitability of certain devices for potential use by Canadian law enforcement to detect drug-impaired drivers at the roadside.[36] Three devices were tested that

had research to support an acceptable standard of performance (1) Alere DDS 2®, (2) Dräger DrugTest® 5000, and (3) Securetec DrugWipe® 6S. Oral fluid specimens were collected using one of three devices from a sample of suspected drug users. A secondary specimen was taken with the Quantisal® oral fluid collection device and sent to a laboratory to obtain an independent reading. This secondary sample acted as a confirmatory test, as the laboratory was instructed to only test for the drug/drug category that was initially detected with one of the three devices. Since the purpose of this study was to examine the ability of these devices to detect the presence of drugs/drug category, and not the individual effectiveness of each device, the results from all three oral fluid devices were combined. The average sensitivity of all the devices for all drug/drug categories was 87%. This means that 87% of those who had used one or more of the substances included in the screening had a positive reading for drugs as detected by an oral fluid device. The specificity of the devices was 93%, which means that 93% of the time subjects who had not used any substances were correctly identified as being drug negative.

Two other important metrics included in the study were the positive predictive value (PPV) and the false alarm rate. The PPV was 96.5%, which means that 96.5% of the drugs identified by the oral fluid screening devices were confirmed in the secondary laboratory analysis. The false alarm rate was 7%, which represents the percentage of oral fluid specimens that were deemed as drug positive, but were not confirmed by the secondary laboratory analysis. Collectively, the devices had a high sensitivity (>80%) and specificity (>90%) for THC, cocaine,

[33] Blencowe et al. 2010
[34] Desrosiers et al. 2012; Desrosiers et al. 2015; Blencowe et al. 2011; Wille et al. 2010; Strano-Rossi et al. 2012
[35] Desrosiers et al. 2015; Blencowe et al. 2011
[36] Beirness & Smith 2017

methamphetamines and opioids. The devices did not perform as well for the detection of benzodiazepines and amphetamines, with an overall sensitivity value of 59% and 77% respectively. Therefore, these three devices were deemed reliable to detect certain drug/ drug categories at the roadside. As a result, these findings can contribute to the development of performance standards for oral fluid screening devices in Canada, and provide guidelines as to which drug/drug categories would likely be included when testing at the roadside.

At the conclusion of the aforementioned study, Public Safety Canada, the Royal Canadian Mounted Police (RCMP) and the Canadian Council of Motor Transport Administrators (CCMTA) conducted a pilot project to test oral fluid screening devices during random stops and road checkpoints to determine the functioning of this technology in the cold Canadian climate, within the practices of Canadian law enforcement, to inform officer training guidelines and to standardize the device operating procedures.[37] The two devices used were the Securetec DrugWipe® 5S and the Alere DDS-2, which were selected based on supporting literature and device portability.

Image retreived from https://www.securetec.net/en/saliva-drug-test-drugwipe

Data was collected from officers using the devices through weekly conference calls,

roadside questionnaires, and individual interviews to identify device issues, obstacles, comfort levels, ease of use and device functioning in various weather conditions. Overall, officers reported that the devices were very easy to use at the roadside. They found that their comfort and confidence increased as they used the device more frequently, and when devices issues did arise, officers were easily able to troubleshoot. The weather conditions did not increase the number of reported device malfunctions, however, a larger proportion of drug-positive readings were found when the device was operating outside of the suggested temperature range and it was concluded that more research is needed to determine the cause of this important observation. Officers also reported that the standardized operating procedures of the device should emphasize safety. Common safety concerns included the time required to complete the screening and the physical proximity to drivers being tested. Overall, it was concluded that oral fluid devices serve as a useful tool for Canadian law enforcement and proper training and standardized operating procedures are needed to ensure officers can definitively detect drugged drivers.

What are the considerations associated with introducing an oral fluid drug screening program for suspected drug-impaired drivers?

The prevalence of different categories of drugs varies across driving populations and jurisdictions; some categories of drugs are more likely to be detected in some countries than others. As such, it is important to understand the prevalence of different types of drugs among the population of drivers who will be subject to an oral fluid screening program since it can be inefficient to test for drugs that are not often detected in the population being tested.

[37] Keeping & Huggins 2017

For example, in Australia, the roadside oral fluid screening program has focused on the detection of THC and amphetamines since these drugs are most often detected among this population. However the oral fluid testing program in the United Kingdom has focused detection efforts on the use of THC and cocaine which are more prevalent among drug-impaired drivers in this country. In Europe as well as Canada, oral fluid testing programs have focused on THC, amphetamine/methamphetamine, cocaine, and opiates.

Oral fluid testing devices are intended to be used as a screening device for drivers at the roadside. This means that that a methodology must be in place to deal with results that indicated a driver is drug-positive. In Australia, drivers who are screened as drug-positive are subject to a follow-up oral fluid collection device that collects a specimen from the driver which is then submitted to a forensic laboratory for analysis and evidential processing. Conversely, in the UK and Europe, the follow-up test protocol involves the collection of a blood sample which is submitted to a laboratory. Legislation in Canada proposes this latter approach.

The main advantage of reliance on confirmatory testing using an oral fluid device is that the sample may be obtained by the arresting officer at the roadside without delay. However, the use of secondary analysis with a blood sample requires a skilled person to attend the roadside to collect the sample, or the driver must be must be transported to another site for this purpose which can result in a substantial delay between the collection of the positive oral fluid screening sample and the confirmatory blood test sample.

In addition, the introduction of an oral fluid screening program requires the availability of forensic laboratories with the necessary analysis tools and equipment, a standardized methodology,

and skilled personnel who are able to analyze saliva and blood specimens in a timely fashion. To this end, experiences from various jurisdictions that have implemented an oral fluid drug screening program have suggested that there may be a dramatic increase in the number of samples being collected from drivers testing positive at the roadside that require confirmatory analysis to support the prosecution of drug-impaired drivers.

In light of the fact that the metabolism of active (impairing) components into inactive (non-impairing) compounds in drugs may occur more quickly, and there is often delays associated with the collection of confirmatory blood sampling, the results of lab analyses may not be consistent with the evidence of impairment collected at roadside with oral fluid screening devices. In particular, the active components of THC are generally metabolized within three hours of smoking cannabis. As such, THC may not be detectable at the roadside, or may not be at sufficient concentrations in the confirmatory sample to support a drug-impaired driving charge.

It is important that jurisdictions selecting oral fluid drug screening devices for use in their jurisdiction are informed by the body of scientific research that has been accumulated from more than a decade of use and evaluation of these devices in various counties around the world. At the same time, it is important to note that there are few laboratories possess the accreditation and scope of experience to conduct evaluations of these products in a rigorous fashion, and the replication of results by state laboratories may not be feasible. Similar to the testing of medical products, credible manufacturers of oral fluid drug screening products have commissioned accredited labs to perform third party testing of the products for accuracy, sensitive and precision for the detection of the target drugs at the designated cut-off limits. Moreover, testing of oral fluid drug screening devices must be conducted

with human saliva collected from drug-free candidates and spiked with drug concentrations representative of the target concentrations. Synthetic saliva is not a representative media and may lead to erroneous results.

Finally, replicate testing from samples collected at the roadside may provide representative data of the validity of the oral fluid drug screening device. However, there are two important factors to consider in this regard:

- the time lapse between the screening test and the confirmatory sample collection; and,

- the different biological matrix.

Notably, the comparison of oral fluid drug screening tests with blood samples drawn thereafter may yield some disparate results due to the collection, handling and analytical methodology. The best correlations (~ 99%) have been obtained from a comparison of the oral fluid drug screening test with the analytical results obtained from a confirmatory oral fluid sample obtained immediately thereafter.

The implementation of an oral fluid screening program also requires attention to several key features:

- the ease of use of the oral fluid screening device;

- the minimum volume of saliva to be collected for analysis;

- the minimum time of interaction between the police officer and suspected drug-impaired driver during sample collection;

- the minimum time for the completion of the analysis and display of results;

- the minimum needs for equipment to conduct the oral fluid sampling and analysis; and,

- the comprehensive and effective training

program for police officers conducting drug-impaired driving enforcement who will be responsible for the detection of impairment and roadside oral fluid drug screening, as well as potentially confirmatory sample collection.

What other types of drug screening tools and technologies are being explored to detect the presence of drugs in drivers?

The ability to test for marijuana in breath samples has been pioneered by a few companies in Canada and the United States, with the development of promising new technology including the Cannabix breathalyzer[38] and the Hound marijuana breathalyzer[39]. These devices are currently undergoing development and beta-testing but are not available for use at this time.

Specifically, the Cannabix breathalyzer is designed to detect the main psychoactive component of marijuana (THC), and serves to indicate recent use (within a two-hour window). The Cannabix Marijuana Breathalyzer Beta prototype device has recently been piloted with human subjects after smoking THC cigarettes. The pilot study demonstrated the successful detection of THC in breath samples, along with other metabolites including 11-hydroxy-delta-9-tetrahydrocannabinol and delta-9-carboxy-tetrahydrocannabinol. Further testing will continue with the Beta and Beta 2.0 prototypes, bringing it closer to realizing its potential of detecting drivers under the influence of marijuana.

A breathalyzer for marijuana may provide a sense of familiarity for drivers as well as law enforcement, since both are already accustomed to breath testing for alcohol and awareness of alcohol breathalyzers is widespread. However, a breathalyzer for cannabis does have certain

[38] www.cannabixtechnologies.com/thc-breathalyzer.html
[39] https://houndlabs.com/

limitations. Since marijuana does not act similar to alcohol in the body, marijuana detected in breath is not reflective of the amount of the substance that is present in the blood or brain of the individual.

Another technology that has been proposed to detect the presence of drugs is the EyeCheck® pupilometer. This device measures the size of the pupil and its' reactivity to a light stimulus. The EyeCheck® is a small portable system that requires subjects to peer into the designated viewing area of the device, as they would a pair of binoculars. They are instructed to do so for 30 seconds (allowing their pupils to dilate due to the darkness) after which a flash of light appears causing the pupil to react by constricting and subsequently re-dilating to adjust back to the darkness. The EyeCheck® system analyses the pupillary response with the use of proprietary algorithms, and provides a pass or fail reading to indicate impairment from marijuana, amphetamine, cocaine, tranquilizers, and heroin.[40] To examine its' effectiveness, this technology was piloted with probationers in the California justice system. The results of a weekly drug test using the EyeCheck® pupillometer were compared to the results of a urinalysis. It was determined that the EyeCheck® had a sensitivity of 86.2% and a specificity of 78.8% and was considered to be a cost-effective method to differentiate drug-impaired individuals from those not under the influence of drugs.[41]
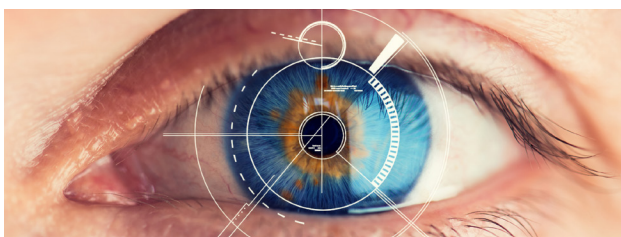
This system has certain benefits: it is portable, inexpensive, non-invasive and it provides immediate results. It could be applied in large-scale drug testing, such as in the workplace or in a

population of inmates. However, pupillometry for practical applications is limited by certain factors. Pupil reflexes can be affected by the presence of certain diseases, other drugs or fatigue.[42]

Single-point sweat-based drug analysis can help to detect recent drug use (<24 hrs). A device called the DrugWipe® 5K sweat test by Securetec can detect the presence of cannabis, amphetamines, methamphetamines, cocaine, and opiates in sweat. Using a device resembling the oral fluid screening device from Securetec, the sample collector is removed from the test cassette to reveal sampling pads on the underside of the sample collector. The sampling pads are moistened with water, and the sampling pads are wiped across the forehead 5-6 times. Once the sample collector is attached back onto the test cassette, the cassettes' test strips are placed in water for approximately 15 seconds. The device is left to process the results for eight minutes and the drug screening results are displayed with the use of red vertical test lines located in the read-out window of the device.[43]

Sweat-based analysis has only been implemented in the field of toxicology since 1990 because of the difficulties associated with collecting sweat excretions from the body. Since then, there have been significant improvements in the field leading to the development of sweat patch technology to monitor the use of illicit drugs, and the single-point sweat-based screening that allows for the detection of recent drug use.[44] Sweat-based screening methods hold promise, as the test has the benefit of being administered at the roadside and is relatively un-intrusive, however, more research is needed to establish the sensitivity and specificity of a single-point sweat-based screening device like the DrugWipe K®.[45]

[40] www.eye-check.com.au
[41] Richman & Noriega (2002)
[42] Karch 2006
[43] www.acs-corp.com: DrugWipe K® sweat drug test
[44] De Giovanni & Fucci 2013
[45] Samyn & Haeren 1999

Another technology based on sweat analysis is the Intelligent Fingerprinting Drug Screening System. This technology analyses small amounts of sweat from an individual's fingerprint with the use of a disposable cartridge. The testing panel includes amphetamines, cannabis, cocaine and opiates. The specimen is analysed in less than ten minutes and the results are displayed on a portable reader.[46]

Traffic Injury Research Foundation

The mission of the Traffic Injury Research Foundation (TIRF) is to reduce traffic-related deaths and injuries. TIRF is a national, independent, charitable road safety institute. Since its inception in 1964, TIRF has become internationally recognized for its accomplishments in a wide range of subject areas related to identifying the causes of road crashes and developing programs and policies to address them effectively.

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[46] https://www.intelligentfingerprinting.com/product/?lang=en-US