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Short communication

Correlates of driving under the influence of cannabis

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Abstract

Background: Identifying cannabis users who are most at risk of driving under the influence of cannabis (DUIC) has important implications for drug treatment and prevention efforts. This paper examined correlates of DUIC among a purposive sample of recent cannabis users.
Methods: Interviews were carried out among a cross-sectional sample of 320 Australian cannabis users. Past-year prevalence of DUIC (without using alcohol or other drugs) was regressed against a range of potential predictor variables.
Results: Use of multiple drugs, believing that DUIC does not increase accident risk and cannabis dependence all predicted likelihood of DUIC. There was an interaction between age of first cannabis use and gender, whereby earlier onset cannabis use predicted DUIC but only among women.
Conclusions: The correlates of drug driving reflected cannabis users' beliefs about the dangers of cannabis use as well as their patterns of drug consumption. The emergence of cannabis dependence and age of onset as predictors of DUIC suggests a clearly defined role for treatment and prevention efforts in reducing the potential harms associated with DUIC.

Keywords: Cannabis; Driving; Predictors; Prevention; Dependence

1. Introduction

There is accumulating evidence showing a strong link between driving under the influence of cannabis (DUIC) and risk of road trauma (Blows et al., 2005; Drummer et al., 2004; Laumon et al., 2005; Mura et al., 2003). Whether these data imply causality is yet to be resolved (Fergusson, 2005) but, even if the risks prove to be small, the public health outcomes could potentially be quite catastrophic. Identifying cannabis users who are most at risk of DUIC is therefore of contemporary relevance to road accident prevention policy.

Only two large studies and one small pilot have specifically assessed risk factors for DUIC. This is unfortunate given that cannabis is the most widely used illicit drug worldwide (United Nations Office on Drugs and Crime, 2005). One of these studies examined DUIC among a large random sample of school students in the Atlantic Canadian provinces. The researchers found that males, more experienced drivers, students who had used fake identification to buy alcohol and students who reported drink driving were more likely to report DUIC in the previous year (Asbridge et al., 2005). The second of these studies investigated predictors of persistent cannabis-intoxicated driving among a longitudinal birth cohort of more than 1000 New Zealanders. Male drivers who exhibited low constraint, had prior traffic and other offending histories, and drivers who met diagnostic criteria for cannabis dependence were more likely to persistently drive after using cannabis (Begg et al., 2002). Frequent cannabis users were also found to be more likely to DUIC in a recent pilot study of Canadian University students (Fischer et al., 2006).

The current study aimed to add to this literature by assessing predictors of DUIC among a purposive sample of 320 drivers who reported using cannabis in the previous year. The primary outcome was participants' stated likelihood of driving within 1 h of using cannabis in the previous year, without using alcohol or other drugs. This was then regressed against a broad range of potential risk factors for DUIC.

2. Methods

2.1. Participants and procedure

Some of the sample characteristics are summarised in Table 1. These characteristics and the sampling procedures have been described in some detail elsewhere (Jones et al., 2006) and will not be repeated here. However, because the 320 participants were primarily recruited by advertising in street press and

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Table 1
Summary of participant characteristics, potential predictor variables and the outcome variable

	% (95% CI)
Age	
18–22	28 (23–33)
23–26	23 (18–28)
27–33	25 (21–31)
34+	24 (20–30)
Male	68 (62–73)
Indigenous	6 (4–9)
Born in Australia	76 (71–81)
In paid employment	46 (41–52)
Highest level of education	
Less than higher school certificate	29 (24–34)
Completed HSC	32 (27–38)
Trade or other certificate	15 (11–19)
Bachelor or higher	24 (20–29)
Peers who DUIC	
None	6 (4–10)
A few/about half	66 (60–71)
Most/all	28 (23–33)
Cannabis dependent	45 (39–50)
First used cannabis aged <16	64 (59–70)
Ever injected any drug	25 (21–31)
Number drug types ever used	
≤3	27 (22–32)
4–5	31 (26–36)
6+	43 (37–48)
Drink at risky levels	
Never	13 (10–17)
<Weekly	38 (33–43)
Weekly+	49 (43–55)
Ever had licence disqualification	33 (28–38)
KM travelled per week	
≤30	34 (29–40)
31–140	32 (27–38)
141+	34 (29–39)
Believe DUIC increases accident risk	53 (48–59)
Believe unlikely/very unlikely to be caught DUIC	80 (75–84)
Maximum fine for DUIC allowed in New South Wales	
No fine	10 (7–14)
≤$ 550	19 (14–23)
$ 1100	17 (13–22)
$ 2200	40 (34–45)
No maximum	14 (11–19)
Reported DUIC in previous year	78 (73–82)

through snowballing, it is important to be clear that this study did not intend to draw a representative sample of cannabis users. The strengths and limitations of this approach are discussed later in this paper.

2.2. Measures

The outcome and predictor variables are summarised in Table 1. The outcome was participants' reported likelihood of driving within 1 h of using cannabis in the previous year, without using alcohol or other drugs (0 = no, 1 = yes). This time frame was employed because psychomotor impairment is known to be most severe within the first hour of use (Ashton, 1999; Ramaekers et al., 2004) and, while providing a conservative estimate, this necessarily captured intoxicated driving and not just driving after recent drug use.

The following potential predictors of DUIC were explored: age, gender, whether participants identified as Indigenous Australians, country of birth, employment, education, peer drug driving, cannabis dependence (as indicated by a score of three or higher on the Severity of Dependence Scale, Gossop et al., 1995; Swift et al., 1998), age of first cannabis use, previous injecting behaviour and the number of other drug types used, risky alcohol use (using guidelines set out by the Australian National Health and Medical Research Council, 2001), prior licence disqualifications, average weekly distance driven in the previous year, and the perceived risk of accident, risk of apprehension and severity of fines associated with DUIC.

2.3. Analysis

Unadjusted logistic regression models were first fitted to examine bivariate relationships. Multivariate models were then fitted to determine which of the significant but unadjusted covariates were independently predictive of DUIC. Once a baseline model had been established and effect modification terms had been assessed, a manual backward elimination modelling approach was employed to determine the most appropriate model. Models were also fitted that explored predictors of driving after using cannabis and alcohol together, and driving after using cannabis and other drugs together. These models are not presented here but are available from the primary author on request. All analyses were carried out using SAS v8.02 (SAS Institute Inc., 1999).

3. Results

Bivariate analyses revealed that men were more likely to report DUIC in the previous year ($\chi^2_1 = 11.70$, $p < 0.001$, odds ratio [OR] = 2.6), as were participants who: were dependent on cannabis ($\chi^2_1 = 16.68$, $p < 0.001$, OR = 3.3), had more peers who drive after using cannabis ($\chi^2_1 = 4.45$, $p = 0.035$, OR = 2.0), had used more types of drugs in their lifetimes ($\chi^2_2 = 16.50$, $p < 0.001$, OR = 2.4 and OR = 3.7 for those who had used 4–5 and 6+ drug types, respectively), had one or more prior licence disqualifications ($\chi^2_1 = 5.99$, $p = 0.014$, OR = 2.1), and felt that cannabis does not increase accident risk ($\chi^2_1 = 25.14$, $p < 0.001$, OR = 4.3). Later onset cannabis users (16+ years) were less likely to report DUIC than early onset users (<16 years; $\chi^2_1 = 7.23$, $p = 0.007$, OR = 0.5). Participants who were in some form of paid employment ($\chi^2_1 = 2.76$, $p = 0.097$, OR = 0.6) and those who felt that they were moderately or very likely to be caught by the police for DUIC ($\chi^2_1 = 3.29$, $p = 0.070$, OR = 0.6) also tended to be less likely to report DUIC in the previous year, although these relationships were not significant at the conventional 5% level.

Table 2 shows the adjusted odds ratio estimates for the final model. Gender was a significant effect modifier of the relationship between age of first cannabis use and past-year DUIC ($\chi^2_1 = 13.81$, $p < 0.001$). Later onset female cannabis users were significantly less likely to report past-year DUIC (OR = 0.1) but age of first cannabis use was not predictive of DUIC among men in the sample. After adjusting for other factors, participants who had used more types of drugs (OR = 2.1 and OR = 2.9 for participants reporting using 4–5 and 6+ drug types, respectively), participants who felt they were not at increased risk of accident when DUIC (OR = 3.5) and cannabis-dependent participants (OR = 2.4) were more likely to report past-year DUIC.

Table 2
Adjusted odds ratios and 95% confidence intervals for factors predicting likelihood of driving under the influence of cannabis (DUIC) in the previous 12 months

Covariate	β	S.E.	Wald	p-Value	OR	CI
Intercept	0.04	0.40	0.01	0.916		
Number of drug types used						
≤3					1.0	
4–5	0.74	0.39	3.61	0.057	2.1	1.0–4.5
6+	1.08	0.38	8.10	0.004	2.9	1.4–6.1
Believe DUIC increases accident risk						
Yes					1.0	
No	1.24	0.34	13.11	<0.001	3.5	1.8–6.8
Gender × age first use						
Female/<16					1.0	
Female/16+	−2.16	0.56	15.00	<0.001	0.1	0.0–0.3
Male/<16	−0.07	0.41	0.03	0.870	0.9	0.4–2.1
Male/16+	0.35	0.45	0.62	0.430	1.4	0.6–3.4
Cannabis dependent						
No					1.0	
Yes	0.88	0.34	6.59	0.010	2.4	1.2–4.7

4. Discussion

Risk factors for DUIC among this sample were earlier onset cannabis use (for women, at least), dependent cannabis use, using multiple drug types and believing that accident risk does not increase following cannabis use. Although they dropped out of the final model, there was also some suggestion that more deviant drivers (using licence disqualifications as a proxy) and those who associated in peer networks where DUIC was more common were also predictive of DUIC. These covariates appeared to drop out of the final model as a result of their close relationship with other risk factors controlled for in the model, such as cannabis dependence and age of first use. However it is possible that they may have remained in the model had greater power been afforded by a larger sample size. This is a question for future research. It is not immediately clear why age of first cannabis use was only predictive of DUIC among women in this sample. It is possible that early onset cannabis use is simply a greater marker for deviance among women than it is among men. It could also be the case that male gender is so strongly predictive of DUIC that age of first cannabis use ceases to be an important predictor among this subgroup of at-risk road users.

It would be imprudent to proceed without making mention of the methodological limitations associated with this study. Firstly, by necessity the Severity of Dependence Scale only provides a proxy for cannabis dependence. However, it has been used extensively by researchers as a marker for dependence and ROC analyses have shown that it diagnoses DSM-III-R cannabis dependence at levels substantially better than chance (Swift et al., 1998). Given the time constraints of the current study it was therefore considered to be an appropriate proxy measure for this purpose. The primary limitation of these data is that the purposive sampling framework does not allow us to generalise these correlates of DUIC to all cannabis users. In fact, the large proportion of the sample that met the criteria for cannabis dependence suggests that the recruitment strategy may have attracted a relatively entrenched subgroup of cannabis users. While this limits the conclusions that may be reached about cannabis users in general, this study may have inadvertently recruited people who are most at risk of persistently driving after using cannabis (Begg et al., 2002) and who should undoubtedly be the focus of drug driving prevention efforts. In this light, in the absence of large-scale random samples of cannabis users that are often prohibitively expensive to conduct, future studies that assess predictors of DUIC within these already at-risk populations would be very worthy endeavours indeed.

These limitations aside, it is hoped that these results provide useful insights into the broader context within which drug driving prevention efforts must be viewed. The data presented here suggest that DUIC might simply reflect a set of generally aberrant attitudes and behaviours involving cannabis and other drugs. Once people begin using cannabis early, experiment with multiple other drugs, develop a dependence on cannabis and form (perhaps false) views about the relationship between cannabis use and accident risk, their likelihood of DUIC increases markedly. However the link between cannabis dependence and DUIC does provide encouragement for policy makers and clinicians who seek to ameliorate the risks associated with DUIC. Brief cognitive-behavioural (Copeland et al., 2001) or motivational enhancement interventions (Monti et al., 2001) that are designed to reduce levels of cannabis dependence might provide follow-on effects in terms of reduced rates of DUIC. The finding that early-onset cannabis use increases the risk of DUIC among women also suggests that primary prevention efforts that aim to delay or prevent the onset of cannabis use may provide some additional scope for reducing rates of DUIC.

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References

Asbridge, M., Poulin, C., Donato, A., 2005. Motor vehicle collision risk and driving under the influence of cannabis: evidence from adolescents in Atlantic Canada. Accid. Anal. Prev. 37, 1025–1034.

Ashton, C.H., 1999. Adverse effects of cannabis and cannabinoids. Br. J. Anaesth. 83, 637–649.

Begg, D.J., Langley, J.D., Stephenson, S., 2002. Identifying factors that predict persistent driving after drinking, unsafe driving after drinking, and driving after using cannabis among young adults. Accid. Anal. Prev. 35, 669–675.

Blows, S., Ivers, R.Q., Connor, J., Ameratunga, S., Woodward, M., Norton, R., 2005. Marijuana use and car crash injury. Addiction 100, 605–611.

Copeland, J., Swift, W., Roffman, R., Stephens, R., 2001. A randomised controlled trial of brief cognitive-behavioural interventions for cannabis use disorder. J. Subst. Abuse Treat. 21, 55–64.

Drummer, O.H., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J.R.M., Robertson, M.D., Swann, P., 2004. The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. Accid. Anal. Prev. 36, 239–248.

Fergusson, D.M., 2005. Marijuana use and driver risks: the role of epidemiology and experimentation. Addiction 100, 577–578.

Fischer, B., Rodopoulos, J., Rehm, J., Ivsins, A., 2006. Toking and driving: characteristics of Canadian university students who drive after cannabis use and exploratory pilot study. Drugs Educ. Prev. Pol. 13, 179–187.

Gossop, M., Darke, S., Griffiths, P., Hando, J., Powis, B., Hall, W., Strang, J., 1995. The severity of dependence scale (SDS): psychometric properties of the SDS in English and Australian samples of heroin, cocaine and amphetamine users. Addiction 90, 607–614.

Jones, C., Donnelly, N., Swift, W., Weatherburn, D., 2006. Preventing cannabis users from driving under the influence of cannabis. Accid. Anal. Prev. 38, 854–861.

Laumon, B., Gadegbeku, B., Martin, J., Biecheler, M., The Sam Group, 2005. Cannabis intoxication and fatal road crashes in France: population based case-control study. Br. Med. J. 331, 1371–1376.

Monti, P.M., Barnett, N.P., O'Leary, T.A., Colby, S.M., 2001. Motivational enhancement for alcohol-involved adolescents. In: Monti, P.M., Colby, S.M., O'Leary, T.A. (Eds.), Adolescents, Alcohol, and Substance Abuse: Reaching Teens Through Brief Interventions. The Guilford Press, New York, pp. 145–182.

Mura, P., Kintz, P., Ludes, B., Gaulier, J.M., Marquet, P., Martin-Dupont, S., Vincent, F., Kaddour, A., Goulle, J.P., Nouveau, J., Moulsma, M., Tilhet-Coartet, S., Pourrat, O., 2003. Comparison of the prevalence of alcohol, cannabis and other drugs between 900 injured drivers and 900 control subjects: results of a French collaborative study. Forensic Sci. Int. 133, 79–85.

National Health and Medical Research Council, 2001. Australian Alcohol Guidelines: Health Risks and Benefits. National Health and Medical Research Council, Canberra.

Ramaekers, J.G., Berghaus, G., van Laar, M., Drummer, O.H., 2004. Dose related risk of motor vehicle crashes after cannabis use. Drug Alcohol Depend. 73, 109–119.

Swift, W., Copeland, J., Hall, W., 1998. Choosing a diagnostic cut-off for cannabis dependence. Addiction 93, 1681–1692.

United Nations Office on Drugs and Crime, 2005. World Drug Report. United Nations Office on Drugs and Crime, Vienna.