

## **Characteristics of Fatal Crashes Involving Drugs (including alcohol) in Victoria and Associated Contributory Factors**

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### **Abstract**

The incidence of alcohol and illicit drug-related crashes continues to represent a significant road safety concern in Victoria. The advent of the random drug testing program to complement long-running breath test operations highlights the high degree of priority placed on addressing this issue. There is however limited information concerning the individual characteristics of those driving with alcohol and other drugs in their system. Using the National Coroners Information System (NCIS), the aim was to explore person-based characteristics of those killed. The Victorian Road Crash Information System was used to supplement and add value to these observations. For the year 2004, 97 drivers, motorcyclists and pedestrians were identified as returning a positive toxicology finding for alcohol and / or other drug. Notably, 49% of these tested positive to alcohol followed by  $\Delta$ 9-THC (20%), and amphetamines (9%); emphasis was therefore placed on alcohol and THC in this paper. Polydrug use was relatively common. Those killed were predominantly young males (90% alcohol; 80% THC), with factors such as unemployment, prior offence history, substance abuse, psychiatric illness, and intentional self-harm highlighting the challenge faced by road safety enforcement agencies and those designing enforcement and educational campaigns. The use of NCIS also permitted the exploration of contributing crash factors, as noted by the Coroner, with excessive speed noted in 25% of alcohol cases in contrast to 10% of THC cases. Despite NCIS primarily serving as a tool to assist the coronial process, the information contained therein, particularly when linked with crash databases, represents a powerful research tool.

**Keywords:** traffic, fatality, crash characteristics, prevalence, contributory factors.

The association between alcohol impairment and the increased risk of involvement in traffic crashes is well established, with alcohol acting to impair the necessary cognitive and motor skills required to perform safely in the road transport system.<sup>1</sup> Despite the success of enforcement programs<sup>2</sup>, alcohol-related crashes continue to represent a substantial proportion of the Victorian road toll. For instance, analysis of the Victorian police reported casualty crash database shows that for 2004, 21% of fatality crashes and 8.3% of serious injury crashes involved a road-user (excluding passengers) with a BAC level of greater than 0.05 g/100ml. Recidivist offenders generally represent approximately 25% of detected drink-drivers.<sup>3</sup>

In addition to the high levels of alcohol involved in fatality crashes, drugs other than alcohol represent a significant road safety concern. In a sample of 3398 fatalities in Victoria, New South Wales (NSW), and Western Australia (WA) for the period 1990-1999, drugs other than alcohol were detected in 26.7% of drivers killed, with cannabis ( $\Delta$ 9-THC, THC-acid) being the most prevalent substance detected.<sup>4</sup> In a sample of 436 injured drivers presenting to The Alfred between December 2000 – April 2002,  $\Delta$ 9-THC was detected in 7.6% of drivers, and were almost exclusively among those aged 15-44 years of age, while opiates (excluding those administered as treatment) were detected in 11% of drivers, with amphetamines detected in 4% of cases.<sup>5</sup> The work of Drummer<sup>6</sup>, as well as others<sup>7-9</sup> has shown that the presence of illicit drugs in fatally injured drivers is associated with increased crash culpability, while others have reported an increased likelihood of being involved in a crash for drugs including, but not limited to  $\Delta$ 9-THC (i.e., the active constituent of cannabis), opiates, and benzodiazepines relative to drug-free drivers.<sup>10-13</sup>

In response to this road safety concern, the Victorian Parliament legislated to permit roadside random drug testing to complement existing breath test operations conducted by Victoria Police\*. The initial focus of the drug testing program was the detection of methylamphetamine and  $\Delta$ 9-THC, and in 2006 was extended to include (3, 4-Methylenedioxy-N-Methylamphetamine -MDMA), more commonly known as 'ecstasy'. According to a Victoria Police media release (28<sup>th</sup> February 2006) there were 13,176 tests conducted with one in 40 drivers and one in 68 truck drivers tested in the year ending 12<sup>th</sup> December 2005 returning a 'positive' test, in contrast to 1 in 265 drivers detected at random breath test operations for the same period, perhaps reflecting a more targeted testing approach.<sup>14, 15</sup>

Despite the considerable road safety problem that drink-drivers and drug-drivers represent, there is limited Australian research concerning the person-based characteristics of those involved in such crashes, such as employment status, location of use, and offence history<sup>16</sup>. This type of information is essential to ensure for optimal targeting of drug-testing programs and the most efficient use of policing resources. Past research, mostly from Europe, indicates that single-vehicle crashes, failure to use safety equipment such as seatbelts and helmets, higher speeds, and time of day are important variables for alcohol and drug-related crashes<sup>4, 6, 17-19</sup>, while male gender, lower levels of education, age, history of alcohol and / or drug abuse, prior traffic violations and criminal offence history are important individual characteristics associated with the pattern of use.<sup>17, 20-22</sup> A recent Victorian study<sup>23</sup> reported that males, unemployment, being unlicensed, and prior offence history were key variables among a sample of 460 drivers convicted for driving while impaired. Finally, in an important study of injured drivers in Denmark, Bernoff<sup>24</sup> characterised three sub-groups of drug-impaired drivers, these being:

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\* The Road Safety (Drug Driving) Act (Vic) 2003 permits the random drug testing of drivers' of motor vehicles (or being in charge of a motor vehicle) for prescribed illicit substances, these being methylamphetamine and delta 9-tetrahydrocannabinol, detected at any concentration in blood or oral fluid; it is also an offence under the Act to fail to volunteer or refuse the provision of a sample. The Act was given Royal Assent on 9 December 2003, came into effect 1 December 2004 with the first tests being conducted on 13 December 2004. The main purpose of the Act was to amend the Road Safety Act (Vic) 1986 to provide for random drug testing for drivers and create new offences for failing a drug test. The random drug testing program was extended under the provisions of the *Road Safety (Drug Driving) Act (Vic) 2006* on 9 May 2006 to include 'ecstasy' (3, 4-Methylenedioxy-N-Methylamphetamine -MDMA).

1. Young, well functioning men who typically used illegal drugs (amphetamines or cannabis) on weekends or evenings. This group generally did not mix drugs with alcohol and do not believe drugs are a traffic safety risk;
2. Middle aged men and women (35-54 years old) who have an alcohol and/or medicine dependency that has resulted in them ceasing employment. This group mix alcohol and prescribed drugs and are generally unaware of the resultant traffic safety risks; and
3. Older drivers (55 and older) who are still working or retired. This group's drug use was restricted to prescribed or over the counter medicines, and they generally do not combine medicines with alcohol.

Given these considerations and research demonstrating that patterns of alcohol and other drug (AOD) use vary according to a range of vehicle and person-based factors, the broad objective of this research was to examine the characteristics of drug (including alcohol)-related fatality crashes in Victoria. Using the National Coroners Information System (NCIS) as the primary data source, coupled with the Victorian Road Crash Information System (RCIS) database for police reported casualty crashes, it was anticipated that rich narrative information concerning the contribution of driver error, individual characteristics (i.e., unemployment, occupation), environmental conditions, the surrounding road environment, and a range of other factors for the occurrence of the crash could be gathered. By examining the characteristics of individuals involved in these crashes, it was expected that the information gathered would be useful in designing targeted prevention and enforcement programs, whilst at the same time examining the utility of NCIS as a tool to inform enforcement programs. Particular emphasis in this paper will be placed on THC and alcohol, with the intent of this paper being to present in broad terms early findings of this on-going research program.

## **Method**

### *Data Sources*

#### *National Coroners Information System (NCIS)*

The NCIS database was the principal database used in this report. The NCIS database is web-based storage ([www.ncis.org.au](http://www.ncis.org.au)) and retrieval system maintained by the Victorian Institute of Forensic Medicine. NCIS contains coronial records for all Australian states and territories<sup>†</sup>, and includes contextual data surrounding each death, demographic data, medical cause of death, mechanism involved in the death, and full text reports. The full-text reports are: police summary of circumstances, toxicology, autopsy reports and a coronial finding. The NCIS<sup>25</sup> reports that the document attachment rates for Victoria in the 2004/2005 FY were 100% for findings documents, 92% for autopsy documents, 100% for toxicology documents, and 98% for police narrative documents. NCIS cases also contain ICD-10 Cause of Death codes (primary and underlying codes), ASCO Occupation codes, and ASGC Residential location codes supplied by the Australian Bureau of Statistics.

*Case criteria:* NCIS cases that met the following criteria formed the basis of analysis:

1. Closed cases
2. Deaths due to land transport crashes
3. Drivers (all vehicle types), motorcyclists, pedestrians, and cyclists
4. Aged 16 years and older
5. Year of crash: 2004
6. Year of death: 2004
7. A positive toxicological result for any substance

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<sup>†</sup> Data for all states (except Queensland) and territories commenced from 1 July 2000; Queensland data commenced from 1 January 2001. NCIS is funded as a Commonwealth and State initiative, with funding from The Justice Departments of each State/Territory; The Commonwealth Department of Health and Ageing; The Australian Institute of Criminology; The Office of the Australian Safety and Compensation Council (known previously known as the National Occupational Health and Safety Commission), and The Australian Competition and Consumer Commission. The website is: [www.ncis.org.au](http://www.ncis.org.au)

Passengers and non-traffic crashes were excluded from analyses. Of cases meeting all inclusion criteria, all available full text documents were downloaded from NCIS and coded according to a coding scheme devised by the research team with data being entered directly into an SPSS data file.

Aside from key crash and person characteristics, data elements of interest included pre-crash risk factors, environmental factors, vehicle factors and individual actions. Environment conditions of interest included visibility of signals, whether pre-crash view was obstructed, road infrastructure variables, lighting conditions, and weather conditions. Vehicle defects included whether the vehicle was roadworthy, whether vehicle defects contributed to the collision, whether tyres, brakes or steering was defective, and whether the vehicle was modified.

Person specific pre-crash risk factors included any sensory deficits (i.e., vision, hearing), the presence of any disability, recent or on-going medical conditions, psychiatric illness, and known drug use. In addition to these factors, other factors of interest were recent periods of hospitalization, use of prescription medications and mental state. Individual person actions noted included excessive speed, slow speed, aggressive behaviors ('road-rage', tail-gating), whether avoidance behaviors were attempted, disregard of traffic controls, negligent driving (i.e., hit-run), phone use while driving, the presence of passengers, restraint use, and inappropriate clothing for motorcyclists. Importantly, it was noted whether these factors were considered by the coroner to have been a 'factor' in the crash or whether the coroner failed to mention these parameters as being either related or unrelated to the occurrence of the crash.

#### *Road Crash Information System (RCIS), Victoria*

The VicRoads Road Crash Information System (RCIS) is the primary traffic crash database for the State of Victoria, Australia and is based upon Police reporting of property damage crashes (where police attend) and casualty crashes that occur on public roads. Fatality crashes result in the State Coroner being notified of the death(s). The data for each person involved in the crash is expansive, and includes information on vehicle involved and the environment. Crashes are also geocoded and details of the road network are link o the crash. This additional data provides details of the road infrastructure, as well as permitting crashes to be represented using Geographic Information System (GIS) methods.

This use of the RCIS combined with the NCIS data was premised to permit the GIS representation of drug-involved crashes, as well as increasing the pool of available information, particularly concerning road infrastructure. Probabilistic matching was used with date and time of crash, age, gender, postcode of residence, postcode of crash being key parameters.

#### **Approval processes**

Approval to access NCIS was obtained from the Victorian Department of Justice Ethics Committee, and the Monash University Standing Committee on Ethics in Research Involving Humans (SCERH). Permission to access and link fatality cases in the Victorian RCIS to coronial records identified as drug (including alcohol) positive cases was also gained for this project.

#### **Results**

For the year 2004, 97 drivers, pedestrians, motorcyclists and cyclists aged 16 and older were included in this study and identified as having alcohol or a licit or illicit drug present at the time of death. Of these 97 cases, drivers of passenger cars represented the highest proportion (56.7%), followed by pedestrians (14.4%), motorcycle riders (11.3%), pick-up truck / van drivers (10.3%), drivers of heavy transport vehicles (5%) and cyclists (2%). Approximately 40% were persons under 30 years of age, 68% were single vehicle crashes, and 71% of deaths occurred at the roadside with the remaining 29% dying at hospital.

Table 1 presents the number and percentage of cases with alcohol and illicit substances detected, along with selected combinations. Alcohol (49.5% of cases) was the most commonly detected drug, followed by  $\Delta$ 9-THC (19.5%), amphetamines (9.2%), and heroin metabolites (7%). Only 2 cases were detected with MDA/MDMA and 1 case for cocaine metabolites. Polydrug use was relatively common, with 8% of cases being detected with ethanol and  $\Delta$ 9-THC being of concern.

This paper is principally interested in the individual characteristics of those detected with alcohol and  $\Delta 9$ -THC, and hence attention is focused on these two substances; it is however important to present the levels of these drugs detected in the sample. With respect to the alcohol findings, 48 (49%) fatally injured individuals were found to have a BAC of greater than 0.01 g/100mL, of which only 14.6% had a BAC <0.05g/100ml (14.6%). Of those with a BAC >0.05g/100ml, 4.2% were in the range of 0.05-0.1 g/100ml, 17% in the range of 0.1-0.15 g/100ml, 27% in the range of 0.15-0.20 g/100ml (27%), and 37.5% of cases had a BAC>0.2 g/100ml. In short, 85.4% of those testing positive to alcohol were above the legal BAC of 0.05 g/100ml. Of those with alcohol present, 14 cases were detected with an illicit substance, with 9 others being detected with a licit substance (e.g., benzodiazepines, analgesics, anti-depressants; not shown in Table 1).

As noted above, 19 fatally injured individuals were found to be positive for THC ( $\Delta 9$ -THC), with the majority of individuals found positive for  $\Delta 9$ -THC having a level greater than 15 ng/mL of THC (58%, n= 11), a level that is indicative of significant impairment. Four cases had a concentration of > 30 ng/mL, with the maximum value being 65 ng/mL. A further two cases (11%) had a THC level between 10-15 ng/mL, with 6 cases (32%) below 10ng/mL.

**Table 1. Drugs detected and selected combinations, split by location of death**

	Death on roadside		Death in hospital		Total	
<i><b>Analyte</b></i>	<b>Freq.</b>	<b>%</b>	<b>Freq</b>	<b>%</b>	<b>Freq.</b>	<b>% of 97</b>
Alcohol (ethanol)	41	85	7	15	48	49.5
$\Delta 9$ -THC	14	74	5	26	19	19.6
Amphetamine & methamphetamine	8	89	1	11	9	9.3
Heroin metabolites	7	100	0	0	7	7.2
Ecstasy	1	50	1	50	2	2.1
Cocaine	1	100	0	0	1	1.0
<i><b>Selected combinations</b></i>						
Ethanol + $\Delta 9$ -THC	7	88	1	13	8	8.2
Ethanol + amphetamine	4	100	Nil	Nil	4	4.1
Amphetamine + $\Delta 9$ -THC	2	67	1	33	3	3.1
Ethanol +Amphetamine + $\Delta 9$ -THC	1	100	Nil	Nil	1	1.1
Ethanol + MDMA/MDA	1	100	Nil	Nil	1	1.1

The principal interest of this paper is the individual characteristics of those detected with alcohol and  $\Delta 9$ -THC-related crashes, and the use of NCIS in deriving these characteristics. A summary of these findings is presented in Table 2. It is evident that young drivers, particularly males represent a significant percent of cases in both the alcohol and the THC group. Approximately three-quarters of THC and alcohol cases were drivers of passenger cars, trucks and vans, with motorcyclists representing one-fifth of THC cases, somewhat higher than alcohol cases (12.5%). Pedestrians represented 15% of alcohol cases, in contrast to 5% of THC cases. While license status was not noted in approximately 40% of cases, probationary drivers represent 20% of THC cases and 15% of alcohol cases. With respect to employment, a higher proportion of THC cases were unemployed compared to alcohol cases. The NCIS data also indicated that one-fifth of THC cases were noted to have a substance abuse history, although it is accepted that the four instances in each group may be the same individuals. Also noted were prior psychiatric history (e.g., severe depression) and prior convictions for traffic offences. Finally, a small percent of cases were considered to be intentional self-harm.

**Table 2.** Individual factors identified from the NCIS database for alcohol and  $\Delta 9$ -THC

Characteristic		Alcohol (n=48)		THC (n=19)	
		n	% (% male)	n	% (% male)
Age	16-25	22	45.8 (91)	6	31.6 (83)
	26-35	10	20.8 (100)	7	36.8 (100)
	36-45	10	20.8 (90)	5	26.3 (60)
	46-55	3	6.3 (67)	1	5.3 (Nil)
	56-65	2	4.2 (100)	Nil	Nil
	76-85	1	2.1 (100)	Nil	Nil
Gender	Male	43	89.6	15	78.9
Roaduser	Driver(cars/trucks/etc)	35	72.9	14	73.7
	Pedestrian	7	14.6	1	5.3
	Motor cyclist	6	12.5	4	21.1
Licence	Learner	1	2.1	Nil	Nil
	Probationary	7	14.6	4	20.1
	Standard	18	37.5	8	42.1
	Unlicensed	1	2.1	Nil	Nil
	Licence not noted	21	43.8	7	36.8
Employment Status	Employed	30	62.5	7	36.8
	Unemployed	5	10.4	4	21.1
	Home duties	Nil	Nil	1	5.3
	Retired/pensioner	5	10.4	2	10.5
	Student	3	6.3	Nil	Nil
	Unlikely to be Known	5	10.4	5	26.3
Substance abuse history		2	4.2	4	21.1
Traffic or other convictions		4	8.3	1	5.3
Pre-crash psychiatric illness		3	6.3	4	21.1
Intent	Intentional self-harm	1	2.1	2	10.5
	Not likely to be known	Nil	Nil	2	10.5
	Unintentional	47	97.9	15	79.0

**Coroner-ruled factors**

Table 3 presents the factors noted by the Coroner as being implicated in the occurrence of the crash. It is important to note that a single case may have multiple factors identified. The most commonly attributed factor was, as expected, drug use (including alcohol). Excessive speed was noted in 25% of cases alcohol cases followed by being unrestrained, however these were less commonly attributed factors to THC and THC + Alcohol cases. The small sample precludes any statistical analysis here.

**Table 3 Factors associated with crashes among alcohol and THC-detected cases, as noted by the Coroner**

Factor	Alcohol (n=48)	THC (n=19)	THC + Alcohol (n=8)
	n (%)	n (%)	n (%)
Drug use	32 (66%)	14 (74%)	6 (75%)
Excessive speed	12 (25%)	2 (10.5%)	1 (13%)
Unrestrained	8 (16.7%)	1 (5%)	Not noted
No avoidance maneuver attempted	6 (12.5%)	3 (16%)	1 (13%)
Failure to correct steering	4 (8.3%)	1 (5%)	1 (13%)
Fatigue	3 (6.3%)	1 (5%)	Not noted

Note: single case may have multiple factors; not all factors noted in table

## Discussion

The findings of this research highlight the broad range of individual characteristics of those involved in alcohol and THC related fatality crashes. It is notable though that in agreement with overseas research as noted in the Introduction, particular characteristics are prominent. For instance, young males represent a significant problem; however employment status, history of psychiatric illness, intent, and substance abuse history. Of concern are the high levels of both alcohol and THC, with the THC levels reported here suggesting recent use and significant impairment. The type of information presented here is critical to aid in the development of diverse and targeted road safety campaigns and with on-going data collections efforts, both of drug-positive and drug free cases, it is considered that the NCIS will make a valuable contribution to road safety in Australia due to containing rich narrative information surrounding the crash, as well the Coroners findings as to contributing factors.

It is important to note that due to reporting requirements under the *Coroners Act (Vic) 1985*<sup>26</sup>, NCIS can be described as a representative source of information concerning traffic fatalities. Despite differences in reporting requirements, there is good concordance with the number of fatalities reported by the TAC (n=330)<sup>27</sup> compared to closed cases on NCIS (n=317) for 2003; it is however acknowledged that NCIS includes deaths off public roads while the RCIS does not. Importantly, all fatally injured drivers are alcohol and drug tested in Victoria.<sup>15</sup> While it could be suggested that a limitation of NCIS as a research tool is the variability in case reporting by Coroners', and hence the observation that some factors are not noted as either contributing to the crash or otherwise, it is critical to note that the primary role of NCIS is '...to assist coroners in their role as death investigators, by providing them with the ability to review previous coronial cases that may be similar in nature to current investigations, enhancing their ability to identify and address systematic hazards within the community'.<sup>28</sup> It is also accepted that post-mortem concentrations may change, particularly if there was a substantial period of time between the death and the blood specimen being extracted<sup>29</sup>, leading to difficulties in defining impairment. Similarly, in cases where the deceased had been in hospital for several days subsequent to their motor vehicle accident, the presence of alcohol or drugs in their system at the time of the crash may not be detected during a post-mortem toxicological investigation.

In sum, the wide range of individual characteristics associated with alcohol and  $\Delta 9$ -THC-related fatality crashes in Victoria highlights the challenge that prevention of such crashes entails. It is anticipated that the type of data collected, some of which is presented here, will assist in formulating targeting preventative programs. That the data was taken from 2004 when random drug testing operations commenced (13<sup>th</sup> December 2004) is an important point to note. Notwithstanding the potential for publicity leading up to the commencement of the influencing behaviour, this data represents 'baseline' data, and analysis of future years (as well as years prior to 2003) might demonstrate the areas the enforcement program has influenced, whilst highlighting targets for enhanced enforcement and media educational campaigns. The rich narrative data of NCIS, along with the toxicology data, linked to the VicRoads RCIS represents an extremely powerful tool for examining the characteristics of alcohol and drug related crashes. The systems potential for monitoring changes in behaviour and value in developing and refining enforcement campaigns is likely to be considerable, particularly when combined with GIS analysis methods in the future. Finally, examination of alcohol-free and drug-free fatalities using the methods adopted here would provide important crash risk factor estimates, thereby enabling optimal targeting of problem behaviours.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge the contribution of MUARC's Baseline sponsors and their representatives in the conduct of research, these being the Transport Accident Commission (Richard Thiele, Allison McIntye), VicRoads (Philip Swann, Pat Rogerson), the Victorian Department of Justice (William Gibbons) and Victoria Police (Insp. David Newton, Insp. Peter Keogh). In addition we acknowledge the input of Diana Viera and Dimitra Tapsas (RACV), Professor Narelle Haworth (QUT), and Professor Ian Johnston as Chair of the MUARC Baseline Committee. Thanks also to Marde Hoy for assistance with NCIS. The views expressed herein are

those of the authors, and do not necessarily represent the views of the Accident Research Centre, Monash University, or the Baseline Sponsors, and those listed in these Acknowledgements.

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