DRUG RESEARCH ON LAND TRANSPORT ACT BLOOD SPECIMENS
Prepared by the Institute of Environmental Science and Research Limited

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Section 209A of the Land Transport Act 1999

Section 209A of the Transport Act 1998 allows Land Transport Act blood specimens to be analysed or reanalysed, by the approved laboratory (in this case ESR), for research purposes relating to alcohol and drugs. The results of research analyses cannot be used in any proceedings for an offence, and cannot be published in a way that would identify individuals. Using these provisions the study targeted drug use by drivers from three groups.

1. Drivers hospitalised following a crash (a section of the driving population not previously studied).
2. Drivers who were found to be impaired by the Police Compulsory Impairment Test and had used methadone.
3. Drivers whose blood samples were sent to ESR under the drug-driving legislation but no drugs were detected in their blood.

Due to ethical protocols relating to this research, it is not possible to determine whether drivers who had used methadone or other prescription medicines had been prescribed these medicines for legitimate therapeutic purposes. This would have required access to those drivers' personal medical records which was outside the scope of this research.

Group 1. Hospitalised drivers

Blood samples that had taken from 453 drivers, who had been hospitalised following a crash, and were deemed to be at fault for the crash, were analysed. At-fault drivers are defined in the Crash Analysis System (CAS) as the driver deemed to have the primary responsibility for a crash. This is based on the crash movements and cause factors assigned in CAS. It is not based on legal liability or court conviction.

A spreadsheet was provided by the Ministry of Transport (MOT) giving names of drivers, dates of crashes and policing areas for the calendar year 2010. The drivers had sustained serious or minor injury and were deemed to be at fault for the crash. The information provided enabled matching to blood samples received in our blood alcohol laboratory for alcohol analysis.

At the time of analysis the blood samples taken prior to May 2010 had already been destroyed. Blood alcohol samples are destroyed one year after a certificate has been issued in accordance with the provisions of section 74(8) of the Land Transport Act. Analyses were carried out on blood samples taken from the months May 2010 to December 2010.

The request had been made to test the blood for drug use in approximately the same number of drivers who had used alcohol as had not. In keeping with the legislation that was current at the time the study commenced, drivers with alcohol levels less than 30 milligrams per 100 millilitres were classified in the "no alcohol" group.

It was clear during the attempt to match blood samples received to the named drivers on the MOT spreadsheet, that ESR does not receive blood samples from all injured drivers to analyse for alcohol. On average ESR received blood samples from 42% of seriously injured at fault drivers from the seven month period covered (Table 1).

Table 1 Numbers of at-fault seriously injured drivers

	Number with serious injury	Number of blood samples received	Percentage
May	81	34	42%
June	66	27	41%
July	74	29	39%
August	66	33	50%
September	56	19	34%
October	69	34	49%
November	85	33	39%
December	88	39	44%

Fewer samples were received from drivers who had sustained minor injuries (Table 2). On average ESR received blood samples from 11% of at fault drivers who had minor injuries from the seven month period covered.

Table 2 Numbers of at-fault drivers with minor injuries

	Number with minor injury	Number of blood samples received	Percentage
May	398	32	8%
June	382	31	8%
July	451	50	11%
August	348	43	12%
September	352	36	10%
October	338	46	14%
November	323	36	11%
December	404	46	11%

Screening tests for the possible presence of a range of illicit and licit drugs were carried out on the blood samples using a Randox immunoassay array. This array is designed to detect use of cannabis, opiate type drugs, amphetamine type drugs, benzodiazepine type drugs, cocaine, phencyclidine, barbiturate type drugs, buprenorphine, tricyclic antidepressant drugs and methadone.

<u>Drugs detected by the Randox screening test</u>

The Randox immunoassay device signals the presence of a drug in a blood sample by a change in chemiluminescent emission in an array of cells. The individual cells target a specific drug or a drug family.

The cells that are specific and detect use of only one drug are those testing for evidence of the use of cannabis, cocaine, methadone, phencyclidine (PCP, angel dust), MDMA (methylenedioxymethamphetamine, Ecstasy) and buprenorphine.

Other cells can detect a number of related drugs. This type of test can not determine which drug is actually present.

The cell designed to test for amphetamine will also detect use of BDB (benzodioxolylbutanamine, an amphetamine analogue), MDA (methylenedioxyamphetamine, an MDMA analogue) and phentermine. The cell designed to test for methamphetamine will also detect MDMA (Ecstasy), MBDB (methylbenzodioxolylbutamine, a methamphetamine analogue) and fenfluramine. It should also be noted that methamphetamine is metabolised to amphetamine in the body so a positive methamphetamine and amphetamine test together is likely to indicate methamphetamine use only.

The tricyclic antidepressant drug assay will detect use of such drugs as amitriptyline, nortripityline, clomipramine, dothiepin and doxepin. Tricyclic antidepressant drugs often have sedative side effects.

The barbiturate assay will detect use of phenobarbital, secobarbital, pentobarbital, amobarbital, barbital, batalbital, alphenal, bubabarbital, cyclopentobarbital and hydroxyphenobarbital.

The tests for use of the group of sedative type drugs known as benzodiazepine drugs are covered by two separate cells. One cell detects the use of flurazepam, alprazolam, bromazepam, chlordiazepoxide, clobazam, flunitrazepam, diazepam, estazolam, lormetazepam, midazolam, nitrazepam, nordiazepam, prazepam, temazepam and triazolam. The other cell detects use of clonazepam and lorazepam.

The opiate assay will detect evidence of the use of heroin, morphine, 6MAM (6-monoacetylmorphine, a compound formed in the body after the use of heroin), codeine and hydromorphine.

The opiate, benzodiazepine and barbiturate assays all detect drugs that might be administered during emergency treatment in hospital or by ambulance personnel. When the tests for these drug groups are positive it is not possible to determine if they were administered to the driver after the crash or if they were present in the drivers' blood before the crash.

The analytical technique used does not confirm drug use or identify which drug might have been used. As with road side testing devices, the technique does not confirm drug use to a standard that is required for a court prosecution. All the drug use discussed in this section must be interpreted as 'indications of possible use of the drug'.

Results

Analyses were carried out on 453 injured drivers who were deemed to be at-fault for the crash in which they were injured. Two groups of drivers were considered, those who had used alcohol and those who had not (Table 3). The target was to look for drug use in a similar number from each group. The legislation current at the time the blood samples were taken was such that the drivers with alcohol levels of less than 30 milligrams per 100 millilitres were placed in the "no alcohol" group.

Table 3 Numbers of injured drivers with evidence of drug and alcohol use

	No drugs detected	Drugs detected	Drugs not administered by medical personnel	Drugs possibly administered by medical personnel
225 drivers with no alcohol*	87 (39%)	138 (61%)	63 (28%)	75 (33%)
228 drivers with alcohol	108 (47%)	120 (53%)	93 (41%)	27 (12%)

*No alcohol includes drivers with a blood alcohol level below 30 milligrams per 100 millilitres

225 drivers who had no alcohol in their blood were tested for drug use. 87 (39%) of these drivers showed no evidence at all of drug use. Of the 138 (61%) drivers who showed evidence of drug use, it is possible that 75 (33%) may not have used a drug prior to the crash. The type of drug detected was such that it may have been administered a drug by medical personnel for pain relief or prior to surgery. At least 63 (28%) drivers, who had not used alcohol, had indications of use of a drug in their blood. The range of drugs tested for are drugs that would be expected to impair driving skills.

228 drivers who had alcohol in their blood at levels greater than or equal to 30 milligrams per 100 millilitres were tested for drug use. 108 (47%) showed no evidence of drug use apart from alcohol. Of the 120 (53%) drivers who showed evidence of drug use in addition to alcohol, it is possible that 27 (12%) may not have used the drug prior to the crash. The drug may have been administered by hospital personnel. At least 93 (41%) of injured drivers who had used alcohol, may have also used another drug that could impair driving skills.

As described earlier, the Randox tests show indications, but not proof, of the use of a drug or one of a drug family. It should be noted that this set of tests does not detect all drugs that might impair the ability to drive safely. Table 4 gives the number of positive tests for each drug or drug family. The number of positive tests when added to the number of negative tests exceeds the number of sample analysed. This is because it is not uncommon for evidence of the use of more than one drug may be detected in a single sample.

Table 4 Drug use detected in injured drivers

Drug classes as defined by the Randox test	**No alcohol (less than 30 mg/100mL)**	**Percentage**	**Alcohol detected**	**Percentage**
Cannabis	54	24%	90	40%
Methamphetamine	12	5.3%	3	1.3%
Amphetamine	4	1.8%	0	0
Methadone	5	2.2%	2	0.9%
Benzodiazepine 2	6	2.7%	2	0.9%
Tricyclic antidepressants	1	0.4%	1	0.4%
MDMA	0	0	1	0.4%
Buprenorphine	0	0	0	0
Phencyclidine	0	0	0	0
Cocaine	0	0	0	0
Opiates*	109	48%	56	25%
Barbiturates*	3	1.3%	1	0.4%
Benzodiazepine 1*	25	11%	16	7%
No drugs detected	87		108	
Number of samples analysed	225		228	

*Very likely that a proportion of these are from hospital administration of the drugs

Because this assay can not distinguish between hospital administration of a drug and use by a driver prior to a crash, it is difficult for some drugs (*opiates, benzodiazepine and barbiturates) to assess if use of these types of drugs by this group of drivers is a problem.

There were indications of cannabis use in 24% of the drivers who had not used alcohol and in 40% of the drivers who had used alcohol. These results may be compared with the study carried out in 2004 on 1999 uninjured drunk drivers. This study found that 35% of drunk drivers may have used cannabis [Alcohol and other Drug Use in New Zealand Drivers 2004 to 2009, Dr Helen Poulsen (ESR) May 2010]. From the same report, further comparison can be made with drug use determined in deceased drivers. Blood samples taken from 1046 deceased drivers were analysed for drug use. 314 (30%) of deceased drivers had used cannabis.

There were indications of methamphetamine use in 5.3% of injured drivers who had not used alcohol and in 1.3% of drivers who had used alcohol. The 2004 study of uninjured drunk drivers found 0.4 % may have used methamphetamine. 44 deceased drivers had used methamphetamine.

2010-2011 Impaired drivers

In the first two years of drug-driving legislation starting November 2009, 540 blood samples have been received at ESR for analysis. 476 blood samples had been taken from impaired drivers, those whose performance on the Compulsory Impairment Test was unsatisfactory, and 64 had been taken from drivers hospitalised following a crash. It must be noted that the Police documentation accompanying the samples generally specifies which drugs the Officer in Charge wants the ESR Toxicology laboratory to analyse for.

Group 2. Drivers with methadone in their blood

Patients on the methadone maintenance program are required to sign a contract with their treatment provider that they will refrain from the use of other drugs without approval. Use of methadone with other drugs may result in impairment of function. Because of the specificity of the request for analysis made by the Police, commonly only one drug is detected and reported for these drivers..

It is possible that some drivers who were identified as having used methadone had obtained it and other detected prescription medicines from illicit sources rather than through a methadone maintenance program. Over the two year period 54 drivers were identified as having used methadone. Additional analyses were carried out to cover the full range of medicinal and illicit drug detection available in our laboratory. The results of these analyses showed every one of the drivers who had used methadone also had at least one other drug in their blood.

Table 5 shows that these drivers who are using methadone and who are found to be impaired are frequently using more than a single additional drug. The additional drugs detected are all drugs that by themselves might impair driving skills.

Table 5 Number of drugs used by methadone using drivers

Number of drugs detected (including methadone)	**Number of drivers using multiple drugs**
1	0
2	13
3	21
4	12
5	7
6	1

It is reported in the scientific literature that once a person is established on the methadone maintenance program, they become tolerant to a number of the side effects and their ability to drive safely should not be impaired. However, this tolerance is lost if other drugs are taken with the methadone. 39% (21) of the 54 methadone using drivers had used two additional potentially impairing drugs. One driver was found with five other drugs that could impair driving, in addition to the methadone.

As shown in Table 6, in most cases the additional drugs were sedatives of the benzodiazepine family, that is, diazepam, clonazepam, oxazepam, temazepam, nitrazepam, lorazepam and triazolam. 73 of the 123 additional drugs detected are taken specifically for their sedative effects. These include zopiclone and the benzodiazepines.

Table 6 Drugs detected in addition to methadone, in drivers with methadone in their blood

Drug	**Number of times detected**
cannabis	32
methamphetamine	5
opiate family	6
morphine	2
zopiclone	6
diazepam	27
nitrazepam	2
citalopram	3
clonazepam	22
oxazepam	3
lorazepam	3
temazepam	3
triazolam	7
venlafaxine	1
cyclizine	1

Cyclizine is generally taken as an anti-nausea medication and venlafaxine and citalopram are prescribed as antidepressants. Eight drivers[1] had used a drug from the opiate family, a drug family that should not be taken with methadone. Opiates should not be taken with methadone without medical supervision because the combined depressant action on the central nervous system could result in coma or death. For two drivers this opiate drug was confirmed as morphine. For the other six drivers who may have used an opiate type drug, the specific drug was not identified.

Cannabis use was common with 32 of the 54 drivers using the drug. Five of the methadone drivers had also used methamphetamine.

Group 3. Drivers tested under drug-driving legislation and reported as not detected

In the two years since the drug-driving legislation was enacted, a number of blood samples have been reported by ESR as not containing the drugs requested. A Police 1120 form accompanies all blood samples that require analysis under the drug-driving legislation. On this form the Police specify which drugs they wish the sample to be analysed for.

These "not detected" blood samples fall into two groups:

1. Drivers who have been hospitalised and therefore can not undergo the Compulsory Impairment Test. These drivers are generally tested only for evidence of the use of Class A controlled drugs as defined in the Misuse of Drugs Act.
2. Drivers who have had a blood sample taken following unsatisfactory performance on the Compulsory Impairment Test.

Over the two year period 45 drivers have been reported as "requested drugs - not detected". Nineteen of the drivers had been hospitalised and 26 were unable to satisfactorily complete the Compulsory Impairment Test. Further analyses were carried out on these blood samples covering the full range of medicinal and illicit drug detection available in our laboratory.

On receipt, at ESR, of blood samples taken from hospitalised drivers, the blood is initially analysed for the presence of alcohol. Then the blood is analysed for the presence of the drug or drugs specified by the Police. For a hospitalised driver to be charged under the drug-driving legislation a Class A controlled drug, such as methamphetamine, needs to be detected. Table 7 shows which drugs were detected when further analyses were carried out for drugs beyond the original request.

[1]This number consists of the six drivers (listed in Table 6) who had used drugs from the opiate family and two drivers who had used morphine.

Table 7 Drugs detected in hospitalised drivers

Blood alcohol result	Drug detected	Blood alcohol result (mg/100mL)	Drug detected
0	cannabis	15	lorazepam
0	opiate	45	cannabis
0	none detected	59	opiate lignocaine midazolam
0	methadone clonazepam	60	cannabis opiate
0	cannabis	80	none detected
0	triazolam	145	none detected
0	opiate cannabis	172	opiate (given morphine)
0	none detected	178	cannabis
0	cannabis		
0	cannabis opiate lorazepam venlafaxine		
0	cannabis opiate		

It should be noted that the possible presence of opiate type drugs in the blood from seven of these drivers could be due to administration by medical personnel. Lignocaine and midazolam are generally administered in hospital.

Eight of the hospitalised drivers had some alcohol in their blood. Five had alcohol levels below the legal limit for their age.

Nine of the drivers had possibly used cannabis. Use of cannabis by these drivers has not been confirmed. The other drugs detected were methadone, clonazepam, triazolam, lorazepam and venlafaxine.

The presence of a drug in a person's blood does not mean that they were impaired by that drug. For this reason, hospitalised drivers are only charged under the drug-driving legislation if their blood contains a Class A controlled drug. Since the legislation was enacted 24 hospitalised drivers have been found with methamphetamine in their blood.

There were 26 drivers who had been stopped due to poor driving and who could not satisfactorily complete the Compulsory Impairment Tests and whose blood did not contain the drugs that Police requested ESR to analyse for. Further analyses were carried out on these blood samples covering the full range of medicinal and illicit drug detection available in our laboratory.

For two of these drivers, no drugs were detected, including their prescribed medication. The absence of the drugs in these cases could explain their state of impairment.

On further analyses, only 5 blood samples contained potentially impairing drugs. These were a combination of cannabis, methamphetamine and sedatives (clonazepam, diazepam and triazolam).