

A Feasibility Study of Roadside Oral Fluid Drug Testing



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December 2015

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Section 1: Background and Rationale

A. An Overview of Drug-Impaired Driving in Canada

Over the last two decades drug-impaired driving has emerged as an important public health issue. Like alcohol, many psychoactive drugs affect one's ability to drive a motor vehicle safely. These include: prescription medications such as opioid/analgesics, benzodiazepines and antidepressants; over-the-counter medications such as anti-histamines; and illegal drugs like cannabis (tetrahydrocannabinol, hashish or marijuana), cocaine and amphetamines (MDMA or ecstasy).

Concern arises from the increasing prevalence of driving after drug use in Canada, which now appears to be similar to the prevalence of drinking and driving. For example, 2010 and 2012 roadside studies reported that 7.2% of drivers in British Columbia who were randomly stopped and requested to provide a saliva sample tested positive for drugs, a rate roughly comparable to that of drinking and driving (9.9%).^{1,2} Cannabis (4.5%) and cocaine (2.3%) were the most commonly detected drugs in both studies.^{1,2} In a 2014 Ontario roadside study, 10.2% of drivers tested positive for drugs compared to only 4% for alcohol.³ These results are similar to findings from a 2007 roadside survey in the United States, where 11% of daytime drivers and 14.4% of nighttime drivers tested positive for drugs. Again, the most commonly found drug was cannabis, followed by stimulants. Unlike alcohol-impaired driving, which tends to spike in the evening or at night, drug-impaired driving occurs more consistently throughout the day.⁴

Drugs are even more prevalent in fatal crashes. A Canadian study reported that approximately 33% of drivers fatally injured between 2000 and 2007 were positive for drugs.^{2,5-7} Two studies of personal injury crashes found that between 11%^{8,9} and 12.6%^{8,10} of the drivers tested positive for drugs, rates that are similar to those in a recent international study.¹¹ Evidence on drug use among injured drivers in Canada is limited for drugs other than cannabis. In a study of over 1,000 drivers involved in crashes presenting to emergency departments in British Columbia, Brubacher et al. (2015) found cocaine in 2.8% of drivers, amphetamines in 1.2%, sedative hypnotics in 5.0%, antidepressants in 6.5%, and diphenhydramine in 4.7%. International studies report that approximately 1.9% of all drivers test positive for illicit drugs, and report¹⁰ rates similar to Canada for drug use in injured drivers and in drivers stopped at roadside. Similarly, cannabis, cocaine, opioids, and benzodiazepines were the most commonly detected drugs among international drivers.¹²⁻¹⁴

Drug-impaired driving will remain salient in the coming years, given the high rates of prescription, over-the-counter and illegal drug use that affect driving. One example is cannabis, which is the second most widely used substance after alcohol among Canadians. Cannabis consumption will likely increase in Canada, given the expansion in the medical marijuana programs and the proposals to legalize recreational use as in Colorado, Washington and other American states.^{9,15,16} Equally relevant is the increased consumption of prescription medications, particularly opioids, and the increased use of benzodiazepines and related drugs among older drivers.¹⁷⁻²⁰ Therefore, it is important to review Canadian drug-impaired driving legislation, and assess current and emerging enforcement practices. In particular, what is the potential role of roadside oral fluid (OF) drug testing and what are its

implications for the federal *Criminal Code* and provincial impaired driving provisions?

B. A Review of the *Criminal Code* and Current Canadian Enforcement Practices

In Canada, operating a motor vehicle while one's ability to do so is impaired by a drug is a federal criminal offence under s. 253(1)(a) of the *Criminal Code*. A majority of the provinces and territories authorize the police to impose a short-term administrative licence suspension on a driver if they have reasonable grounds to believe (suspect) that the driver's physical or mental ability to drive is impaired (affected) by a drug. Depending on the jurisdiction, the length of the suspension may be 24 hours, 3 days or 7 days. In addition, several provinces impose short-term administrative licence suspensions on drivers who fail a standard field sobriety test (SFST). Finally, more than half of the provinces and territories impose a 90-day administrative licence suspension on drivers who fail or refuse to take a SFST. The SFST which is conducted at roadside consists of three physical/behavioral tests, namely the horizontal gaze nystagmus, walk and turn, and one-leg stand tests.

Canada has adopted a behavioural impairment approach to drug-impaired driving enforcement, as opposed to per se drug limits. Under the current legislation, the assessment process may only begin if an officer has reasonable grounds to suspect that a driver has alcohol and/or drugs in his or her body. If this criterion is met, the officer may demand that the driver provide a breath sample on an approved screening device (ASD), and/or submit to a SFST. If the driver fails the ASD test or SFST, the police may demand that the driver accompany them to the police station to take evidentiary breath tests. If the individual fails the SFST, but is not found to be impaired by alcohol, the police may demand that the driver accompany them to the police station and submit to a drug recognition evaluation (DRE). The *Criminal Code* provides that a DRE can only be conducted by an "evaluating officer" who is certified as a "drug recognition expert" by the International Association of Chiefs of Police.

The DRE protocol relies on the evaluating officer's observations of socio-behavioural cues, the driver's biological and vital signs, performance on physical co-ordination and balance tests, and direct questioning. Based on these observations and tests, the officer then prepares a written report indicating whether the driver's ability to drive is impaired by a drug and, if so, by which one or more of seven categories of drugs. The seven categories are: cannabis (e.g., marijuana); central nervous system depressants (e.g., benzodiazepines); central nervous system stimulants (e.g., cocaine); hallucinogens (e.g., LSD); dissociative anaesthetics (e.g., ketamine); narcotic analgesics (e.g., heroin); and inhalants (e.g., gasoline).

If the evaluating officer concludes that the suspect's ability to drive was impaired by a drug, the officer may then demand that the suspect provide a sample of blood, urine or OF for analysis. A drug-impaired driving charge will only proceed to trial if the suspect's bodily sample tests positive for the category of drugs identified in the evaluating officer's report. It must be emphasized that the bodily fluid test merely confirms the presence of the drug, and not whether the driver's ability to drive was impaired by that drug. It takes approximately two hours in total to undertake the preliminary roadside SFST, transport the suspect to the police station, allow him or her to consult with counsel, and conduct the DRE.

C. Assessing the Drug Recognition Evaluation (DRE) Program

The DRE program has been in existence since the early 1970s, and evaluations of the program's effectiveness have been mixed. Validation studies generally demonstrate that evaluating officers in the field are able to correctly identify the category of drug that is present in the suspect's bodily fluid sample 75 to 90% of the time.²¹⁻²⁷ However, other studies report lower accuracy rates.²³ One clear benefit of the DRE program is its ability to adapt through supplementary training to the emergence of new drugs and drugs that are not included in traditional drug screening tests. Another strength of the DRE program is its focus on drug impairment, rather than the mere presence of a drug. However, the degree to which the DRE can establish impairment is contentious. As Chamberlain, Solomon and Kus noted, no field studies exist which assess the DRE protocol against impairment of actual driving skills.²⁸

There are additional concerns with the program. First, the DRE protocol is complex and technically exacting, requiring the officer to collect and record more than 100 discreet pieces of information. Second, the number of evaluating officers is limited and they are not distributed evenly across and within provinces, or between urban and rural areas. This is partially due to the lengthy and expensive training required to become a certified drug recognition expert (approximately \$17,000 per officer, made up of \$6,000 for the training and \$11,000 in travel/administration costs).²⁹ Third, evaluating officers are better at identifying certain drugs as opposed to others. Similarly, they are better at identifying drivers who have consumed large quantities of drugs. It is less clear how they perform in assessing more typical drivers who have consumed smaller quantities of drugs.^{27,30} Fourth, given the short half-life of some drugs, the time between the roadside stop and the subsequent testing of the suspect's fluids can pose difficulties in successfully charging and prosecuting the suspect.³¹ Finally, recent research indicates that the DRE program has not had a significant impact on the incidence of drug-impaired driving in Canada.²⁸ This is due to the courts' reluctance to accept DRE evidence and the general public perception that the likelihood of being apprehended and charged for drug-impaired driving is remote.^{28,32}

These concerns point to the need to complement the DRE process with an objective, easy to use, less costly, and more readily available roadside drug screening test for the most commonly used drugs. The costly and time-intensive DRE protocol should be reserved for cases in which new or less commonly used drugs are suspected.

Section 2: Roadside OF Drug Testing

A. How is Roadside OF Drug Testing Conducted?

There has been a long-standing need for a portable, roadside drug test akin to the ASD test for alcohol.³³⁻³⁵ Although both sweat and OF testing have been examined in the last 20 years, the recent focus has clearly been on developing OF testing devices.³³

OF drug testing has been conducted since the early 1970s, with the development of lab-based drug screening using immunoassays.³⁶ Roadside OF tests rely on the excretion of saliva from three

glands in the mouth. A swab, pad or other object is used to collect a small sample of saliva from the suspect's mouth. While the exact mechanisms vary among the devices, the OF from the collection object is generally diluted with a solution. The solution is then tested against immunoassays to identify a specific range of drugs. Oral fluid is preferable to urine or blood because its collection can be observed by the officer, in public without compromising the suspect's privacy, while providing results that are comparable to blood and urine testing. Moreover, OF testing reflects drug use that is contemporaneous with driving.^{33,37}

B. OF Drug Testing in the Canadian Context

In order to take full advantage of OF testing, four major amendments would have to be made to the *Criminal Code*'s impaired driving provisions. First, police officers would have to be authorized to demand an OF sample from any driver who they have reasonable grounds to suspect has any drug in his or her body. The police would also require authority to demand a confirmatory test if the driver tested positive on the initial OF test. Second, the failure or refusal to take the OF or confirmatory test without a reasonable excuse would have to be made a criminal offence. Third, per se limits would have to be enacted for each of the commonly used drugs. Finally, a provision would have to be enacted stating that driving or having care or control of a motor vehicle with a quantity of a drug in one's body above the relevant per se limit constitutes a federal impaired driving offence. Pursuant to these amendments, OF testing coupled with some form of confirmatory drug analysis would be central to the new per se drug-impaired driving offence.

Alternatively, OF testing could be used at roadside solely for screening purposes to establish grounds for demanding that the suspect submit to a DRE. As with the ASD, the results of the OF test would not be admissible in evidence to establish that the suspect's ability to drive was impaired by a drug. Similarly, the OF test results would not be admissible to establish that the suspect was driving with drugs in his or her body above the per se drug limits, should such an offence be created. Another option would be to expand the role of OF testing in a revised DRE protocol.

Currently, the *Criminal Code* only permits OF testing as the last stage of the DRE protocol. Even then, the officer may only demand a blood, urine or OF test if, based on the first 11 steps of the protocol, the officer has reasonable grounds to believe that the suspect's ability to drive was impaired by a drug. As indicated, the OF test results can only be used to confirm the presence of the drug in the suspect's body.

C. OF Drug Testing in Other Jurisdictions

Many countries have adopted roadside OF testing in an effort to reduce drug-impaired driving. Unlike the situation with alcohol, there is no consensus in the international community on the appropriate per se drug limits for driving. The impact of a given quantity of drugs on individuals varies greatly depending on, among other factors, habitual use, interactions with other drugs, metabolic variation, and delivery method. Given the lack of a consensus on per se driving limits, the variability in the impact of drugs and the hundreds of potential drugs of abuse, it is easy to understand why countries have moved slowly on the issue. Many countries have adopted a zero tolerance

approach, which criminalizes driving with any detectable level of prohibited drugs in one's body. As Table 1 illustrates, a broad range of permissible drug limits has been adopted.

Table 1: A Sample of Drug Limits for Driving

	EU Consortium*	United Kingdom	United States	Australia**
Amphetamines	25 ng/mL	250 ng/mL	The permissible limits vary from state to state, but most states with a drug-impaired driving law have adopted zero tolerance limits	0 ng/mL
Benzodiazepines	10 ng/mL	-----		0 ng/mL
Cocaine	20 ng/mL	10 ng/mL		0 ng/mL
Methamphetamines	25 ng/mL	10 ng/mL		0 ng/mL
Opioids	20 ng/mL	5 ng/mL		0 ng/mL
Cannabis (THC)	1 ng/mL	2 ng/mL		0 ng/mL

* More than 20 European countries have collaborated on the Driving Under the Influence of Drugs, Alcohol and Medicines project (DRUID) which is designed to develop research-based regulations that are adopted throughout the EU.

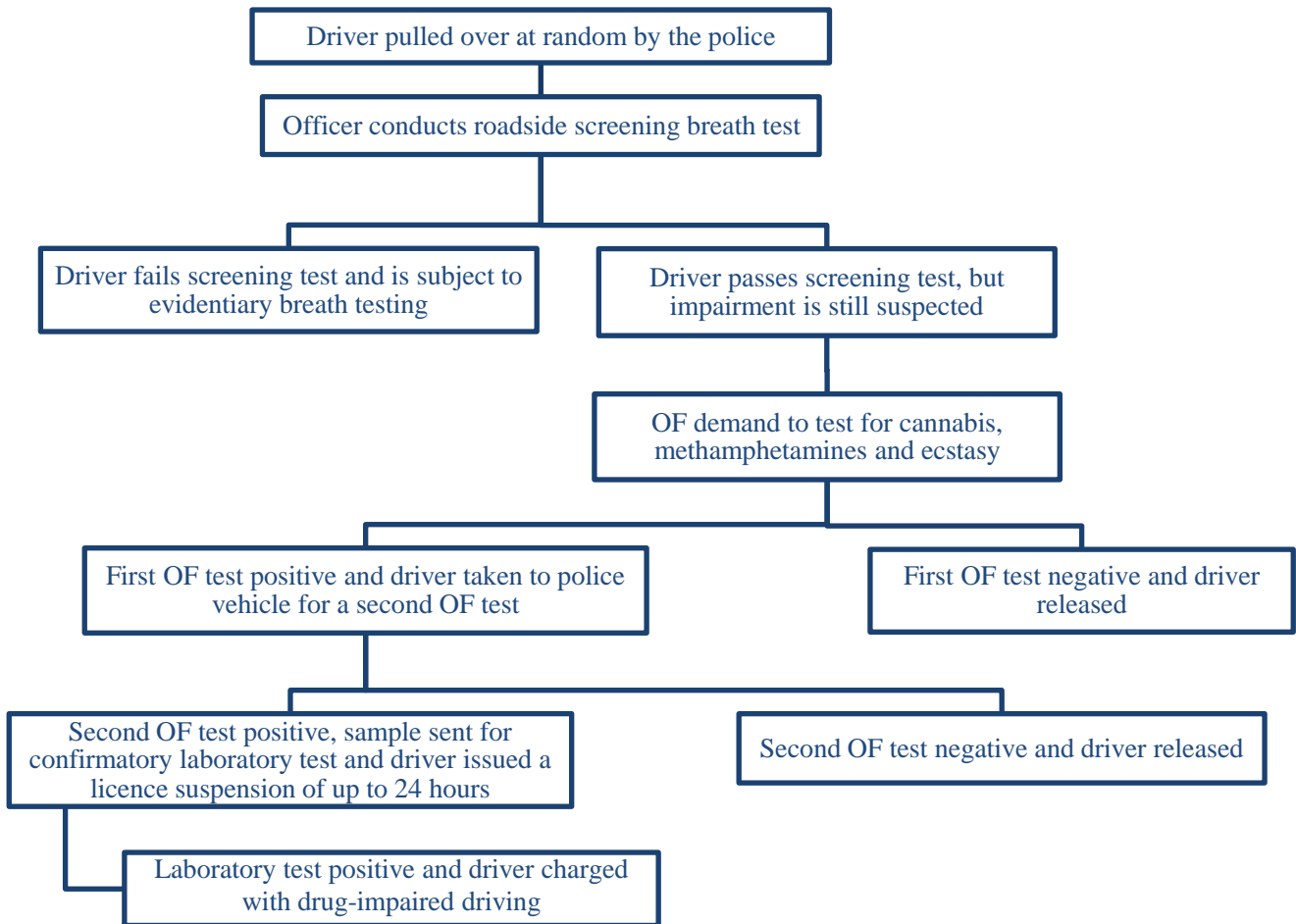
** The test device used in Australia has a threshold for each drug that creates a de facto zero tolerance approach.

United Kingdom: In 2015, the UK established per se limits for the illegal drugs and eight commonly abused lawful drugs. The police are now authorized to demand a roadside OF test from a driver who they suspect is impairment by a drug. More specifically, the police are using the DrugWipe® test to screen drivers for the presence of cannabis and cocaine. Even if the suspect does not test positive for these two drugs, the police can detain the driver and test for additional drugs at the police station. The setting of the per se limit for amphetamines was more complicated, as they are often used in treating attention deficit hyperactive disorder.³⁸ To accommodate this medicinal use of the drug, the UK set the its per se limit at ten times that of the EU consortium.

Australia: As of 2003, the police in the state of Victoria were authorized to conduct random roadside drug testing for cannabis, methamphetamines and MDMA (ecstasy), which permitted them to test hundreds of drivers in a four to five-hour period. The initial drug screen is conducted with the driver in the vehicle using the DrugWipe Twin®. If the initial test is positive, the driver is required to provide a second sample at roadside which is tested using the Alere DDS2®, which tests for a broader range of drugs.³⁹ In conjunction with OF testing, the police demand that the driver submit to a Standard Impairment Assessment (SIA) which includes an interview, and physical impairment, walk and turn, and one-leg stand tests. The SIA is used to assist the police in assessing the driver's level of impairment. If the second OF test is positive for illegal drugs, the sample is sent to the lab for confirmatory analysis. Victoria is one of the few jurisdictions that makes the OF test results admissible in evidence.³³ The processing of drug-impaired driving suspects using OF testing in Victoria is illustrated in Figure 1.

If drug impairment is suspected and OF testing is not available, the police will demand that the driver submit to a SIA. If the results confirm the officers' suspicion, the driver will be taken to the police station and required to provide a urine or blood sample.⁴⁰ The remaining Australian states and the Northern Territory have adopted similar roadside drug testing practices.⁴¹

Figure 1: Random Roadside OF Drug Testing in Victoria



United States: There is tremendous variation in how the individual states approach drug-impaired driving. Most states do not have either per se or zero tolerance drug-impaired driving laws. Sixteen states have a zero tolerance law for some drugs, and six states have per se drug limits above zero for some drugs.⁴² Six states permit the collection of OF from drivers for laboratory testing.

California has long been the leader in addressing drug-impaired driving and was the jurisdiction in which the DRE program was developed in the early 1970s. Currently, some counties in California are piloting OF testing following the completion of the DRE. The suspect's participation in the OF test is voluntary. If the suspect consents, the first sample is taken and analyzed using the Dräger Drug Test 5000®. While the first sample is being processed, a second sample is taken and sent for confirmatory testing.⁴³

OF testing can assist in prosecuting drug-impaired driving cases in two ways. First, unlike blood and urine tests, OF testing is conducted when the vehicle is stopped and provides results that more accurately reflect the driver's drug levels while driving. Second, the OF results are available when the case is filed, resulting in more cases pleading out. In February 2015, a Bill was proposed authorizing roadside OF testing across California, but it failed to pass despite the support of a broad

coalition of road safety organizations and law enforcement. The Bill will be re-evaluated in January, 2016. Currently, three states are reviewing California’s OF testing practices.

D. Current Roadside OF Drug Testing Devices

There are more than a dozen drug testing devices on the international market. Information on the four most commonly used devices is summarized below.

Table 2: An Overview of Four Roadside OF Drug Testing Devices*

Device & Manufacturer	Mechanism	Weight, Size and Test Time	Jurisdictions
Dräger Drug Test 5000®; Dräger Safety AG & CO. KGaA	OF is collected on a swab on a test cassette, which is inserted into a reader.	4.5 kg; 20x26x25 cm; 9 minutes	California; Portugal; Poland; and Germany
Alere DDS2®; Alere Toxicology, Alere Incorporated	A test cartridge is inserted in an analyzer and OF sample is inserted in the test cartridge.	1 kg; Handheld; 6 minutes	Austria; Spain; and Italy
DrugWipe 5S®; Securetec Detektions-Systeme AG	A collection swab is saturated, and paired with a test body. A liquid ampule with buffer solution is added to the test body. The results can be read from test device or the electronic DrugRead reader.	0.7 kg; 21x10x12 cm; 3-8 minutes	Spain; England; France; Belgium; Germany; Finland (DrugWipe 6S®, incl. ketamine); and Australia (Drug Wipe Twin, incl. MDMA and Methamphetamines)
RapidSTAT®; Mavand Solutions	A collection swab with aroma field is saturated, placed in a buffer solution, agitated, and removed. Seven drops of the buffer fluid is added to each well of the test device and left for 4 minutes. The result can be read from the test device or the electronic reader.	1 kg; 14x21x8 cm; 7-12 minutes	Spain; Scandinavia; Italy; Switzerland; and Germany

* Table 2 is based on information obtained from the manufacturers’ websites.

Section 3: An Evaluation of Roadside OF Drug Testing Methods

A. Roadside Validation

Comparing the studies on the effectiveness of the roadside OF testing devices can be challenging as the research protocols vary greatly. Table 3 summarizes five studies evaluating the effectiveness of the four most commonly used devices. Only studies which assessed the sensitivity and specificity of the devices at the roadside and against their own cut-offs were included. Studies which assessed devices against DRUID cut-offs or country-specific per se levels were not included.

Three variables are reported in the table below. The first is the cut-off, which indicates the

drug concentration level at which the device can detect a given drug. It is important to note that for many drugs, THC in particular, the device cut-offs far exceed the DRUID impairment thresholds set out in Table 1. The second variable is the sensitivity of the device. Sensitivity indicates the probability of obtaining a positive test result if the driver has drugs in his or her system at the time of testing. The higher the sensitivities of a device, the lower its false negative rate will be. The final variable, specificity, measures the probability of obtaining a negative result if the driver does not have drugs in their system at the time of testing. The higher the specificity of a device, the lower its false positive rate will be. A roadside drug testing device with high sensitivity and high specificity ensures that drivers with drugs in their system are identified quickly and that drug-free drivers are only briefly detained. OF devices with very low false positive rates may be accurate enough for screening, but their use for evidentiary purposes in criminal cases would likely be successfully challenged.

Table 3: OF Drug Testing Devices: Cut-offs, Sensitivities and Specificities*

		Dräger Drug Test 5000®	Alere DDS2®	DrugWipe 5, 5+, and 5S®	RapidSTAT®
Amphetamines	Cut-off	50 ng/mL	50 ng/mL	50 ng/mL	25 ng/mL
	Sensitivity (%)	40-100 %	---	36.4-100 %	90 %
	Specificity (%)	90-99.8 %	---	33-96.5 %	43-98.6 %
	No. of Studies	3 ^{3,4,5}	0	3 ^{1,3,4}	2 ^{4,5}
Benzodiazepines	Cut-off	15 ng/mL	20 ng/mL	---	25 ng/mL
	Sensitivity (%)	33 %	---	100 %	---
	Specificity (%)	100 %	---	98.8 %	100 %
	No. of Studies	2 ^{3,4}	0	2 ^{3,4}	1 ⁴
Cocaine	Cut-off	20 ng/mL	20 ng/mL	30 ng/mL	12 ng/mL
	Sensitivity (%)	76-97 %	82 %	35.9-100 %	81-100 %
	Specificity (%)	74-100 %	100%	84.4-99 %	99-100 %
	No. of Studies	3 ^{3,4,5}	1 ⁵	4 ^{1,3,4,5}	2 ^{4,5}
Methamphetamine	Cut-off	35 ng/mL	50 ng/mL	25 ng/mL	25 ng/mL
	Sensitivity (%)	50-86.4 %	---	60 %	76.2-100 %
	Specificity (%)	94-100 %	---	96.5-100 %	71-99 %
	No. of Studies	3 ^{2,3,4}	0	2 ^{2,3}	2 ^{3,4}
Opioids	Cut-off	20 ng/mL	40 ng/mL	10 ng/mL	25 ng/mL
	Sensitivity (%)	40-95 %	---	42.9-100 %	100%
	Specificity (%)	91-100 %	---	50-99.8 %	100 %
	No. of Studies	2 ^{2,3}	0	2 ^{2,3}	2 ^{3,4}
Cannabis	Cut-off	5 ng/mL	25 ng/mL	30 ng/mL	15 ng/mL
	Sensitivity (%)	58.3-92.3 %	37.8 %	7.7-93.3 %	72-91 %
	Specificity (%)	47-98.5 %	100 %	29-100 %	9-97 %
	No. of Studies	3 ^{2,3,4}	1 ⁴	5 ^{1,2,3,4,5}	2 ^{3,4}

*The citation numbers in this chart refer to the numbered studies described below in Table 4.

Table 4: Studies Assessing OF Drug Testing Devices

Authors	Year	Test Conditions	Publication Type	Devices Tested
1 Crouch et al. ⁴⁴	2008	Field	Peer - Reviewed	DrugWipe5®
2 Logan et al. ⁴⁵	2014	Field	Peer - Reviewed	DrugWipe5® and Dräger Drug Test 5000®
3 Musshoff et al. ⁴⁶	2014	Field	Peer - Reviewed	DrugWipe5®; DrugWipe5+®; Dräger Drug Test 5000®; and RapidSTAT®
4 Strano-Rossi et al. ⁴⁷	2012	Field	Peer - Reviewed	DrugWipe5+®; Dräger Drug Test 5000®; DDS®; and RapidSTAT®
5 Wille et al. ⁴⁸	2015	Laboratory	Peer - Reviewed	DrugWipe5S®

As Table 3 illustrates, the OF testing devices varied greatly in their sensitivities and specificities and no device had consistently favourable findings across the six drug categories examined. Moreover, large scale studies evaluating devices against national per se laws and DRUID thresholds demonstrated similar variability in results. These studies also concluded that the OF devices are not currently accurate enough to be used independently of other evaluative/testing processes. Wille et al. (2010) evaluated the Dräger Drug Test 5000®, DrugWipe 5+® and the RapidSTAT® against Belgian per se laws. They reported THC sensitivities of 93%, 71% and 71% respectively, and specificities of 71%, 50% and 55%. In terms of cocaine, the sensitivities were 64%, 78% and 75% respectively, and the specificities were 77%, 100% and 88%.⁴⁹ Blencowe et al. (2011) evaluated eight OF testing devices against DRUID cut-offs. The Dräger Drug Test 5000®, DrugWipe 5+® and the RapidSTAT® showed THC sensitivities of 59%, 43% and 56% respectively, and specificities of 90-100% for all three devices. For cocaine, the sensitivities were 50% for the Dräger Drug Test 5000® and 33% for the RapidSTAT®, and the specificities were 100% for both devices. There were no positive results for the DrugWipe 5+®.⁵⁰

B. Assessing Specific OF Drug Testing Devices

Dräger Drug Test 5000®: The device was specifically designed for law enforcement use and tests for seven of the most commonly used drugs. The reader unit weighs just less than 10 lbs and can operate at temperatures of between 4 and 40°C, and can be stored at temperatures of between -20 and +60°C, making it suitable for use in northern climates. In addition to the six drugs listed in Table 3, the device can detect methadone (20 ng/mL). While no roadside OF testing device has yet met the DRUID cut-offs, the Dräger Drug Test 5000® comes the closest to this mark. The device was also found to have the highest sensitivity for THC, when assessed against the DRUID thresholds.⁴⁹

Alere DDS2®: Until recently, the Alere DDS2® was known as the Cozart DDS®. Alere obtained Cozart and has released a new model of their DDS unit. The Alere DDS2® is a handheld device which can identify the six drugs in Tables 3. The device can be purchased in the UK, Germany,

Italy, Spain, and Australia. The company has offered trials of the device in other countries to encourage uptake. The test operates at temperatures of between 5 and 35°C, and can be stored at temperatures of between -20 to +45 °C. The handheld reader eliminates the training required for on-site individual interpretation of the test results. Early studies reported mechanical issues with the test cartridges, but the recent studies of the most current DDS devices found no such problems.⁵¹

DrugWipe 5S® and 6S®: Securetec’s most recent OF testing products are the DrugWipe 5S® and 6S®. The latter product now includes an immunoassay for benzodiazepines. If the handheld reader (DrugRead®) is not used, the officer is required to interpret the results of the DrugWipe test. The test must be conducted at temperatures of between 5 and 40°C, and the test units must be stored between these temperatures. The DrugWipe device only requires a small amount of OF (20µL) which is particularly advantageous for testing drug-impaired suspects who may experience “dry mouth.”⁴⁸ Evaluative data for the DrugWipe 6S® are not available. However, the sensitivity for cannabis of the DrugWipe 5S® sharply decreased after 80 minutes, despite the drug’s ongoing impairing impact. Thus, the DrugWipe 5S® resulted in higher false negative results as the time period from cannabis use to testing increased.^{48,52}

RapidSTAT®: In 2006-2007, Mavand created the RapidSTAT® which can detect the six drugs in Tables 3 and Methadone. The RapidSTAT® is a small, handheld test that can be read manually or with an electronic reader. Roadside readers range in weight from .28kg to 1kg (digital read-out). The manufacturer has indicated that the device operates optimally at temperatures between 2 and 30°C. Recent research has demonstrated that the RapidSTAT® has high sensitivity for opiates when compared to blood samples.⁴⁶

C. OF Drug Testing Technology: Challenges and Benefits

There will never be a 100% correlation in the drug readings from OF, blood and urine. The length of time between consumption and testing impacts the results. If an impaired driver used the drug shortly before testing, it may be found in the driver’s blood and OF, but not in his or her urine. If a suspect took the drug well before being tested, it may only be found in his or her urine and possibly sweat. This challenge is not attributable to the testing devices per se, but rather should be considered in determining best practice when testing for impairment.

Another often noted issue is whether OF testing devices should be used with or without a reader. Devices that can be used without readers, such as the DrugWipe 5S®, are smaller, less cumbersome and easier to store. However, the interpretation of the results is somewhat subjective and may be even more challenging when it is dark. Given that as many as 70% of traffic stops requiring OF testing occur outside of daylight hours, this is a legitimate consideration.⁵³ Devices with readers, such as the Dräger Drug Test 5000®, are larger and more cumbersome but the results are more objective as they are generated by the device. Moreover, the results can be stored for reference and read in low-light conditions.⁵¹ A consistently noted challenge is that a suspect’s ability to provide OF may be affected by various factors, including drug use. A number of legal and illegal drugs may result in dry mouth which can limit the ability to collect sufficient OF for testing.^{33,54}

Roadside OF testing is becoming accepted for opioids, methamphetamine (including ecstasy) and amphetamines, and to a lesser extent for cocaine and its metabolites. However, detection issues remain for benzodiazepines and cannabis.

The ability to screen for alcohol at roadside has been a powerful tool in apprehending and prosecuting drinking drivers. It has also had a significant deterrent impact by increasing the likelihood of being caught. Roadside drug tests would encourage the police to lay more charges. Without an on-site tool to confirm their suspicion of drug impairment, the police are often reluctant to charge suspected drivers. Roadside drug tests would predictably save both time and money by simplifying drug enforcement procedures and by limiting the need for drug recognition experts. If the technology continues to develop and Canadian law changes accordingly, roadside OF testing could substantially minimize laboratory costs by reducing the number of blood and urine samples that have to be analyzed. In addition, implementing roadside OF drug screening, assuming sensitivity levels remain high, would quickly identify drug-free drivers and reduce the time that they are inconvenienced by having to submit to a full DRE. Evaluation studies have noted that most subjects were impressed by the roadside OF drug testing results, particularly when the results were read electronically.³³

Section 4: Feasibility of Adopting Roadside OF Drug Testing

A. Testing Costs

Undertaking a cost analysis of roadside OF testing devices is challenging because the unit price varies with size of the order. Moreover, the companies do not readily disclose their prices. However, studies have indicated that the unit prices range from \$14 to \$45 per device that can test for 5-7 drugs. The readers cost from \$2,800-\$6,000,⁵⁵ but they may be provided at little to no cost if a sufficient number of test cartridges are purchased. Federal and even provincial legislation authorizing roadside OF testing may induce the manufacturers to lower their prices due to the higher anticipated volume of sales.

B. Availability and Suitability

Manufacturers are eager to have their technology adopted by law enforcement and thus availability is not an issue. More concerning is whether the devices are appropriate for Canada's extreme climate. The devices will have to meet the operational standards presently being set by the federal Department of Justice, which will include environmental specifications relating to humidity, dust, temperature, and other matters. While it is reasonable to expect the OF collection to take place in temperatures above freezing, adopting devices such as the DrugWipe® which cannot be used or stored at temperatures below +5°C would require the police to establish clear protocols for shipping, storing and using the device.

C. Ease of Use and Training: Roadside OF Drug Testing and DRE

Police officers from 21 European countries were asked about various aspects of roadside drug testing, taking into consideration the reality of roadside stops. The officers reported a preference for OF as the test medium, over sweat or urine, due to the ease of collection, its minimally invasive nature and the low risk of infection. The officers indicated that testing should take no more than 10 minutes and generally favoured devices that could test for a number of drugs simultaneously.⁵³

OF drug testing technology has been designed to require minimal training and be easy to use across a range of environments, including roadsides and workplaces. On their websites, the manufacturers generally offer training to members of an organization that purchase their devices. Organizations are encouraged to adopt an internal “train the trainer” model to train the remaining staff members who will be using the device. If OF testing devices are used without readers, additional training in interpreting the results may be required.

Training all frontline officers in using a roadside OF testing device is far more feasible than training more drug recognition experts. The program to become a drug recognition expert requires 16 hours of pre-study, 56 hours of class time and 40-60 hours of field work,⁵⁶ at a cost of approximately \$17,000. In addition to being far less expensive, training officers in OF testing would help to address the unequal distribution of drug recognition experts across Canada and between rural and urban communities.

Table 5. OF Drug Testing and DRE: Assessment Outcomes and Strengths

	Assessment Outcome	Strengths
Drug Recognition Expert	Drug Impairment	<ul style="list-style-type: none">• Detects impairment from a wide range of lawful and illegal drugs
Roadside OF Drug Testing	Drug Presence	<ul style="list-style-type: none">• Ease of use (minimal training)• Available at roadside• Low cost (relative to DRE)• Detects presence of 5-7 of the most common classes of drugs

Section 5: Moving Forward

A. Technical Considerations

Roadside OF drug testing has been shown, through this review and others, to be useful in identifying drug-impaired drivers.⁵¹ Sensitivity thresholds are getting closer to levels associated with impairment for the most commonly used drugs in Canada. However, there is an ever-growing market for synthetic/designer drugs, which poses challenges for even the most sophisticated laboratories. While roadside OF drug testing has improved tremendously since its inception in the 1990s, it is not yet reliable enough to completely replace the DRE program, or the accuracy and breadth of laboratory blood/plasma testing. While all devices show promising results, no single device has emerged as the

clear leader in OF drug testing.

In moving forward with OF testing it will be important to consider the primary objectives of testing, namely ensuring that the test accurately identifies drivers under the influence of drugs and does not falsely identify drivers who are not under the influence of drugs. In other words, the devices must have both high sensitivities and specificities. The key question in selecting an appropriate device and per se limits, rests on the balance between missing drivers who are impaired versus wrongly detaining and charging drivers who are not impaired.

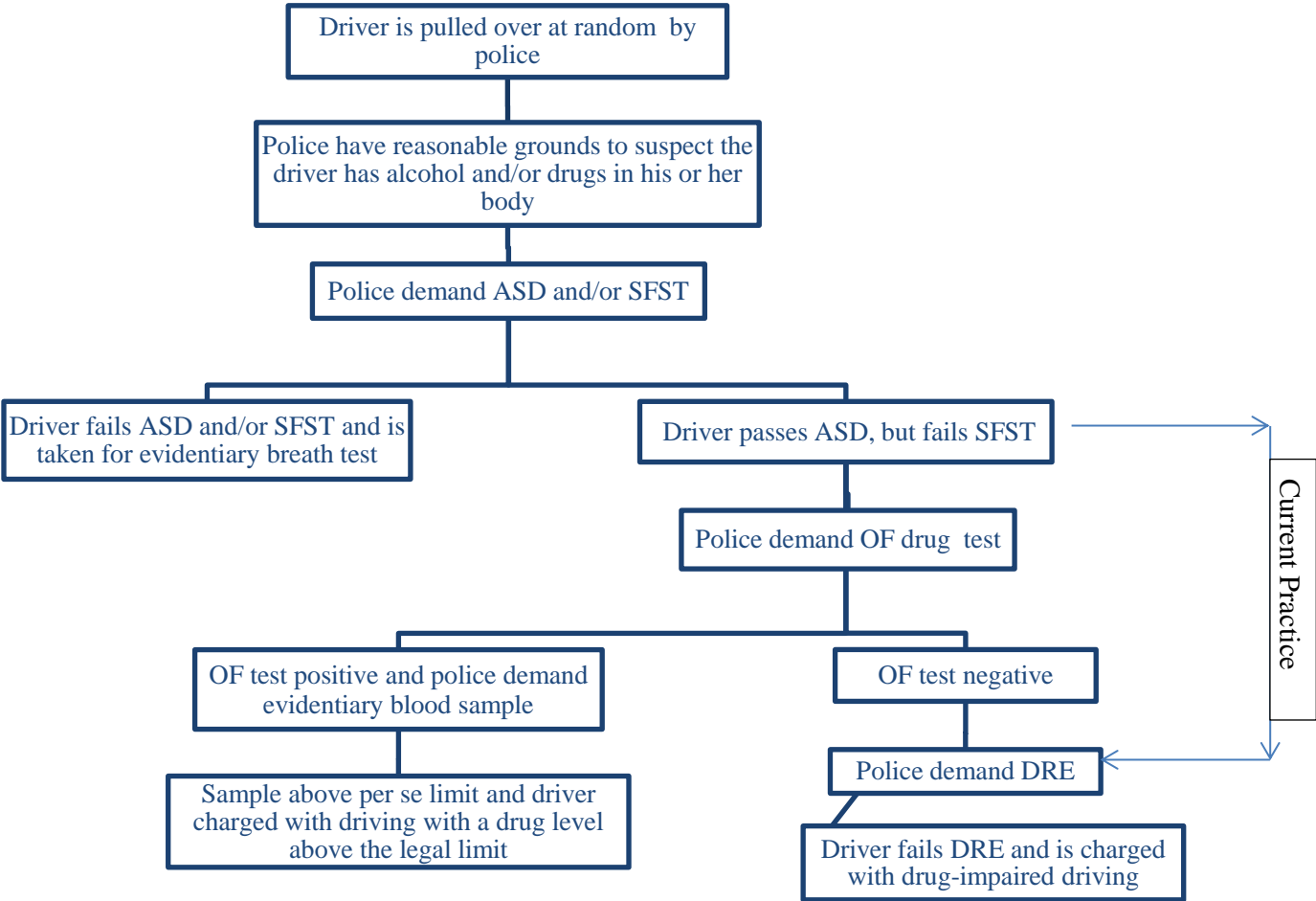
The Dräger Drug Test 5000® and the Alere DDS2® are the most appropriate in the Canadian context, given their performance in regard to cannabis, the most commonly used illicit drug. Both devices take less than 10 minutes to administer, meaning that drivers who test negative would only be detained for a relatively short period of time. The Dräger Drug Test 5000® has achieved the lowest detection threshold for cannabis (5 ng/mL), while maintaining comparable or superior sensitivities to other devices. The Dräger Drug Test 5000® also has a low threshold for cocaine (20 ng/mL), the second most commonly used illicit drug. The Alere DDS2® also has some advantages, in that it is handheld and more portable than the Dräger reader system. However, while DrugWipe 6S® has reported thresholds of 10 ng/mL for THC, there is not yet sufficient evidence to evaluate its sensitivities and specificities at this cut-off. This device should be re-evaluated when such evidence is available.

B. Implementation Considerations

Canada does not have the infrastructure to support the Australian OF testing model, whereby OF gathered at roadside would be the medium used for confirmatory lab testing. Canadian laboratories are set up to test blood for this purpose and lack capacity to conduct confirmatory OF analyses. Consequently, blood will continue to be the evidentiary medium for drug-impaired cases.⁵⁷ Currently, OF testing devices would be most useful as preliminary screening tools in cases of suspected drug use. Thus, OF devices would be used in the same way ASDs are used in cases of suspected alcohol consumption. OF testing could be of particular benefit in rural and other areas in which a drug recognition expert is not readily available, but where being able to make a timely demand for a blood or urine sample as a result of a positive OF test would increase the likelihood of a conviction.

In order to implement roadside OF testing at the national level, drug limits would have to be established, the testing devices would have to rigorously assessed and approved for use by the Attorney General, and the *Criminal Code* would have to be significantly amended. Although a zero tolerance approach for driving is warranted for LSD, PCP and some other drugs, per se limits would need to be established for many other drugs. As in the United States, one province could serve as a test site for implementing roadside OF testing. The province could also enact amendments imposing administrative fines, and short-term licence suspensions and vehicle impoundments for violations. Subsequent violations could be subject to escalating sanctions and mandatory drug assessments. Outlined below is a model of how roadside OF drug testing could be implemented to reduce demand for, rather than replace, the DREs.

Figure 2. Proposed National Model for Roadside OF Drug Testing in Canada



Conclusion

Roadside OF drug testing shows promise in reducing the incidence of drug-impaired driving in Canada. While the technology has improved considerably, concerns remain over sensitivity and specificity thresholds. Also of concern are uncertainties about impairment cut-offs relative to agreed-upon standards for driver impairment. Granted, administrative bodies in Canada are working to set per se standards for a range of common drugs. The lack of laboratory capacity/infrastructure for OF testing will likely prevent its use as a stand-alone evidentiary test in drug-impaired driving cases for the foreseeable future. Given the current state of the technology and infrastructure, the provinces could use OF testing to screen drivers for drug use and impose appropriate administrative sanctions. Although advances are certain to be made, the current technology does not support the complete replacement of the DRE. With political will and appropriate federal and/or provincial legislation, roadside OF testing could be used as an effective complement to the DRE protocol in addressing drug-impaired driving.

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