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What contributes to drug driving? An exploratory investigation into the influence of problematic substance use, roadside testing and alternative transport options

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ABSTRACT

Despite a strong reliance on enforcement approaches to prevent drug driving in Australia, this behaviour is still prevalent. The objective of this study was to investigate the influence of problematic drug use (i.e., showing indications of addiction), exposure to roadside drug testing, the use of detection avoidance strategies, and perceptions relating to alternative transport options on drug driving among illicit drug users. A total of 1,541 licensed drivers from the states of Queensland, New South Wales, and Victoria completed an online survey. The survey collected demographic and problematic substance use information, as well as items assessing drug driving behaviour. Cannabis was reported to be the most commonly used drug (36.0%); the most common drug of problematic use (27.9%), and the drug most often taken prior to driving (43.5%). Observing police operating Roadside Drug Tests (RDT) was more common among the participants than being tested by RDT (35.7% vs 23%). The results indicated a significant association between being a drug driver and observing or being tested by RDT. The drug drivers were significantly more likely to report using a range of strategies to avoid police detection than the non-drug drivers. Similarly, the drug drivers reported that it was more difficult for them to use various alternative transport options than the non-drug drivers. Decision tree analyses found that significant predictors of self-reported drug driving were problematic drug use, holding a provisional or probationary licence, earning a low- or middle-income, and using detection avoidance strategies like remaining watchful for police vehicles and taking back streets. The findings of this study suggest that ongoing improvements to drug driving enforcement will need to be complemented by health-based approaches designed to reduce drug abuse and dependence, and improvements to public transport, in order to achieve a sustainable reduction in drug driving.

1. Introduction

Driving after drug use is a major concern that hinders efforts to enhance road safety. The use of illicit drugs, even at low doses, can impair certain skills essential for safe driving (Ortiz-Peregrina et al., 2021; Simmons et al., 2022; Stough et al., 2012). Research has shown that many drivers who died in road crashes and tested positive for drugs had prior drug abuse problems (Karjalainen et al., 2012). It has been argued that the problem of drug abuse (i.e., the use of drugs in a way other than prescribed) and dependence (i.e., loss of physical and psychological control due to continuing substance abuse) manifests as a compulsive need to continue taking drugs in order to stimulate pleasure and avoid discomfort (Health Research Board; World Health Organization, 1994). The main problematic illicit drugs identified by health

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authorities are amphetamines, ecstasy (MDMA), cocaine, heroin and cannabis (except for countries that have legalised its use) (Australian Government- Department of Health, 2019; Drug Enforcement Administration: Department of Justice, 2016; International Narcotics Control Board, 1961; National Collaborating Centre for Mental Health, 2008). The problematic use of these drugs has been highlighted as a major influence on the likelihood of drug driving (Hasan et al., 2022), and thus this study addresses this issue.

Although it has been shown that a large number of drug users actually drug drive (Davey et al., 2005; Horyniak et al., 2017), the association between drug dependence and drug driving has not been thoroughly researched, with the exception for two groups of interest: those suspected of driving under the influence of illicit drugs (Adams et al., 2008; Karjalainen et al., 2013), and cannabis users (Berg et al., 2018; Jones et al., 2007; Patel and Amlung, 2019). In the case of those suspected of driving under the influence of illicit drugs, those diagnosed with illicit drug use disorders reported a higher prevalence of drug driving (Adams et al., 2008; Karjalainen et al., 2013). Similarly, among cannabis users a significant association was reported between drug driving and a clinical diagnosis of cannabis dependence (Berg et al., 2018; Jones et al., 2007; Lasebikan, 2010; Love et al., 2022b; Patel and Amlung, 2019). The abundance of cannabis resulting from the legalisation of its therapeutic and recreational use may be accompanied by excessive use that may lead to physical dependence (Hall et al., 2019), which in turn increases the likelihood of engaging in drug driving (Cuttler et al., 2018). Furthermore, driving after taking cannabis has been found to be positively associated with heavy drinking (Lewis et al., 2008). Indeed, alcohol is perhaps the most common substance found in combination with drugs among positive-tested drivers (Li et al., 2020). However, alcohol use disorder (AUD) (i.e., compulsive drinking of alcohol despite the associated serious consequences for health) appears to have a weak relationship with drug driving (Mahindhoratep et al., 2013).

In regard to the dominant characteristics of drug drivers, high rates of illicit drug use leading to drug dependence appear to be more prevalent among individuals under 35 years of age (Bonar et al., 2019), polydrug users (Davey and Freeman, 2009), and individuals with psychosocial difficulties (Berg et al., 2018). Other socioeconomic characteristics, such as education level (Bonar et al., 2018; Cuttler et al., 2018; Salas-Wright et al., 2021) and employment (Adams et al., 2008; Jones et al., 2007), and their association with drug driving among those with substance abuse/dependence disorders remain insufficiently researched. This is particularly important for identifying these characteristics of people with drug abuse/disorders who are less likely to comply with road rules and police enforcement (Adams et al., 2008), to enable the implementation of more effective strategies tailored to them.

The most widely applied enforcement approaches to limit drug driving are on-road police drug screening and impairment tests (Davey and Freeman, 2009; US Department of Transportation: National Highway Traffic Safety Administration, 2007). In Australia (where this study took place), police operate Roadside Drug Testing (hereafter referred to as RDT) to determine the presence of drugs in drivers' systems. This testing approach aims to detect offenders and provide the basis for long-term behavioural and social changes regarding drug use and driving (National Drug Driving Working Group, 2018). RDT was first introduced to Australian roads in 2004 with limited test resources (9,000 tests in the first year) (Drummer et al., 2007; Haworth and Lenné, 2007). The number steadily increased to become as many as 500,000 RDT tests in 2019, only to drop afterwards to almost 330,000 tests in 2020 (BITRE, 2021). The high costs of supplying and implementing RDTs (Cameron, 2013; Mills et al., 2021; National Drug Driving Working Group, 2018) and the unprecedented restrictions associated with the COVID-19 pandemic (Mills et al., 2021) are likely the main factors that explain the decline in the number of tests in 2020. The relatively low number of tests has reportedly prompted RDT operations to become more targeted than random (Mills et al., 2022a), which, in turn, positively influenced specific deterrence (i.e., through personal exposure to enforcement) at the expense of general deterrence (i.e., observing others being punished for the offending behaviour).

However, that was not the case for the Random Breath Testing of alcohol (hereafter referred to as RBT), on which RDT procedures were modelled (Watson et al., 2005), because RBT is more randomly applied with a much larger number of annual tests (BITRE, 2021; Mills et al., 2021). In this regard, previous research has shown that the perceived likelihood of being detected and penalised for driving after using cannabis was much lower than driving after consuming alcohol (Barrie et al., 2011; Matthews et al., 2012). Moreover, it remains questionable whether current police RDT operations are sufficient to either enhance specific deterrent effects among those who are tested, or establish general deterrence among those who observe/hear about such operations. Indeed, a 2017 community survey in Australia indicated that only 46% of the participants had seen police conducting drug tests in the past two years, and only one in ten drivers stated that they had been tested for drugs over the same period (Souwe et al., 2018).

RDT testing not only suffers from operational challenges, but also gaps in the enforcement system that drug drivers exploit to evade detection and thus avoid punishment. Previous studies have found that the most common avoidance strategies are: responding to intelligence from friends about where police are conducting tests, taking back streets, driving slowly, using a designated driver and using social media for identifying police locations (Duff and Rowland, 2006; Mills et al., 2022b; Papafotiou Owens and Boorman, 2011). Moreover, recent research has suggested that mobile apps that assist drivers to locate police checkpoints undermine police enforcement by enabling drivers to avoid detection, thus threatening road safety (Mills et al., 2022b; Oviedo-Trespalacios and Watson, 2021). Some drug users also report limiting drug intake to their tolerance level and waiting for drugs to wear off before driving (Love et al, 2022a; McIntosh et al., 2008). It is worth noting that scant research exists on alternative options to driving that drug users may consider. The dearth of mobility alternatives in some areas, particularly public transport, leads people to rely on their cars for transport and thus increases the prevalence of drug driving (Gavin et al., 2008). Previous research showed that drug users who wanted to travel to nightclubs or to drive short distances chose to drug drive because they believed that cars were more cost-effective and convenient than public transport (Calafat et al., 2009; Donald et al., 2006).

1.1. Aim

Drug driving remains prevalent in Australia, despite the strong enforcement approach. Indeed, 39% of people who regularly use illicit drugs and reside in the capital cities have self-reported drug driving within the past six months (Sutherland et al., 2021a). As such, other strategies for reducing drug driving need to be considered.

Whilst previous research has examined drug availability, drug use and drug driving separately (Hasan et al., 2022), it is timely to investigate these broad factors in an integrated manner that allows a better understanding of the drug driving problem. Consequently, the aim of this research was to investigate the influence of problematic drug use on drug driving, relative to other key influences identified in the literature including exposure to and experiences with drug driving enforcement and the availability of alternative transport options. The study focused on the behaviour and perceptions of those who self-reported driving after having consumed at least one of the four drugs screened for at RDT, namely cannabis, methamphetamine, MDMA and cocaine.

2. Materials and methods

2.1. Participants and substance use

A total of 1,541 licensed drivers from the most populous states in

Australia (Queensland, New South Wales, and Victoria) completed an online survey. Table A1 in the Appendix shows some of the demographic characteristics of these drivers. Compared to the licensed drivers in these states, the participants were more likely to be male (58% vs 51%), younger (30% vs 12% aged 24 or younger) and less likely to hold an open drivers' licence (78% vs 88%) (Bureau of Infrastructure Transport and Regional Economics (BITRE), 2021).

The research reported here was part of a larger study that recruited participants who self-reported having consumed any alcohol and/or drugs during the last 12 months. This paper focused on those participants who reported having consumed alcohol and/or at least one of the four drugs screened by RDT, namely cannabis, methamphetamine and MDMA in Queensland and Victoria, as well as cocaine in New South Wales. Therefore, 9% of the sample respondents (n = 136), who had consumed no drugs or alcohol in the past three months (i.e., non-recent consumers), plus 10 other respondents indicated having used only drugs other than RDT drugs or alcohol in the past 3 months (i.e., opioids, hallucinogens, GHB and other drugs), were omitted from the analysis. Furthermore, those who consumed one or more RDT drugs in addition to other drugs (i.e., opioids, hallucinogens, GHB and other drugs) but only drove after using those other drugs were excluded from this analysis (n = 30). However, the patterns of using opioids, hallucinogens, GHB and other drugs and the corresponding drug driving after using them are outlined in Table A2 in the Appendix. The final sample size was 1,365 respondents.

2.2. Measures

2.2.1. Problematic substance use

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST, version 3.1) developed for the World Health Organization (WHO) was used to assess and identify problematic substance use (Humeniuk et al., 2010; Humeniuk and Holmwood, 2011). The process of determining each participant's level of problematic substance use is detailed in the Appendix.

2.2.2. Illegal driving behaviours

Respondents were asked, "*Over the past 3 months, have you driven your vehicle within one hour of taking (selected drug/drugs)?*" with response options being: (1) Never, (2) Rarely, (3) Sometimes, (4) Often and (5) Always. Response choices were dichotomised into "no" if the respondents answered "never" and "yes" if they chose any of the remaining options for the decision tree analysis. The term drug driving will be used to refer to driving after using at least one of the four police-tested drugs in the three Australian states.

Similarly, alcohol-positive driving was assessed with the question: "*Over the past 3 months, have you ever driven within one hour after consuming alcoholic drinks (beer, wine, spirits, etc.)?*". A similar five-point Likert scale was also dichotomised into "yes" and "no", was used for alcohol-positive driving responses. The term "drug + alcohol-positive driving" refers to either the occurrence of drug taking and alcohol consumption at the same time then driving (i.e., drug + alcohol-positive driving on same occasion) or drug driving and alcohol-positive driving on different occasions during the past three months by the same participant.

2.2.3. Experiences of police enforcement

Participants were asked how often they had seen police conducting Roadside Drug Testing (RDT) with responses on a five-point Likert scale ranging from "Never" to "Always". They were also asked whether they had been tested by Roadside Drug Testing (RDT), with responses being either "Never tested" or "Once or more". Participants were asked a similar set of questions about their experiences of seeing or being tested by Random Breath Testing (RBT).

2.2.4. Avoidance strategies and alternative transport options

Participants were asked to report strategies they used to avoid police enforcement and being caught for drink or drug driving. Participants could choose one or all of the following strategies: staying away from known police-testing locations; locating police operations by using apps or GPS (e.g., Waze and Google Maps), remaining watchful for police vehicles, watching out for other drivers flashing their lights, driving more carefully, taking the back streets home or getting someone else to drive. Responses were on a Likert scale ranging from 1 "Never" to 5 "Always".

The survey also asked participants whether they used any other forms of transport instead of driving, after consuming alcohol and/or drugs. An item measured how convenient it would be for respondents to catch public transport, to catch a courtesy bus or a taxi, to use a designated driver, or to ride a bicycle or an e-scooter. Responses were on a Likert scale ranging from 1 "Extremely easy" to 5 "Extremely difficult".

2.3. Procedure

Data were collected using an anonymous, online survey administered by Queensland University of Technology (QUT). Details of the survey procedure are provided in the Appendix.

2.4. Data analysis

Data were analysed using IBM Statistical Package for the Social Sciences (Version 25). Chi-square analysis was used to test for associations between the behaviours of interest and the independent variables, considering the effect sizes between these variables. All analyses were evaluated at a significance level of $\alpha = 0.05$. To avoid Type I Error, a post-hoc pairwise comparison was conducted applying the Bonferroni corrected alpha level.

A decision tree analysis was conducted to examine the factors influencing drug driving; alcohol-positive driving, and drug + alcohol-positive driving to avoid concerns associated with the subsample sizes being unevenly distributed across levels of the dependent and independent variables, and violation of assumptions such as linearity, normality and non-multicollinearity. Decision trees can examine all variables of interest simultaneously to detect all significant interactions between them without having to pre-specify the model. The exhaustive Chi-Squared Automatic Interaction Detection (CHAID) algorithm is an increasingly common method used to identify the most statistically significant independent variables in the tree (Kass, 1980). Previous research explaining participants' behaviours in traffic psychology and public health has used this technique (de Oña et al., 2013; Hasan et al., 2020; Newton et al., 2022; Oviedo-Trespalacios and Scott-Parker, 2019; Saul et al., 2021).

The exhaustive CHAID algorithm divides variables into nodes and builds the tree model through the growth of branches through sequential grouping and division based on a statistical Chi-Square test. It identifies the variable with the most significant difference between its categories, and then splits the sample according to the categories in this variable. The process is repeated including all branches until non-significant variables are found. The starting node concentrates the sample according to the dependent variable, which was categorised into four levels: no-drug/alcohol-positive driving; alcohol-positive driving only, drug driving only, and drug + alcohol-positive driving. Independent variables included various demographic characteristics (age, gender, driver's licence, etc.), traffic offence history, the status of problematic alcohol and drug use, experiences of police enforcement, and reported use of police detection avoidance strategies and alternative transport options (see Table A3 in the Appendix). A cross-validation method using 20 folds was conducted to validate the tree. The maximum depth of the tree was set to 3 and the minimum parent node size was 100 and the minimum child node size was set to 50. Adjusted significance values were specified using Bonferroni correction. A classification table for decision tree analysis was included in the Appendix (Table A7).

Table 1
Self-reported patterns of alcohol and RDT drug use.

Total (N = 1,365)		Substance use				Driving after using the specific substance	
		No		Yes			
Substance type		N	%	N	%	N	%
Alcohol		53	3.9	1,312	96.1	616	47.0
RDT Drugs	***Any of the four RDT drugs***	822	60.2	543	39.8	241	44.4
	Cannabis	873	64.0	492	36.0	214	43.5
	MDMA	1,247	91.4	118	8.6	7	5.9
	AM/MA*	1,316	96.4	49	3.6	27	55.1
	Cocaine	1,233	90.3	132	9.7	33	25.0
	Polysubstance use	1,189	87.1				
	with Alcohol			170	12.5	30	17.6
	without Alcohol			6	0.4	3	50.0

* AM/MA: Amphetamine and Methamphetamine.

3. Results

3.1. Patterns of substance use, drug driving and participant demographics

At least one of the four police-tested drugs in the three Australian states was used by 543 respondents, while 176 participants indicated poly-use of at least two of the four RDT drugs (with or without alcohol). The most used drug was cannabis (n = 492, 36.0%), followed by cocaine (n = 132, 9.7%), and MDMA (n = 118, 8.6%). Almost all respondents reported using alcohol (n = 1,312, 96.1%). Table 1 shows the usage patterns for these substances.

Overall, 241 individuals reported drug driving after using at least one of the four RDT drugs (with or without alcohol) within the past three months; 91 of them were drug-only drivers (i.e., without alcohol). Most drug driving was reported after using cannabis (n = 214), and cocaine (n = 33). In total, 616 respondents indicated alcohol-positive driving (with or without drugs) during the past three months, and of these, 466 were alcohol-positive-only drivers (i.e., without drugs).

Of the 1,365 participants, 31.8% were aged 18 to 24 years and 68.2% were aged 25 to 84 years (M = 36.9, SD = 16.3). In terms of participants' states, 60.4% were from Queensland, 23.7% from New South Wales and 15.9% from Victoria. The mean number of years since obtaining a driver's licence for the first time was 2.5 years (SD = 1.68) for the 18 to 24 years group, and 25.8 years (SD = 14.4) for the 25 to 84 years group. Table 2 summarises the demographic and driving-related characteristics of the participants.

Chi-square tests were conducted to measure the association between drug driving and demographic and driving-related variables. Analysis of these variables showed a significant association between drug driving (with or without alcohol) and being male, single, middle household income per year, driving more than 17 h per week, driving for a personal/leisure purpose, being an alcohol-positive driver, being penalised for one or more traffic offences and for one or more drug driving offences in the past three years. Bonferroni corrections showed significant association ($p < .005$) for being single, middle household income per year and driving for a personal/leisure purpose. Those who reported accurate knowledge about the value of fines applied for first-time drug driving offence and the period of licence disqualification for a first-time drug driving or drink driving were more likely to be drug drivers than those who reported inaccurate knowledge.

3.2. Problematic substance use among alcohol and RDT drugs users

In total, 791 participants (58%) met the threshold for problematic substance use (i.e., medium- or high-risk), of which 225 (16.5% of the whole sample) had a score indicative of problematic use of drugs-only; 351 (25.7%) for problematic use of alcohol-only and 215 (15.8%) for problematic alcohol and drug use.

Table 3 shows the risk level for each substance as either low or problematic use (i.e., medium- and high-risk). Forty-eight respondents (3.5%) were at high-risk for drug dependence (with or without alcohol dependence), while 392 were at medium-risk (28.7%). Cannabis was the most common drug of problematic use among the high-risk group (n = 42, 3.1%), followed by amphetamine/methamphetamine (n = 8). Furthermore, 78 participants were at high-risk (5.7%) and 488 were at medium-risk (35.8%) for alcohol use disorder.

Chi-square tests showed that drug driving was significantly associated with problematic use of alcohol, cannabis and amphetamine/methamphetamine, while problematic use of MDMA was associated with less drug driving.

3.3. The demographic characteristics and driving behaviour of problematic substance users

Overall, 232 participants with problematic substance use (i.e., medium- or high-risk) self-reported driving after using at least one of the RDT drugs (with or without alcohol) within the past three months. Of these, 87 were drug-only drivers (i.e., without alcohol). Most drug driving was reported after problematic use of cannabis (n = 206), with 36 drug drivers being at high-risk of cannabis use. All respondents with high-risk dependence on MDMA, amphetamine/methamphetamine, and cocaine were also found to be drug drivers (n = 10), while only one-fifth of participants with high-risk of alcohol use were drug drivers (n = 15). One participant, who was identified with high-risk dependence on polydrug and alcohol, reported drug and alcohol-positive driving, while another diagnosed with polydrug dependence (i.e., without alcohol) reported drug-only driving. Fig. 1 shows the frequency of drug driving among those with different levels of problematic use of alcohol and RDT drugs.

In total, 431 respondents with problematic substance use indicated alcohol-positive driving (with or without drugs) during the past three months, and of these, 286 were alcohol-positive-only drivers (i.e., without drugs). About three-quarters of those identified with high-risk use of alcohol self-reported alcohol-positive driving (with or without drugs) within the past three months (n = 59). Among those reporting problematic use of RDT drugs, 28 alcohol-positive drivers indicated high-risk of cannabis use.

Furthermore, 145 respondents with problematic substance use indicated RDT drug + alcohol-positive driving during the past three months. About one-quarters of those identified with high-risk use of

Table 2
Participants' characteristics according to the status of RDT drug driving (with or without alcohol).

Total (N = 1,365)			Non-RDT drug drivers (N = 1,123)		RDT Drug drivers (N = 241)		Chi-Square		
Age	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Young adult (18–24)	434	31.8	368	84.8	66	15.2	2.62	0.105	0.044 (1)
Adult (+25)	931	68.2	756	81.2	175	18.8			
Gender *	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Male	801	58.7	617	77.0	184	23.0	42.41	<0.001	0.177 (1)
Female	549	40.2	498	90.7	51	9.3			
Other	15	1.1	9	60.0	6	40.0			
Marital status	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Single	497	36.4	389	78.3	108	21.7	9.57	0.008	0.084 (2)
Married/ have a partner	787	57.7	669	85.0	118	15.0			
Divorced/ Widowed	80	5.9	65	81.3	15	18.8			
Level of education	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Primary & secondary	467	34.2	376	80.5	91	19.5	1.64	0.201	0.035 (1)
Tertiary	898	65.8	748	83.3	150	16.7			
Employment status	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Unemployed	371	27.2	314	84.6	57	23.7	1.84	0.175	0.037 (1)
Employed	994	72.8	810	81.5	184	18.5			
Household Income per year	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Low (less than $30,000)	230	16.8	185	80.4	45	19.6	22.09	<0.001	0.127 (3)
Middle ($30,000- $99,999)	502	36.8	386	76.9	116	23.1			
High ($100,000 or greater)	473	34.7	411	86.9	62	13.1			
Did not state	160	11.7	142	88.8	18	11.3			
Licence type **	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Provisional/ Probationary	314	23.0	270	86.0	44	14.0	3.72	0.054	0.052 (1)
Open/ Full/ Foreign driver's licence	1,051	77.0	854	81.3	197	18.7			
Average hours of driving per week	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Below 17 h	1,116	81.8	933	83.6	183	16.4	6.66	0.010	0.070 (1)
Over than 17 h	249	18.2	191	76.7	58	23.3			
Driving purpose	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Mostly for work	397	29.1	321	80.9	76	19.1	10.43	0.005	0.087 (2)
Mostly for personal/ leisure purposes	299	21.9	265	88.6	34	11.4			
Mixture of work and personal/ leisure	669	49.0	538	80.4	131	19.6			
Access to a vehicle (past 3 months)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	1,355	99.3	1,114	82.2	241	17.8	–	–	–
No	10	0.7	10	100.0	0	0.0			
Type of vehicle	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Car	1,258	92.8	1,034	82.2	224	17.8	0.188	0.979	0.012 (3)
Motorcycle	38	2.8	32	84.2	6	15.8			
Truck	25	1.8	20	80.0	5	20.0			
Other	34	2.5	28	82.4	6	17.6			
Prior involvement in crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	356	26.1	281	78.9	75	21.1	3.86	0.050	0.053 (1)
No	1,009	73.9	843	83.5	166	16.5			
Prior involvement in drug driving crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	9	2.5	2	22.2	7	77.8	–	–	–
No	347	97.5	279	80.4	68	19.6			
Traffic offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	508	37.2	380	74.8	128	25.2	31.65	<0.001	0.152 (1)
No	857	62.8	744	86.8	113	13.2			
Drug driving offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	38	7.5	9	23.7	29	76.3	56.77	<0.001	0.335 (1)

(*continued on next page*)

Table 2 (*continued*)

Total (N = 1,365)			Non-RDT drug drivers (N = 1,123)		RDT Drug drivers (N = 241)		Chi-Square		
No	469	92.5	370	78.9	99	21.1			
Alcohol-positive driving	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	616	45.1	466	75.6	150	24.4	34.61	<0.001	0.159 (1)
No	749	54.9	658	87.9	91	12.1			
Knowledge about licence disqualification (drink driving)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Inaccurate knowledge	1,049	77.6	895	85.3	154	14.7	23.78	<0.001	0.133 (1)
Accurate knowledge	303	22.4	222	73.3	81	26.7			
Knowledge about fines (drink driving)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Inaccurate knowledge	1,238	92.0	1,030	83.2	208	16.8	3.66	0.056	0.052 (1)
Accurate knowledge	108	8.0	82	75.9	26	24.1			
Knowledge about licence disqualification (drug driving)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Inaccurate knowledge	1,216	89.9	1,039	85.4	177	14.6	66.21	<0.001	0.221 (1)
Accurate knowledge	137	10.1	79	57.7	58	42.3			
Knowledge about fines (drug driving)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Inaccurate knowledge	1,301	96.4	1,089	83.7	212	16.3	26.96	<0.001	0.141 (1)
Accurate knowledge	49	3.6	27	55.1	22	44.9			

* Given the small number of "Other" participants (n = 15), they were excluded from the Chi-square analysis for gender.
** The terminology of Provisional/ Probationary differs between states, but for the majority it was chosen to refer to their first licence after a learner one.

alcohol self-reported RDT drug + alcohol-positive driving within the past three months (n = 15). Among those of problematic use of RDT drugs, 24 RDT drug + alcohol-positive drivers indicated high-risk of cannabis use.

Of those identified with any problematic substance use (n = 791), 30% were aged 18 to 24 years and 70% were aged 25 to 84 years (M = 36, SD = 15). About 58% of participants indicated being residents of Queensland, 26% from New South Wales and 16% from Victoria. The total number of years of obtaining a driver's licence for the first time was 2.6 years (SD = 1.7) for the 18 to 24 years group, and 23.9 years (SD = 13.3) for the 25 to 84 years group. Chi-square tests for the association between behaviour of interest and other variables are presented in the Appendix with a detailed description (Tables A4, A5 and A6).

3.4. Experiences of police enforcement

The descriptive findings relating to experiences of police enforcement are reported in the Appendix, since they were not significant in the decision tree.

3.5. Drug driving detection avoidance strategies

Compared with the non-RDT drug drivers, the RDT drug drivers were significantly more likely to report using most of the avoidance strategies (see Table 4). Staying away from known police-testing locations; locating police operations by using apps or GPS (e.g., Waze and Google Maps), remaining watchful for police vehicles, watching out for other drivers flashing their lights, driving more carefully, taking the back streets home were all statistically significantly more followed by drug drivers than non-drug drivers. No differences were found between the two groups of drivers for the strategy of getting someone else to drive.

3.6. Alternative transport options

The descriptive findings relating to experiences of alternative transport options are reported in the Appendix, since they were not significant in the decision tree.

Table 3
Substance risk status of those who used alcohol or RDT drugs.

Total (N = 1,365)		Risk level of substance use				Non-RDT drug drivers				RDT drug drivers				Chi-Square		
		Low		Problematic use		Low		Problematic use		Low		Problematic use				
Substance type		N	%	N	%	N	%	N	%	N	%	N	%	χ^2	*p*	*Φ (1)*
Cannabis		111	8.1	381	27.9	91	82.0	175	45.9	20	18.0	206	54.1	44.98	<0.001	0.302
MDMA		58	4.2	60	4.4	23	39.7	36	60.0	35	60.3	24	40.0	4.88	0.027	0.203
*AM/MA**		12	0.9	37	2.7	6	50.0	5	13.5	6	50.0	32	86.5	6.93	0.008	0.376
Cocaine		64	4.7	68	5.0	34	53.1	36	52.9	30	46.9	32	47.1	0.000	0.983	0.002
Alcohol (with or without problematic drug use) **		746	54.7	566	41.5	645	86.5	462	81.6	101	13.5	104	18.4	5.71	0.017	0.066
Poly- Problematic substance use	*with problematic Alcohol use*	7	0.5	46	3.4	3	42.9	22	47.8	4	57.1	24	52.2	–	–	–
	without problematic Alcohol use	0	0.0	24	1.8	0	0.0	9	37.5	0	0.0	15	62.5	–	–	–

* AM/MA: Amphetamine and Methamphetamine.
** The number of respondents who reported their use of alcohol only (i.e., without problematic drug use) is 522 (38.2%) who had a low-risk of alcohol use (163 alcohol-positive drivers), and 351 (25.7%) who had problematic alcohol use (189 alcohol-positive drivers).

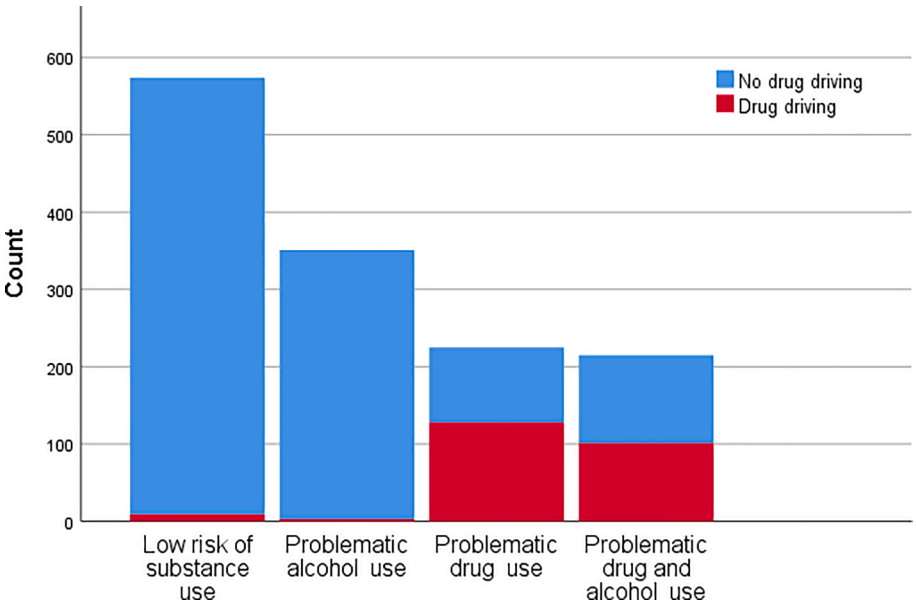

Fig. 1. Drug driving among different groups of alcohol and RDT drug users.

Table 4
Respondents' self-reported strategies they applied to avoid being caught for driving within an hour of consuming alcohol and/or drugs.

Avoidance strategy (N = 1,365)	Non-RDT drug drivers			RDT drug drivers			Differences (Mann-Whitney *U* test)
	Never or Rarely (%)	Sometimes (%)	Often orAlways (%)	Never or Rarely (%)	Sometimes (%)	Often orAlways (%)	*p*
Staying away from known police-testing locations	976 (86.8%)	85 (7.6%)	63 (5.6%)	128 (53.1%)	48 (19.9%)	65 (27.0%)	<0.001
Driving more carefully	906 (80.7%)	105 (9.3%)	112 (10.0%)	107 (44.6%)	46 (19.2%)	87 (36.3%)	<0.001
Watching out for other drivers flashing their lights	820 (73.0%)	146 (13.0%)	157 (14.0%)	103 (42.7%)	45 (18.7%)	93 (38.6%)	<0.001
Getting someone else to drive	434 (38.7%)	188 (16.8%)	500 (44.6%)	93 (38.6%)	54 (22.4%)	94 (39.0%)	0.375
Taking the back streets home	926 (82.5%)	117 (10.4%)	79 (7.0%)	130 (53.9%)	62 (25.7%)	49 (20.3%)	<0.001
Remaining watchful for police vehicles	758 (67.6%)	130 (11.6%)	234 (20.9%)	47 (19.5%)	51 (21.2%)	143 (59.3%)	<0.001
Locating police operations by using apps or GPS (e.g., Waze and Google Maps)	976 (87.0%)	68 (6.1%)	78 (7.0%)	141 (58.5%)	37 (15.4%)	63 (26.1%)	<0.001

3.7. Decision tree

A decision tree analysis was conducted to identify variables that best distinguish four self-reported outcomes in the last three months: drug driving (n = 91); alcohol-positive driving (n = 466), drug + alcohol-positive driving (n = 150), and not having driven after consuming drugs or alcohol (termed here no-drug/alcohol-positive driving, n = 658). The resulting tree consisted of 3 layers (depth), 23 groups (nodes) and 13 terminal groups, which were all significant at $p < .05$ (see Fig. 2). The final tree correctly predicted 65.0% of all cases. The cross-validated risk estimate was 40.7% (SE = 1.3%).

The most important factor distinguishing the four groups was the level of problematic use of any of the RDT drugs or alcohol (χ^2 (9, N = 1,365) = 664.81, $p < .001$). The resulting categories comprised participants who had low-risk substance (RDT drug or alcohol) use; and those who had problematic (medium- or high-risk) drug, alcohol or drug and alcohol use. The percentage of respondents who self-reported drug-only driving within the past three months increased from 0.7% among those who indicated low-risk substance use to 29.3% among those who were classified as having problematic drug use. Similarly, the percentage of respondents who self-reported drug + alcohol-positive driving increased from 0.9% among those with low-risk substance use to 27.6% of those with problematic drug use and 37.7% of those classified with problematic drug and alcohol use. The pattern differed somewhat for alcohol-positive only driving, where those with problematic alcohol use were more likely to drive alcohol-positive only than those who had problematic drug and alcohol use (53.3% versus 29.8%).

3.7.1. Variables influencing drug driving

Among those with problematic drug use, drug driving was related to the frequency of remaining watchful for police vehicles as a strategy to avoid being detected (χ^2 (3) = 41.87, $p < .001$). Those who responded that they sometimes to always utilised this avoidance strategy were more likely to report drug driving (37.5% versus 16.9% "never or rarely"), particularly if they belonged to the low- or middle-income groups (48.7%) (χ^2 (3) = 13.22, $p < .042$).

Among those with problematic drug and alcohol use, drug driving was more common among those with provisional or probationary licences than those with an open/full/foreign driver's licence (19.2% versus 6.1%), particularly if they reported sometimes to always utilising the avoidance strategy of taking the back streets home (7% versus 4.8%) (χ^2 (3) = 28.81, $p < .001$).

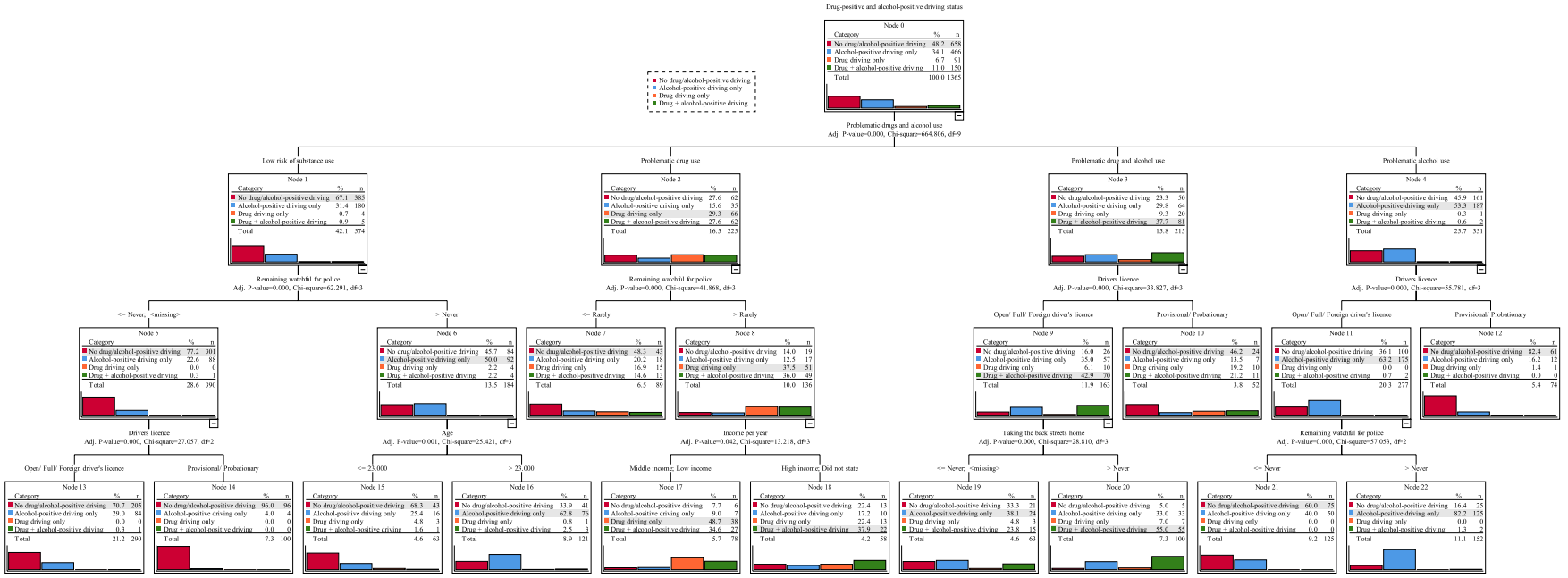

Fig. 2. A Decision Tree analysis for illegal driving behaviours.

For those with low risk substance use, engaging in drug driving was more commonly reported among those aged 23 or younger who sometimes to always utilised the avoidance strategy of remaining watchful for police vehicles (4.8% versus 0.8%).

3.7.2. Variables influencing alcohol-positive driving

Participants with problematic alcohol use who held an unrestricted driver's licence (63.2%) were more likely to report engaging in alcohol-positive driving than those holding a provisional/probationary driver's licence (16.2%) (χ^2 (3) = 55.78, p <.001). Those holding an open/full/foreign driver's licence who sometimes to always utilised the strategy of being watchful for police vehicles were more likely to report alcohol-positive driving (χ^2 (2) = 57.05, p <.001) than those never or rarely used this strategy (82.2% versus 40.0%).

Among those with problematic drug and alcohol use who held an open/full/foreign driver's licence, engaging in alcohol-positive driving was more likely to be reported by those participants who never or rarely utilised the strategy of taking the back streets home (38.1%) compared to those who frequently followed this strategy (33.0%) (χ^2 (3) = 28.81, p <.001).

Respondents with low-risk substance use who (sometimes to always) were watchful for police vehicles were more likely to report alcohol-positive driving (50.0% versus 22.6% "never or rarely") (χ^2 (3) = 62.29, p <.001), and this percentage was lower for young adults (<=23 years, 25.4%) compared to adult participants (62.8%) (χ^2 (3) = 25.42, p <.001). On the other hand, among those who never or rarely were watchful for police vehicles, alcohol-positive driving was lower among those holding a provisional/probationary driver's licence than those holding an open/full/foreign driver's licence (4.0% versus 29.0%, χ^2 (2) = 27.06, p <.001).

3.7.3. Variables influencing drug + alcohol-positive driving

Participants with problematic drug use who were sometimes to always watchful for police vehicles were more likely to report drug + alcohol-positive driving (36.0% versus 14.6%), but higher-income respondents were more likely to engage in drug + alcohol-positive driving (37.9%) than those with a low or middle income (34.6%).

Those with problematic drug and alcohol use who held an open/full/foreign driver's licence (42.9%) were more likely to report engaging in drug + alcohol-positive driving than those holding a provisional/probationary driver's licence (21.2%) (χ^2 (3) = 33.83, p <.001). Engaging in drug + alcohol-positive driving was associated with taking the back streets home (sometimes – always), with those holding an open/full/foreign driver's licence who frequently utilised this strategy being more likely to report drug + alcohol-positive driving (χ^2 (3) = 28.81, p <.001) than those who never or rarely adopted this strategy (55.0% versus 23.8%).

3.7.4. Variables influencing no-drug/alcohol-positive driving

The term "no drug/alcohol-positive driving" refers to neither drug taking nor alcohol consumption occurring at the same time then driving. Among the participants with problematic drug use, those who reported never or rarely being watchful for police vehicles were more likely not to drug/alcohol-positive drive (48.3%) than those who repeatedly (sometimes – always) adopted this strategy (14.0%).

Non-drug/alcohol-positive drivers (82.4%) with problematic alcohol use were more likely to hold a provisional/probationary driver's licence than an open/full/foreign driver's licence (36.1%). Also, those with problematic alcohol use who never or rarely were watchful for police vehicles were more likely not to drug/alcohol-positive drive (60%) than those who repeatedly (sometimes – always) adopted the strategy (16.4%).

Among the participants with problematic drug and alcohol use, those holding a provisional/probationary driver's licence (46.2%) were more likely not to drug/alcohol-positive drive than those holding an open/full/foreign driver's licence (16.0%).

Those who had low risk substance use and never or rarely were watchful for police vehicles reported less engagement in drug or alcohol-positive driving compared to those who frequently utilised this strategy (77.6% versus 45.7%). Furthermore, participants aged 23 or younger with low risk substance use who frequently were watchful for police vehicles (sometimes – always) were more likely to not drive while drug/alcohol-positive (68.3%) compared to older participants (33.9%).

4. Discussion

This study sought to investigate and explore the relative influence of problematic substance use, exposure to roadside drug testing, the use of detection avoidance strategies and perceptions toward alternative transport options on drug driving in Australia.

The study provides an in-depth analysis of the association between problematic substance use and self-reported drug driving behaviours. It appears that the problematic use of drugs and alcohol is prevalent among substance users, with 58% (n = 791) of the sample classified as problematic substance users, of whom 16% indicating a high risk of substance dependence. Among high-risk drug users (6.1% of problematic substance users), nearly 88% reported engaging in drug driving. Cannabis was the most common drug of problematic use among the high-risk group (87.5%), with 86% of high-risk cannabis users self-reporting drug driving. Participants who reported high-risk use of MDMA, amphetamine/methamphetamine, and cocaine were also found to be drug drivers. On the other hand, nearly 10% of participants meeting the threshold for problematic substance use were at high risk for alcohol use, of which only 19% self-reported drug driving compared to 76% indicating alcohol-positive driving. It is noteworthy that fewer alcohol-positive drivers were identified with dependency issues (9.6% of all alcohol-positive drivers n = 616) than was the case for drug drivers (17.4% of all drug drivers n = 241). Thus, it appears that alcohol consumption is not highly correlated with dependency (i.e., high-risk consumption), and thus deterring alcohol-positive driving appears relatively more achievable through an enforcement-based approach than drug driving. Nonetheless, previous research has indicated that those people who are addicted to alcohol tend to drive more compared to other regular drinking drivers, and that deterring such drivers is a challenging task (Freeman et al., 2006; Yu et al., 2006).

The drug driving patterns reflected in the current sample highlight the problem associated with drug abuse, with 95% of all drug drivers reporting problematic drug use. This problematic use of drugs appears to have a detrimental impact on the traditional enforcement approach through undermining its efficiency to effectively counteract drug driving. This is evident by most drug drivers attempting to avoid detection by locating and staying away from police operations. Therefore, it may be more effective to treat the problematic use as a health issue rather than rely solely on an enforcement-based approach.

Given the significant association between problematic drug use and drug driving, greater consideration needs to be given to approaches to address drug abuse and addiction. It is well documented that risks involved in addiction are mainly health-related, such as short- and long-term physical and psychological disorders, and in some cases of overdose, may even lead to death (Hedegaard et al., 2020; Sutherland et al., 2021b). Therefore, psychological and cognitive behavioural therapy, family-based prevention programs and educational campaigns are considered promising interventions. While some of these approaches have been shown to be effective in treating those with harmful levels of

alcohol intake (McQueen et al., 2011), the evidence for the efficacy of similar interventions for illicit drug use is scant (Davey et al., 2017). Furthermore, harm reduction approaches may also be useful to guide the design of educational campaigns aimed at discouraging people from taking drugs in the first instance, or at least encouraging them to better separate their drug use from their driving. It should be acknowledged, however, that some drug users are vulnerable people with specific needs; some use drugs for medical reasons, while others compulsively need drugs as addiction dominates their daily routine, including driving (Davey et al., 2005).

In addition, consideration needs to be given to targeting repeat drug driving offenders through rehabilitation and awareness courses, which seek to address the underlying problems contributing to the behaviour in order to reduce re-offending. Indeed, there is strong evidence that rehabilitation schemes for drink drivers have been successful in reducing reoffending (Department of Transport, 2022; Wells-Parker et al., 1995). Therefore, further work is warranted to develop and pilot rehabilitation programs specifically designed to address the needs of drug drivers. Certainly, the results of this study suggest that a health-based approach addressing drug abuse might be more effective than sanctions alone for drug drivers. Research shows that when such a health-based approach to alcohol addiction has been adopted over the past few decades, drink driving-related crashes have been reduced by 50%, suggesting that a similar approach with adequate health resources for drug addiction can be successful in reducing drug driving (Salmon et al., 2020).

Problematic use of drugs is not the only personal characteristic emerging as important from this study, as drug driving was found to be related to the gender of the driver. In line with previous research (Cook et al., 2017; Scott-Parker et al., 2014; Oviedo-Trespalacios and Scott-Parker, 2017), this study found that there is an overrepresentation of males among drug drivers. However, previous research has also highlighted a lack of explanation for this overrepresentation, whether it is due to higher drug consumption or a higher propensity to take risks compared to females (Hasan et al., 2022). Indeed, the results of the current study showed that more males were problematic drug users than females, indicating higher levels of problematic drug consumption among them. Such finding will assist in the creation of intervention proposals tailored to the drivers' characteristics, such as educating drug drivers about applicable laws and fines.

Patterns of substance use differed among the participants, as did self-reported drug driving. Among the participants who reported driving after taking drugs, nine out of every ten (89%) reported using cannabis and driving in the past three months. This is consistent with earlier research, cannabis was found to be the most consumed drug of the four drugs tested by police in Australia at RDT operations (Donald et al., 2006; Transport Accident Commission, 2019). As for alcohol consumption, the levels appear to have remained relatively high over the last 20 years among the general Australian population, as approximately 96% of participants reported consuming alcohol in the previous 3 months, with almost half of those reporting driving after drinking (Australian Institute of Health and Welfare, 2020; Mallick et al., 2007). Similarly, drug driving was found to be associated with polydrug use (Davey and Freeman, 2009; Hammig et al., 2021; Sutherland and Burns, 2011).

Measuring drivers' knowledge of the applicable penalties associated with illegal driving behaviour is a complex and challenging task. This, in turn, makes it difficult to interpret why the drug drivers in the sample were more likely to accurately report the value of the fines and the period of licence disqualification associated with drug driving compared with the non-drug drivers. It could be argued that most people would only seek out this information if it was relevant to them, which applies to drug drivers. Nonetheless, the results of the current study suggest that knowledge of penalties appears insufficient to discourage drivers from engaging in drug driving. Given this, designing intervention programs for drug users who have low-risk perceptions of being involved in a crash when driving after using drugs might assist in decreasing this behaviour (Arkell et al., 2020).

In Australia, the process of changing illegal driving behaviours has largely relied on the adoption and enforcement of laws (i.e., through the policing of the laws and the application of penalties for non-compliance) (Bates et al., 2012). Based on this behavioural change approach implemented through RDT and RBT operations, people might either be deterred (i.e., to not drive after taking drugs or alcohol), or not sufficiently deterred (i.e., continue to drug/drink drive). Therefore, to minimise circumvention opportunities, further evidence is required regarding the type of enforcement operations and the level of exposure to these that is required to achieve both a general and specific deterrent effect. In this study, observing the police performing RDT tests had no apparent deterrent effect on drivers, as engaging in drug or drug + alcohol-positive driving was likely to occur even if the drivers observed the RDT testing. This indicates a relatively low level of general deterrence, in which the threat of being tested is not sufficiently high among drivers who perceive low risks of being randomly tested (Scott-Parker et al., 2014). Furthermore, the experience of being tested through an RDT or RBT was reported more often by those who had engaged in any of the illegal driving behaviours than by those who had not. These findings are consistent with those of Horyniak et al. (2017), who concluded that there is no significant association between being tested once or more and recent drug driving among drug users. One proposal to enhance the deterrent effect of RDT is to increase the number of random and targeted RDT tests performed annually in Australia (Newstead et al., 2020). However, although RDT and RBT are theoretically implemented anywhere and anytime, in reality they are skewed towards high alcohol and drug use times and recreational road use, since the lack of police resources limits a more frequent conduct of these operations (Papafotiou Owens and Boorman, 2011). Due to limited resources, it appears that implementing fully random drug testing operations is elusive and that more opportunities to evade being tested or punished could arise.

Avoidance of detection and punishment are salient factors that can weaken the deterrent effect of enforcement (Stafford and Warr, 1993). Indeed, avoidance of detection could indicate that the enforcement approach has not been entirely implemented in a rigorous way (as it was somehow possible for it to be avoided), while experiencing the punishment and continuing to offend suggests that the penalties are not acting as a sufficient deterrent (Armstrong et al., 2005; Mills et al., 2022a). The current study found that most of detection avoidance strategies reported by the participants were significantly more likely to be utilised by the drug drivers than non-drug drivers. Those strategies can basically be categorised into two types: police-related strategies and driving-related strategies. For the first type, intelligence gathering about the police and their operations appears to be the primary technique. Driving-related strategies, on the other hand, mainly involved drivers trying to camouflage their impaired driving performance so that the police would not suspect them. Together, these strategies indicate a certain level of deterrence resulting from the current enforcement approach, since the drug drivers were motivated to avoid detection. Therefore, regardless of how successful the strategy is among those who utilise it, the design of supportive countermeasures should help increase the risk of detection while encouraging those who consume alcohol and/or drugs to use alternative driving options.

Previous research in Australia has shown that limited access to alternative transport options was a leading factor contributing to the decision to drug drive (Gavin et al., 2008). People who were less likely to use alternative transport after taking drugs attributed this to the lower reliability of transport options (e.g., buses and taxis) and to cars being

more convenient than public transport (Barrie et al., 2011; Bonar et al., 2018). The results of the current study showed that non-drug drivers found the options of catching public transport, catching a taxi, catching a courtesy bus, or using a designated driver, to be more convenient for them than the drug drivers. Therefore, to encourage the wider use of alternative transport, it is important that transport authorities maintain existing alternative mobility options and design policies that can encourage more drug users to consider them rather than drive. It is interesting to note that of all six investigated options, the only one for which there was no difference between drug- and non-drug drivers was riding an e-scooter. Due to the diverse demographics of participants, including the areas where they resided, the choice to use an e-scooter is arguably highly dependent on the participant living in the city where these services are available and easy to find. It should be noted, though, that more empirical research on transport alternatives is needed.

The final analysis focused on factors that would motivate drivers to engage in drug driving and other illegal driving behaviours and the variables that could distinguish between them. The decision tree analysis allowed the importance of various factors to be explored and compared in an integrated manner. Problematic substance use was the main common factor influencing all driving behaviours. That is, those classified as having problematic drug use were more likely to self-report drug-only driving; those with problematic alcohol use were more likely to drive alcohol-positive only, whereas those with problematic drug and alcohol use were more likely to drug + alcohol-positive drive. This highlights how the availability of drugs within a setting can not only influence the type and amount of drugs consumed and whether they develop dependence, but also affect their decision to drive after consumption (Hasan et al., 2022). These findings again suggest that long-term investment in strategies that can control drug availability and thus drug use may achieve a sustainable reduction in drug driving.

Adopting an avoidance strategy of staying alert to police vehicles was a common activity reported by drivers who engaged in illegal driving behaviour. Another avoidance strategy that has been prominent among those who have engaged in drug or drug + alcohol-positive driving is choosing to drive home through back streets. Although previous research has investigated some avoidance methods related to drug driving and other forms of illegal driving behaviours (Bates et al., 2020; Mills et al., 2022b; Truelove et al., 2021), the lack of detailed research on how to counter such avoidance strategies highlights the need for further investigations into this issue. One suggestion is to make RDT operations more unpredictable in time and location and to be highly visible to the public, which may increase awareness of detection risk among drivers who may consider implementing these avoidance strategies (Haworth and Lenné, 2007).

Significant differences were found between the three illegal driving behaviours in relation to the type of driver's licence held by the relevant participants. Drivers holding provisional or probationary licences were more likely to drug drive, while those with open/full/foreign driver's licence reported greater alcohol-positive driving or drug + alcohol-positive driving. This was supported by an emerging node in the decision tree showing that those aged 23 or younger were more likely to drug drive, the age at which most drivers would still be holding provisional or probationary licences. Therefore, it might be useful to couple the licencing procedures for learners, including tests and practice requirements, to short awareness-based courses about the risks of drug driving and the likelihood of being involved in a crash after using drugs.

The participants' level of income contributed differently to the decision to engage in the corresponding illegal driving behaviour, with a higher tendency to engage in drug driving among those with low- or middle-income, while drug + alcohol- positive driving was reported more often by higher-income respondents. These findings are consistent with previous research on drug driving coming from global settings that provided evidence of an increased likelihood of drug driving among low-income individuals (Benedetti et al., 2021; Yockey et al., 2020), but research on the impact of income from Australian research is limited.

A number of limitations should be borne in mind when interpreting the findings of the current study. First, the analysis only sought to explain the associations between variables, and it was not possible to draw conclusions about the causal relationships between the variables. Second, there are some limitations regarding the current sample, as the recruitment of participants may imply a self-selection bias which in turn can affect the representativeness of the sample. In particular, the sample featured an overrepresentation of males, younger drivers and provisional/probationary drivers. Third, as this study asked questions about illegal driving behaviours, participant may have underreported undesirable responses and overreported more desirable attributes, leading to a social desirability bias. Furthermore, the survey asked the participants to indicate their behaviours over a relatively long period of time (i.e., 12 months) which they may not be able to accurately recall leading to memory loss bias. Fourth, as this study is primarily focusing on the RDT drug drivers, participants indicating use of other drugs led to their exclusion from the analysis. Therefore, a broader sample that includes these types of impairing drugs is required for future research analysing drug driving behaviour among users. Moreover, omitting non-recent drug users reduced the ability to compare their perceptions to drug users in terms of police enforcement experiences and alternative transport, especially if they normally drink alcohol or use drugs before the three months window. Fifth, although the ASSIST is a cost-effective tool for online surveys and given the self-report nature of this study, reliable levels of dependency could only be confirmed by laboratory tests that were not applicable in this study. Finally, the definition of alcohol-positive driving was assessed based on consuming alcoholic drinks rather than the BAC level of 0.05 or above (the offence level), and this was adopted for the purpose of comparability with the drug drivers. As such, this definition does not reflect the driver's impairment status formally recognised as an offence in many jurisdictions. However, drivers tend to underestimate their BAC levels, which in turn could support high-risk decisions such as driving after drinking, regardless of the actual BAC in their system (Kypri and Stephenson, 2005; Laude and Fillmore, 2016).

5. Conclusions

The present study explored the effect of problematic substance use, along with other key enforcement and alternative transport factors, on drug driving behaviour. The high prevalence of drug dependency among drug drivers found highlights the need to treat the problematic use of drugs through health-based programs rather than solely rely on enforcement-based measures. The findings question the sufficiency of enforcement in deterring drug driving. Neither observing the police performing RDT or being aware of the drug driving penalties were associated with drug driving. In addition, many drug drivers reported using strategies to evade detection for drug driving, further eroding deterrence-related perceptions. While one response to this situation would be to further increase the resources devoted to RDT, the likely adequacy of such an approach remains unclear. Therefore, it may be more resource effective to consider how alternative transport options after consuming drugs can be made more convenient and economical.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix

Table A1
Demographic and driving characteristics of the total sample.

Total (N = 1,541)	N	%
Age		
Young adult (18–24)	464	30.1
Adult (+25)	1,077	69.9
Gender		
Male	899	58.3
Female	626	40.6
Other	16	1.0
Marital status		
Single	553	35.9
Married/ have a partner	885	57.4
Divorced/ Widowed	102	6.6
Level of education		
Primary & secondary	516	33.5
Tertiary	1,025	66.5
Employment status		
Unemployed	441	28.6
Employed	1,100	71.4
Licence type		
Provisional/ Probationary	342	22.2
Open/ Full/ Foreign driver's licence	1,199	77.8
Average hours of driving per week		
Below 17 h	1,246	80.8
Over than 17 h	295	19.2

Table A2
Self-reported use patterns of drugs other than RDT drugs.

Total (N = 1,541)		Substance use				Driving after using the specific substance	
		No		Yes			
Substance type		N	%	N	%	N	%
Opioids/ Sedatives		1,399	90.8	142	9.2	71	50.0
Hallucinogens		1,441	93.5	100	6.5	7	7.0
GHB		1,533	99.5	8	0.5	3	37.5
Other drugs		1,505	97.7	36	2.3	18	50.0
Polysubstance use (all drugs including RDT ones)	*with Alcohol*	1,273	82.6	253	16.4	144	56.9
	without Alcohol			15	1.0	12	80.0
Total illicit drugs including RDT ones (with or without alcohol)		904	58.7	637	41.3	300	47.1

Table A3
Variables included in decision tree analysis and measurement type.

Variable	Measurement type	Scale
Drug or alcohol-positive driving	Nominal	(1) No drug/alcohol-positive driving (2) Alcohol-positive driving only (3) Drug driving only (4) Drug + alcohol-positive driving
Problematic alcohol and drugs use status	Nominal	(1) Low risk of substance use (2) Problematic alcohol use (3) Problematic drug use (4) Problematic drug and alcohol use
Age	Continuous	Digits
Gender	Nominal	(1) Male (2) Female (3) Other
Marital status	Dichotomous	(1) Not partnered (2) Partnered
Level of education	Dichotomous	(1) Not tertiary (2) Tertiary
Employment status	Dichotomous	(1) Unemployed (2) Employed
Income per year	Ordinal	(1) Low income (2) Middle income (3) High income (4) Did not state
Driver's licence	Dichotomous	(1) Provisional/ Probationary (2) Open/ Full/ Foreign driver's licence
Hours of driving per week	Dichotomous	(1) Below median (2) Over median
Purpose of driving	Nominal	(1) Mostly for work (2) Mostly for personal/ leisure purposes (3) Mixture of work and personal/ leisure
Access to a vehicle	Dichotomous	(1) No (2) Yes
Type of vehicle	Nominal	(1) Car (2) Motorcycle (3) Truck (4) Other
Crashes	Dichotomous	(1) No crashes (2) At least one crash
Drug driving crashes	Dichotomous	(1) No drug driving crashes (2) At least one crash
Offences	Dichotomous	(1) No traffic offences (2) At least one offence
Drug driving offences	Dichotomous	(1) No drug driving offences (2) At least one offence
Drug injection	Nominal	(1) No, never (2) Yes, in the past three months (3) Yes, but not in the past three months
Seeing police operating RBT	Dichotomous	(1) Never seen (2) Seen
Seeing police operating RDT	Dichotomous	(1) Never seen (2) Seen
Being breath tested	Dichotomous	(1) Never been tested (2) Tested
Being drug tested	Dichotomous	(1) Never been tested (2) Tested
Strategies to avoid being caught for drink or drug driving		
Staying away from known police locations	Ordinal	(1) Never – (5) Always
Driving more carefully and in a sober-like way	Ordinal	(1) Never – (5) Always
Watching out for other drivers flashing their lights	Ordinal	(1) Never – (5) Always
Getting someone else to drive	Ordinal	(1) Never – (5) Always
Taking the back streets home	Ordinal	(1) Never – (5) Always
Remaining watchful for police vehicles	Ordinal	(1) Never – (5) Always
Using apps or GPS to locate where the police operations are	Ordinal	(1) Never – (5) Always
Alternative transport options	Ordinal	(1) Extremely easy – (5) Extremely difficult
Catch public transport	Ordinal	(1) Extremely easy – (5) Extremely difficult
Catch a taxi	Ordinal	(1) Extremely easy – (5) Extremely difficult
Catch a courtesy bus	Ordinal	(1) Extremely easy – (5) Extremely difficult
Use a designated driver	Ordinal	(1) Extremely easy – (5) Extremely difficult
Ride an e-scooter	Ordinal	(1) Extremely easy – (5) Extremely difficult
Ride a bicycle	Ordinal	(1) Extremely easy – (5) Extremely difficult

Table A4
Demographic and driving characteristics of problematic substance users according to RDT drug driving status (with or without *alcohol*).

Total (N = 791)			Non-RDT drug drivers (N = 559)		RDT Drug drivers (N = 232)		Chi-Square		
Age	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Young adult (18–24)	237	30.0	175	73.8	62	26.2	1.64	0.20	0.046 (1)
Adult (+25)	554	70.0	384	69.3	170	30.7			
Gender *	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Male	507	64.1	330	65.1	177	34.9	24.27	<0.001	0.258 (1)
Female	271	34.3	222	81.9	49	18.1			
Other	13	1.6	7	53.8	6	46.2			
Marital status	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Single	312	39.5	209	67.0	103	33.0	5.63	0.06	0.084 (2)
Married/ have a partner	438	55.4	324	74.0	114	26.0			
Divorced/ Widowed	40	5.1	25	62.5	15	37.5			
Level of education	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Primary & secondary	276	34.9	188	68.1	88	31.9	1.33	0.25	0.041(1)
Tertiary	515	65.1	371	72.0	144	28.0			
Employment status	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Unemployed	207	26.2	151	72.9	56	27.1	0.70	0.40	0.03 (1)
Employed	584	73.8	408	69.9	176	30.1			
Household Income per year	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Low (less than $30,000)	139	17.6	95	68.3	44	31.7	14.51	0.002	0.135 (3)
Middle ($30,000- $99,999)	310	39.2	199	64.2	111	35.8			
High ($100,000 or greater)	269	34.0	210	78.1	59	21.9			
Did not state	73	9.2	55	75.3	18	24.7			
Licence type	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Provisional/ Probationary	168	21.2	128	76.2	40	23.8	3.14	0.08	0.063 (1)
Open/ Full/ Foreign driver's licence	623	78.8	431	69.2	192	30.8			
Average hours of driving per week	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Below 17 h	660	83.4	483	73.2	177	26.8	12.13	<0.001	0.124 (1)
Over than 17 h	131	16.6	76	58.0	55	42.0			
Driving purpose	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Mostly for work	235	29.7	161	68.5	74	31.5	7.94	0.019	0.362 (2)
Mostly for personal/ leisure purposes	166	21.0	132	79.5	34	20.5			
Mixture of work and personal/ leisure	390	49.3	266	68.2	124	31.8			
Access to a vehicle (past 3 months)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	789	99.7	577	70.6	232	29.4	–	–	0.032 (1)
No	2	0.3	2	100.0	0	0.0			
Type of vehicle	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Car	732	92.8	516	70.5	216	29.5	0.22	0.974	0.017 (3)
Motorcycle	23	2.9	17	73.9	6	26.1			
Truck	15	1.9	11	73.3	4	26.7			
Other	19	2.4	13	68.4	6	31.6			
Prior involvement in crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	221	27.9	147	66.5	74	33.5	2.55	0.110	0.057 (1)
No	570	72.1	412	72.3	158	27.7			
Prior involvement in drug driving crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	8	3.6	1	12.5	7	87.5	–	–	–
No	213	96.4	146	68.5	67	31.5			
Traffic offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	324	41.0	199	61.4	125	38.6	22.66	<0.001	0.169 (1)
No	467	59.0	360	77.1	107	22.9			
Drug driving offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	36	11.1	7	19.4	29	80.6	30.11	<0.001	0.305 (1)
No	288	88.9	192	66.7	96	33.3			

* Given the small number of "Other" participants (N = 13), they were excluded from the Chi-square analysis for gender.

Table A5
Demographic and driving characteristics of problematic substance users according to alcohol-positive driving status (with or without *drugs*).

Total (N = 791)			**Non-alcohol-positive drivers (N = 360)**		**Alcohol-positive drivers (N = 431)**		**Chi-Square**		
Age	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Young adult (18–24)	237	30.0	146	61.6	91	38.4	35.33	<0.001	0.211 (1)
Adult (+25)	554	70.0	214	38.6	340	61.4			
Gender *	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Male	507	64.1	183	36.1	324	63.9	51.94	<0.001	0.177 (1)
Female	271	34.3	171	63.1	100	36.9			
Other	13	1.6	6	46.2	7	53.8			
Marital status	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Single	312	39.5	164	52.6	148	47.4	10.86	0.004	0.117 (2)
Married/ have a partner	438	55.4	177	40.4	261	59.6			
Divorced/ Widowed	40	5.1	18	45.0	22	55.0			
Level of education	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Primary & secondary	276	34.9	158	57.2	118	42.8	23.54	<0.001	0.173 (1)
Tertiary	515	65.1	202	39.2	313	60.8			
Employment status	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Unemployed	207	26.2	108	52.2	99	47.8	5.02	0.025	0.08 (1)
Employed	584	73.8	252	43.2	332	56.8			
Household Income per year	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Low (less than $30,000)	139	17.6	85	61.2	54	38.8	26.55	<0.001	0.183 (3)
Middle ($30,000- $99,999)	310	39.2	129	41.6	181	58.4			
High ($100,000 or greater)	269	34.0	103	38.3	166	61.7			
Did not state	73	9.2	43	58.9	30	41.1			
Licence type	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Provisional/ Probationary	168	21.2	128	76.2	40	23.8	80.95	<0.001	0.32 (1)
Open/ Full/ Foreign driver's licence	623	78.8	232	37.2	391	62.8			
Average hours of driving per week	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Below 17 h	660	83.4	317	48.0	343	52.0	10.19	0.001	0.114 (1)
Over than 17 h	131	16.6	43	32.8	88	67.2			
Driving purpose	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Mostly for work	235	29.7	98	41.7	137	58.3	3.55	0.17	0.067 (2)
Mostly for personal/ leisure purposes	166	21.0	85	51.2	81	48.8			
Mixture of work and personal/ leisure	390	49.3	177	45.4	213	54.6			
Access to a vehicle (past 3 months)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	789	99.7	358	45.4	431	54.6	–	–	0.055 (1)
No	2	0.3	2	100.0	0	0.0			
Type of vehicle	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Car	732	92.8	338	46.2	394	53.8	10.02	0.018	0.113 (3)
Motorcycle	23	2.9	9	39.1	14	60.9			
Truck	15	1.9	1	6.7	14	93.3			
Other	19	2.4	10	52.6	9	47.4			
Prior involvement in crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	221	27.9	102	46.2	119	53.8	0.051	0.821	0.008 (1)
No	570	72.1	258	45.3	312	54.7			
Prior involvement in drug driving crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	8	3.6	2	25.0	6	75.0	–	–	–
No	213	96.4	100	46.9	113	53.1			
Traffic offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	324	41.0	124	38.3	200	61.7	11.6	0.001	0.121 (1)
No	467	59.0	236	50.5	231	49.5			
Drug driving offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	36	11.1	18	50.0	18	50.0	2.36	0.125	0.085 (1)
No	288	88.9	106	36.8	182	63.2			

* Given the small number of "Other" participants (N = 13), they were excluded from the Chi-square analysis for gender.

Table A6
Demographic and driving characteristics of problematic substance users according to RDT drug + alcohol-positive driving status.

Total (N = 791)			Non-RDT drug + alcohol-positive drivers (N = 646)		RDT drug + alcohol-positive drivers (N = 145)		Chi-Square		
Age	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Young adult (18–24)	237	30.0	198	83.5	39	16.5	0.79	0.373	0.032 (1)
Adult (+25)	554	70.0	448	80.9	106	19.1			
Gender *	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Male	507	64.1	388	76.5	119	23.5	28.06	<0.001	0.19 (1)
Female	271	34.3	249	91.9	22	8.1			
Other	13	1.6	9	69.2	4	30.8			
Marital status	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Single	312	39.5	246	78.8	66	21.2	3.05	0.218	0.062 (2)
Married/ have a partner	438	55.4	367	83.8	71	16.2			
Divorced/ Widowed	40	5.1	32	80.0	8	20.0			
Level of education	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Primary & secondary	276	34.9	226	81.9	50	18.1	0.013	0.909	0.004 (1)
Tertiary	515	65.1	420	81.6	95	18.4			
Employment status	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Unemployed	207	26.2	176	85.0	31	15.0	2.11	0.146	0.052 (1)
Employed	584	73.8	470	80.5	114	19.5			
Household Income per year	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Low (less than $30,000)	139	17.6	119	85.6	20	14.4	6.4	0.094	0.09 (3)
Middle ($30,000- $99,999)	310	39.2	240	77.4	70	22.6			
High ($100,000 or greater)	269	34.0	225	83.6	44	16.4			
Did not state	73	9.2	62	84.9	11	15.1			
Licence type	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Provisional/ Probationary	168	21.2	150	89.3	18	10.7	8.27	0.004	0.102 (1)
Open/ Full/ Foreign driver's licence	623	78.8	496	79.6	127	20.4			
Average hours of driving per week	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Below 17 h	660	83.4	553	83.8	107	16.2	11.95	0.001	0.123 (1)
Over than 17 h	131	16.6	93	71.0	38	29.0			
Driving purpose	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Mostly for work	235	29.7	182	77.4	53	22.6	10.27	0.006	0.114 (2)
Mostly for personal/ leisure purposes	166	21.0	149	89.8	17	10.2			
Mixture of work and personal/ leisure	390	49.3	315	80.8	75	19.2			
Access to a vehicle (past 3 months)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	789	99.7	644	81.6	145	18.4	–	–	0.024 (1)
No	2	0.3	2	100.0	0	0.0			
Type of vehicle	N	%	N	%	N	%	χ^2	*p*	*V (df)*
Car	732	92.8	599	81.8	133	18.2	0.81	0.846	0.032 (3)
Motorcycle	23	2.9	19	82.6	4	17.4			
Truck	15	1.9	11	73.3	4	26.7			
Other	19	2.4	15	78.9	4	21.1			
Prior involvement in crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	221	27.9	177	80.1	44	19.9	0.051	0.475	0.025 (1)
No	570	72.1	469	82.3	101	17.7			
Prior involvement in drug driving crashes (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	8	3.6	3	37.5	5	62.5	–	–	–
No	213	96.4	174	81.7	39	18.3			
Traffic offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	324	41.0	249	76.9	75	23.1	8.51	0.004	0.104 (1)
No	467	59.0	397	85.0	70	15.0			
Drug driving offences (past 3 years)	N	%	N	%	N	%	χ^2	*p*	*Φ (df)*
Yes	36	11.1	21	58.3	15	41.7	7.81	0.005	0.155 (1)
No	288	88.9	228	79.2	60	20.8			

*Given the small number of "Other" participants (N = 13), they were excluded from the Chi-square analysis for gender.

Table A7
Classification table for decision tree analysis.

Observed	Predicted				
	No drug/alcohol-positive driving	Alcohol-positive driving only	Drug driving only	Drug + alcohol-positive driving	Percent Correct
No drug/alcohol-positive driving	547	87	6	18	83.1%
Alcohol-positive driving only	191	225	7	43	48.3%
Drug driving only	29	4	38	20	41.8%
Drug + alcohol-positive driving	26	20	27	77	51.3%
Overall Percentage	58.1%	24.6%	5.7%	11.6%	65.0%

Growing Method: EXHAUSTIVE CHAID.
Dependent Variable: Drug-positive and alcohol-positive driving status.

Methods

Procedure

Information relating to the survey was disseminated using social media (i.e., Facebook advertisement) and electronic mail through QUT mailing lists. Those participating in the survey had the opportunity to enter a draw to win 1 of 6 $200 Giftpay.com.au vouchers at the end of the survey. To maintain anonymity, a separate form was created to collect the information required for the purpose of the prize draw. QUT Psychology students received one SONA credit (i.e., through the QUT School of Psychology and Counselling SONA system) for their participation in the survey. This research study was approved by the Human Research Ethics Committee of the Queensland University of Technology (approval number 2000001069).

ASSIST scale for problematic substance use

After participants chose their substance of use, they were asked six items about: frequency of use; urge to use, drug-induced life problems (i.e., financial, legal, etc.), failure to perform usual tasks, others' expressed concerns about the participant's drug use and unsuccessful attempts to cut down on use. Possible overall scores on the ASSIST scale range from 0 to 39, with three levels of risk of drug use: 0–3 indicating low risk, 4–26 indicating medium risk and 27 or more indicating a high risk. The corresponding values for alcohol consumption are: 0–10 (low-risk), 11–26 (medium-risk) and + 27 (high-risk). As a result, each participant's score was calculated, and problematic substance use was identified with a score of 4 or greater for drugs and 11 or greater for alcohol (i.e., medium- or high-risk) (Humeniuk et al., 2008).

Results

Chi-square tests for driving behaviour of problematic substance users

As presented in Table A4 in the Appendix, Chi-square tests showed a significant association between **drug driving** and being male; middle household income per year, driving more than 17 h per week, driving for personal/leisure purposes, and being penalised for one or more traffic offences and drug driving offences in the past three years (effect size (Φ and Cramer's V) indicated strong relationships for gender, driving purpose and drug driving offences).

As for **alcohol-positive driving**, Chi-square tests showed a significant association between alcohol-positive driving and being adult; male, having a partner, having completed tertiary education, being employed, high household income per year, holding an open/full/foreign driver's licence, driving more than 17 h per week, driving a truck, and being penalised for one or more traffic offences in the past three years (effect size (Φ) indicated moderate relationships for age only) (Table A5 in the Appendix).

Furthermore, Chi-square tests showed a significant association between **RDT drug + alcohol-positive driving** and being male; holding an open/full/foreign driver's licence, driving more than 17 h per week, driving for personal/leisure purposes, and being penalised for one or more traffic offences and drug driving offences in the past three years (Table A6 in the Appendix).

Experiences of police enforcement

Seeing police operating RDT tests was reported by 35.7% (sometimes, often or always), while seeing police conducting RBT tests frequently (i.e., sometimes, often or always) was reported by nearly 61% of participants. Chi-square analyses showed a significant association between being an RDT drug driver (χ^2 (1, N = 1,344) = 6.85, p =.009) or an RDT drug + alcohol-positive driver (χ^2 (1, N = 1,344) = 8.48, p =.004) and observing police conducting RDT. No significant differences were found between the groups in relation to having observed police conducting RBT tests.

About 23% of participants reported having been tested at least once by RDT, while almost 85% reported having been tested at least once by RBT. Chi-square analyses showed that RDT drug drivers reported being tested by RDT (χ^2 (1, N = 1,345) = 45.91, p <.001) and RBT (χ^2 (1, N = 1,344) = 16.67, p <.001) more often than non-drug drivers. Similarly, alcohol-positive drivers reported being tested by RDT (χ^2 (1, N = 1,345) = 32.59, p <.001) and RBT (χ^2 (1, N = 1,344) = 51.22, p <.001) more often than non-alcohol-positive drivers. Furthermore, RDT drug + alcohol positive drivers were more likely to be tested for RDT (χ^2 (1, N = 1,345) = 39.80, p <.001) and RBT (χ^2 (1, N = 1,344) = 13.63, p <.001) than non-drug + alcohol-positive drivers.

Alternative transport options

Participant's responses about the perceived convenience of using alternative transport options if they had consumed alcohol and/or drugs and needed to travel are presented in Table A8. The alternative options of catching public transport, catching a taxi, catching a courtesy bus, or using a designated driver, were all statistically significantly more convenient (i.e., somewhat easy or extremely easy) for non-drug drivers than for drug drivers. In contrast, drug drivers found it more convenient to ride a bicycle if they had consumed alcohol and/or drugs than non-drug drivers. As for riding an e-scooter, there were no differences between the two groups of drivers.

Table A8
Respondents' self-reported levels of convenience to use alternative transport when consumed alcohol and/or drugs.

Transport mode (N = 1,365)	Non-RDT drug drivers			RDT drug drivers			Differences (Mann-Whitney *U* test)
	Extremely easy or somewhat easy (%)	Neither easy nor difficult (%)	Somewhat difficult or extremely difficult (%)	Extremely easy or somewhat easy (%)	Neither easy nor difficult (%)	Somewhat difficult or extremely difficult (%)	*p*
Catch public transport	454 (40.5%)	100 (8.9%)	567 (50.6%)	53 (22.0%)	22 (9.1%)	166 (68.9%)	<0.001
Catch a taxi	759 (67.8%)	134 (12.0%)	227 (20.3%)	88 (36.5%)	52 (21.6%)	101 (41.9%)	<0.001
Catch a courtesy bus	308 (27.5%)	216 (19.3%)	597 (53.3%)	39 (16.3%)	35 (14.6%)	166 (69.2%)	<0.001
Use a designated driver	745 (66.5%)	138 (12.3%)	238 (21.2%)	81 (33.6%)	49 (20.3%)	111 (46.1%)	<0.001
Ride an e-scooter	143 (12.8%)	128 (11.4%)	849 (75.8%)	34 (14.2%)	29 (12.1%)	177 (73.8%)	0.491
Ride a bicycle	210 (18.8%)	133 (11.9%)	777 (69.4%)	55 (22.8%)	38 (15.8%)	148 (61.4%)	0.022

References

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