PERGAMON

Accident Analysis and Prevention 35 (2003) 669–675

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

Identifying factors that predict persistent driving after drinking, unsafe driving after drinking, and driving after using cannabis among young adults

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Received 20 January 2002; received in revised form 18 April 2002; accepted 22 April 2002

Abstract

The main aim of this study was to identify adolescent/young adulthood factors that predicted persistent driving after drinking, persistent unsafe driving after drinking, and persistent cannabis use and driving among young adults. It was a longitudinal study of a birth cohort ($n = 933$, 474 males and 459 females) and was based on data collected at ages 15, 18, 21 and 26 years. At each of these ages members of the cohort attended the research unit for a personal interview by a trained interviewer, using a standardised questionnaire. For this study, the data for the outcome measures (persistent driving after drinking, persistent unsafe driving after drinking, and persistent driving after using cannabis) were obtained at ages 21 and 26 years. The main explanatory measures were collected at ages 15, 18, 21 years and included demographic factors (academic qualifications, employment, parenting); personality measures; mental health measures (substance use, cannabis dependence, alcohol dependence, depression); anti-social behaviour (juvenile arrest, aggressive behaviour, court convictions); early driving behaviour and experiences (car and motorcycle licences, traffic crashes).

The analyses were conducted by gender. The results showed that females who persisted in driving after drinking (13%, $n = 61$) were more likely than the others to have a motorcycle licence at 18. The males who persisted in driving after drinking (28%, $n = 135$) were more likely than the other males to have some school academic qualifications and to be employed at age 26. Compared to the other males, those who persisted in unsafe driving after drinking (4%, $n = 17$) were more likely to be aggressive at 18 and alcohol dependent at 21. Only six (1%) females persisted in unsafe driving after drinking so regression analyses were not conducted for this group. For persistent driving after using cannabis, the univariate analyses showed that females who persisted with this behaviour tended to have high substance use at 18, cannabis dependence at 21, police contact as a juvenile, and to be a parent at 21. For this group, because of the small numbers (3%, $n = 13$) multivariate analyses were not appropriate. For the males who persisted in driving after using cannabis (14%, $n = 68$) a wide range of variables were significant at the univariate stage. The multivariate analysis showed that the most important factors were dependence on cannabis at 21, at least one traffic conviction before 21, a non traffic conviction before 18, and low constraint at 18.

Conclusion: These results show different characteristics were associated with persistence in each of these outcome behaviours. This indicates that different approaches would be required if intervention programmes were to be developed to target these behaviours.

Keywords: Young adults; Persistence; Alcohol; Cannabis; Driving

1. Introduction

For many years throughout the industrialised world alcohol impaired driving has been an important road safety problem (Bailey and Carpinter, 1991; Farrow and Brissing, 1990; Guppy and Adams-Guppy, 1995). Since the 1980s, however, there has been a downward trend in the rate of alcohol-related traffic crashes and more recently there has been an increasing awareness that a relatively large proportion of the remaining problem can be attributed to a small group of drivers who repeatedly drive after drinking large quantities of alcohol (Beirness et al., 1997; Stewart, 2000). These are the persistent, or hard-core, drinking drivers.

After alcohol, cannabis is the psychoactive substance most frequently found in the blood of motorists involved in traffic crashes. The contribution of cannabis as a causal factor in traffic crashes is equivocal. A review of analytical studies concluded there was no evidence that cannabis alone increased the risk of culpability for traffic crash fatalities or serious injuries but that it may lead to an increased risk of crashes causing less serious injury and vehicle damage (Bates and Blakely, 1999).

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0001-4575/02/$ – see front matter
PII: S0001-4575(02)00045-3

Although, the role of alcohol, and to a lesser extent cannabis, has been extensively studied in relation to traffic crashes, to our knowledge no research has examined the early characteristics of young drivers who have gone on to become persistent high risk drivers (such as the persistent drinking driver and possibly the persistent cannabis using driver). The relevant longitudinal data for many of the potential risk factors for such a study (Beirness et al., 1997) are available from a multidisciplinary birth cohort study in New Zealand. In addition, road safety behaviour has been an ongoing part of this cohort study with driving behaviour in relation to alcohol and cannabis included at the young adult stages. The prevalence of these behaviours, especially among the males, has been reported to be quite high. At age 21, over 50% of the males had driven after drinking, 20% had driven when it was perhaps unsafe for them to drive, 25% had driven after using cannabis (Begg and Langley, 1999). At age 26, the prevalence of these behaviours was 57, 10 and 25%, respectively (Begg and Langley, 2001).

The aims of the present study were to determine if those who persisted in (1) driving after drinking, (2) driving after drinking too much to be able to drive safely, and (3) driving after using cannabis, differed from those who did not engage in these behaviours, and (4) to identify similarities and differences in the factors that predicted each of these behaviours.

2. Method

The study population was the Dunedin multidisciplinary health and development study (DMHDS) which is a longitudinal study of the health, development, attitudes and behaviour of a cohort of 1037 young people born at the only obstetric hospital in Dunedin, New Zealand between 1 April 1972 and 31 March 1973. Members of this cohort have been assessed at two yearly intervals from age 3 to 15 years, and again at 18, 21 and 26 years. The DMHDS is characterised by high follow-up rates and the wide variety of studies that have been included at each assessment, details of which are provided elsewhere (Silva and Stanton, 1996).

2.1. Outcome measures

These data were obtained from study members who participated in a road safety interview at the ages 21 and 26 assessments, using similar questions to other surveys for which the reliability has been shown to be at least "substantial" (Brener et al., 1995). For the present study information was sought on the number of times in the previous month (30 days) they had: (1) driven a car within 2 h of drinking (alcohol); (2) driven a car when they thought that perhaps they had too much to drink to be able to drive safely; (3) driven a car within 2 h of using marijuana (cannabis). From these data, three outcome categories were created: drink-drive, unsafe drink-drive and cannabis use and drive. The responses were scored 0 (no times) or 1 (one or more times). Those who scored a 1 at both ages 21 and 26 were classified as "persistent", and they were compared with the remainder.

2.2. Explanatory factors

The explanatory measures for this study were obtained in a range of studies that are part of the DMHDS. Demographic data was obtained in interviews at ages 18, 21 and 26 (Caspi et al., 1996). A school academic qualification was defined as at least one school certificate subject pass, which is the first formal academic qualification that can be gained at secondary school in New Zealand, usually around the age of 15–16 years. A university qualification required at least a bachelors degree from a university, which requires a minimum of 3 years tertiary study. Mental health was assessed at ages 18 and 21, using a modified version of the diagnostic interview schedule (DIS) (Robins et al., 1981; Feehan et al., 1994; Newman et al., 1996). In this study, a measure of high substance use at age 18 was used to indicate early problems associated with alcohol and cannabis use. The study members with symptom scores in the upper quartile were classified as high substance users. At age 21, diagnostic measures for alcohol and cannabis dependence, and depression (major depressive episode) were included. Antisocial behaviour was indicated using the official police conviction records (excluding drunk driving and criminally negligent driving), (Krueger et al., 1994) traffic convictions which included all driving and other traffic violations, (Reeder et al., 1998) and juvenile arrests, which were "police contacts" between the ages of 10 and 16 years. For each of these antisocial behavioural measures, those with any police record were compared with those with none. "Aggressive behaviour" was a subset of items from a self-report delinquency scale (Moffitt et al., 1994) obtained at age 18 using a standardised questionnaire, comprising only those behaviours which were deemed to be aggressive: set fire to a building, hit a parent/partner, fought an officer, fought on the street or in a public place, used force or threats to get money from a person, used a weapon in a fight. The aggressive behaviour score is a frequency count of the number of times each of these behaviours was performed in the previous year. Aggressive behaviour was classified as having performed at least one aggressive act, which for the females was those in 89th percentile or above, and for the males was the upper quartile. Personality was assessed at age 18, using a modified version of the multidimensional personality questionnaire (MPQ) (Caspi et al., 1997). For this study, three higher order factors were used: constraint (traditionalism, harm avoidance and control scales), negative emotionality (aggression, alienation, stress reaction), and positive emotionality (achievement, social potency, well-being, social closeness) (Begg et al., 1999). Data on early driving experiences, driver licensing (Begg et al., 1995) and motorcycle use (Reeder et al., 1995) were obtained at ages 15 and

Table 1
Numbers classified in each of the three driving categories (drink-drive, unsafe drink-drive and cannabis drive), based on self-reported behaviour at ages 21 and 26 years, by gender

Driving category	Gender	Persistent *N* (%)	Others *N* (%)	Total *N* (%)
Drink-drive	Females	61 (13)	398 (87)	459 (100)
	Males	135 (28)	339 (72)	474 (100)
Unsafe drink-drive	Females	6 (1)	453 (99)	459 (100)
	Males	17 (4)	457 (96)	474 (100)
Cannabis use drive	Females	13 (3)	446 (97)	459 (100)
	Males	68 (14)	404 (86)	472[a] (100)

[a] Missing data for two males.

18, and self-reported traffic crash involvement from age 13 to 26 years (Begg et al., 1990; Begg et al., 1999).

2.3. Statistical analyses

At the univariate stage, unadjusted odds ratios were calculated for each of the potential explanatory variables in relation to each of the outcomes, using logistic regression. Where adequate numbers were available in the outcome groups, that is approximately 10 observations in each outcome group to each explanatory variable (Harrell et al., 1996) multivariate logistic regression analyses were conducted. Given the relatively large number of explanatory variables and small number of observations in some of the outcome groups, only variables associated with the outcome at $P < 0.01$ were retained for the multivariate analysis. From the multivariate analyses, adjusted odds ratios were calculated and a significance level was set at $P < 0.05$. Where it was considered appropriate, the multivariate analysis was conducted in two stages. At the first stage, the potential predictors (i.e. variables measured before age 21) were examined simultaneously, and the significant variables were retained for the next stage when the significant correlates (i.e. variables measured at age 21 or age 26) from the univariate analysis were added to the model. The purpose of the second stage was to assess the strength of the association between the predictors and the outcome behaviour, after adjusting for factors associated with the behaviour.

3. Results

Of the 992 and 980 study members who participated in the ages 21 and 26 assessments, respectively, 933 (474 males and 459 females) completed both interviews on road safety

Table 2
Unadjusted odds ratios (OR) and 95% confidence intervals (CI) from logistic regression models comparing those who persisted in drinking and driving with the others for each of the demographic, personality, antisocial behaviour, and early driving behavioural measures, by gender

Explanatory measures (age in years)	Males			Females		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Demographic characteristics						
School qualifications (21)	2.3	1.3–4.2	<0.01	1.4	0.5–3.6	0.50
University qualifications (26)	0.9	0.6–1.5	0.71	1.4	0.8–2.5	0.26
Employed (26)	2.7	1.2–5.9	0.01	4.9	0.7–36.5	0.12
A parent (21)	0.9	0.5–1.5	0.73	1.2	0.7–1.9	0.46
Personality measures						
Low constraint (18)	1.2	0.8–1.9	0.44	0.9	0.4–1.6	0.64
Low positive emotionality (18)	0.7	0.4–1.1	0.09	1.2	0.6–2.1	0.70
High negative emotionality (18)	0.9	0.6–1.4	0.67	1.1	0.6–2.0	0.81
Mental health measures						
High substance use (18)	0.8	0.5–1.4	0.50	1.2	0.7–2.4	0.45
Alcohol dependence (21)	1.2	0.7–2.1	0.49	0.5	0.1–2.3	0.39
Cannabis dependence (21)	0.9	0.5–1.7	0.89	0.3	0.0–2.3	0.24
Depression (21)	0.7	0.4–1.5	0.39	1.0	0.5–1.9	0.96
Anti-social behaviour						
Juvenile arrest (<16)	0.8	0.5–1.4	0.41	1.0	0.4–2.5	0.99
Aggressive behaviour (18)	0.7	0.4–1.2	0.18	0.6	0.2-2.0	0.42
Police conviction (18)	1.6	0.9–2.7	0.13	0.9	0.6–1.2	0.73
Traffic conviction (16–21)	0.6	0.3–1.0	0.07	0.4	0.0–2.7	0.33
Alcohol traffic conviction (16–21)	0.7	0.3–1.5	0.36	0.6	0.1–4.9	0.64
Early driving related behaviours						
Able to drive a car (15)	1.0	0.7–1.6	0.86	1.3	0.7–2.4	0.40
Car licence (15–16)	1.1	0.6–2.0	0.80	1.7	0.7–4.0	0.20
Ride a motorcycle (15)	1.0	0.7–1.6	0.83	1.3	0.7–2.3	0.45
Motorcycle licence (18)	0.9	0.5–1.6	0.77	5.6	1.5–21.7	0.01
Traffic crash (13–26)	1.0	0.5–1.9	0.99	0.7	0.2–2.4	0.59

issues and were eligible for the present study. Table 1 shows few females ($n = 6$) engaged in unsafe driving after drinking so regression analyses were not attempted for this outcome.

3.1. Persistent drink-driving

The unadjusted results (Table 2) show that for the males, those that persisted in driving after drinking were more likely than the others to have some school academic qualifications and to have been employed at age 26. The adjusted results were very similar (school qualifications: OR 2.1, 95% CI 1.7–3.9, $P = 0.01$; employed at age 26: OR 2.4, 95% CI 1.1–5.2, $P = 0.03$). For the females, the only difference (Table 2) was that those who persisted in driving after drinking were more likely than the others to have a motorcycle licence at 18.

3.2. Persistent unsafe drink-driving

The univariate results (Table 3) show that the males who persisted in unsafe drink-driving were more likely to be alcohol dependent at age 21 and have reported aggressive behaviour at 18. The adjusted results remained unchanged (alcohol dependence at 21: OR 3.3, 95% CI 1.1–9.3, $P = 0.03$; aggressive behaviour at age 18: OR 3.3, 95% CI 1.2–8.8, $P = 0.02$).

Table 3
Unadjusted odds ratios (OR) and 95% confidence intervals (CI) comparing males who persisted in unsafe drinking and driving compared with the others for each of the demographic, personality, antisocial behaviour, and early driving behavioural measures

Explanatory measures (age in years)	Males only		
	OR	95% CI	*P*-value
Demographic characteristics			
School qualifications (21)	1.7	0.4–7.4	0.50
University qualifications (26)	0.2	0.0–1.7	0.15
Employed (26)	2.1	0.3–16.5	0.46
A parent (21)	1.3	0.4–4.2	0.61
Personality measures			
Low constraint (18)	0.9	0.3–2.9	0.90
Low positive emotionality (18)	1.7	0.6–4.7	0.31
High negative emotionality (18)	0.4	0.1–1.7	0.21
Mental health measures			
High substance use (18)	2.5	0.9–6.9	0.07
Alcohol dependence (21)	3.7	1.3–10.2	0.01
Cannabis dependence (21)	1.9	0.6–5.9	0.29
Depression (21)	0.5	0.1–3.9	0.51
Anti-social behaviour			
Juvenile arrest (<16)	1.8	0.6–5.2	0.29
Aggressive behaviour (18)	3.5	1.3–9.3	0.01
Police conviction (18)	1.3	0.4–4.8	0.66
Traffic conviction (16–21)	1.0	0.3–3.7	0.96
Alcohol traffic conviction (16–21)	0.6	0.1–5.0	0.68
Early driving related behaviours			
Able to drive a car (15)	2.0	0.6–6.3	0.24
Car licence (15–16)	0.8	0.2–3.5	0.72
Ride a motorcycle (15)	1.2	0.4–3.3	0.74
Motorcycle licence (18)	1.4	0.4–4.5	0.54
Traffic crash (13–26)	1.2	0.3–5.2	0.84

3.3. Persistent cannabis use and driving

For the males, the univariate results (Table 4) show that those who persisted in driving after using cannabis were more likely to report low constraint, high levels of negative emotionality, high substance use at age 18, alcohol dependence at age 21, cannabis dependence at age 21, juvenile arrest, non traffic related police conviction before age 18, a traffic conviction before age 21, an alcohol traffic conviction, aggressive behaviour at age 18, able to drive a car at age 15, motorcycle licence at age 18, and to have been involved in a traffic crash between the ages of 13 and 26 years.

For the females (Table 4) those who persisted in driving after using cannabis were more likely to have been a parent at age 21, had high substance use at age 18, cannabis dependent at age 21, and been arrested as a juvenile between age 10–16 years.

For the males, the adjusted results from stage 1 of the multivariate analysis (i.e. the predictor variables) are presented in Table 5. These show that low constraint at age 18, a non-traffic police conviction before age 18, and a traffic conviction before age 21, predicted persistent driving after using cannabis. At stage 2, when the significant correlates from the univariate analysis were added to the model (Table 5) cannabis dependence at age 21 was shown to be the most powerful factor associated with persistent driving after using cannabis but, after adjusting for cannabis dependence, a police conviction (traffic and non-traffic) and low constraint remained significant predictors.

Due to the small number of females who persisted in driving after using cannabis, no multivariate analyses were undertaken for this group.

4. Discussion

Unlike other studies which typically have studied drivers whose persistent drinking and driving behaviour had brought them to the attention of the police, the drivers in this study were part of a much larger study of health and development and their classification as a persistent drinking driver, a persistent unsafe drinking driver, or a persistent cannabis using driver, was based on self-report recorded at two points in time, ages 21 and 26 years. An advantage of the present study, therefore, is that the participants were analogous to a community sample and the results may be generalisable to young adults in other communities, whereas in other studies the participants are analogous to a clinical sample, and thus, the results may not be generalisable to the community.

With the exception of the police conviction data, all data for this study was self-reported and the limitations associated with this form of data collection apply. Of particular

Table 4
Unadjusted odds ratios (OR) and 95% confidence intervals (CI) from logistic regression models comparing those who persisted in driving after using cannabis with all the others for each of the demographic, personality, antisocial behaviour, and early driving behavioural measures, by gender

Explanatory measures (age in years)	Males			Females		
	OR	95% CI	[a]*P*-value	OR	95% CI	[b]*P*-value
Demographic characteristics						
School qualifications (21)	0.6	0.3–1.0	0.05	0.4	0.1–1.4	0.15
University qualifications (26)	0.4	0.2–0.9	0.02	0.8	0.2–3.0	1.00
Employed (26)	1.4	0.6–3.4	0.47	0.9	0.1–6.9	0.60
A parent (21)	1.7	0.9–3.1	0.08	5.0	1.6–15.6	0.01
Personality measures						
Low constraint (18)	3.4	2.0–5.8	<0.001	3.8	1.2–11.5	0.02
High negative emotionality (18)	2.1	1.2–3.7	0.01	2.0	0.6–6.3	0.33
Low positive emotionality (18)	1.4	0.8–2.4	0.30	1.9	0.6–5.9	0.32
Mental health measures						
High substance use (18)	3.3	1.9–5.5	<0.001	6.7	2.0–22.9	<0.01
Alcohol dependence (21)	2.9	1.6–5.5	<0.001	3.2	0.7–15.2	0.17
Cannabis dependence (21)	12.9	7.1–23.6	<0.001	23.0	6.9–76.2	<0.001
Depression (21)	0.9	0.4–2.2	0.87	1.5	0.5–5.1	0.50
Anti-social behaviour						
Juvenile arrest (<16)	2.1	1.2–3.8	0.01	8.9	2.9–27.9	<0.001
Police conviction (18)	5.1	2.8–9.5	<0.001	3.9	0.8–19.0	0.25
Aggressive behaviour (18)	3.3	1.9–5.7	<0.001	2.4	0.5–11.3	0.13
Traffic conviction (16–21)	3.9	2.2–6.9	<0.001	5.2	1.0–25.8	0.08
Alcohol traffic conviction (16–21)	4.4	2.2–9.0	<0.001	3.7	0.4–31.8	0.27
Early driving related behaviours						
Able to drive a car (15)	2.2	1.2–4.2	0.01	3.6	1.1–11.5	0.05
Car licence (15–16)	0.7	0.3–1.7	0.43	1.2	0.1–10.6	0.59
Ride a motorcycle (15)	1.7	1.0–3.0	0.06	1.7	0.5–5.6	0.35
Motorcycle licence (18)	2.9	1.6–5.3	<0.01	[c]		
Traffic crash (13–26)	2.7	1.4–5.4	<0.01	4.7	1.2–17.9	0.05

[a] Based on χ^2.
[b] Based on Fisher's Exact.
[c] Zero cell count.

Table 5
Results from the multivariate logistic regression to identify adolescent/early young adulthood predictors of persistent driving after using cannabis among males

Explanatory measures (age in years)	Stage 1			Stage 2		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Predictors						
Low constraint (18)	2.8	1.4–5.7	<0.01	2.4	1.2–4.8	0.02
High negative emotionality (18)	1.3	0.6–2.6	0.54			
High substance use (18)	1.3	0.6–2.8	0.47			
Aggressive behaviour (18)	1.3	0.6–2.6	0.54			
Juvenile arrest (<16)	1.3	0.6–3.0	0.51			
Police conviction (18)	2.5	1.1–5.8	0.03	3.1	1.4–6.8	0.01
Traffic conviction (16–21)	2.3	1.1–4.9	0.03	2.4	1.1–5.2	0.03
Able to drive a car (15)	1.6	0.7–3.3	0.24			
Motorcycle licence (18)	1.6	0.8–3.5	0.20			
Correlates						
Cannabis dependence (21)				8.7	4.2–18.0	<0.001
Alcohol dependence (21)				1.5	0.6–3.3	0.38
Traffic crash (13–26)				1.2	0.4–3.2	0.75

relevance in this study may have been the under-reporting of behaviours that are perceived to be being socially undesirable, such as unsafe drinking and driving. Nevertheless, because the Dunedin cohort have provided information on sensitive topics over many years, without any breaches of confidentiality, this potential source of bias may be minimal in this study.

The results from this study show quite clearly that different factors were associated with each of the outcomes. Overall, those who persisted in driving after drinking (no specified amount of alcohol) did not differ greatly from others, although, it was interesting that the males were more likely to have gained some school academic qualification and to be employed at age 26. This latter finding may be related to the results of another study of this cohort where situational factors associated with specific incidents of drinking and driving were examined. In that study it was found that one of the most common occasions for a drink-drive incident to occur, was following after-work drinks, but these incidents usually involved relatively small amounts of alcohol (Morrison et al., in press). Incidents of this type may have influenced the results shown in this study.

Of the three outcome groups examined, the persistent unsafe drinking drivers can be considered those most at risk of being involved in a traffic crash. However, despite the wide range of factors examined in this study, only aggressive behaviour at age18 and alcohol dependence at age 21, predicted this outcome. Although, it was not statistically significant, high substance use at age 18 was also associated with this outcome and this may provide an early indication of future unsafe driving behaviour. An advantage of developing an intervention based on factors that are evident before the behaviour has commenced, is that is may be possible to prevent the outcome behaviour from occurring. In the present case, if high alcohol use could be identified and treated during adolescence, then the problem of persistent unsafe drinking and driving among young adults may be avoided.

The role of alcohol as a risk factor for crash involvement is thought to be exacerbated when used in combination with cannabis, although Bates and Blakely (1999) considered that the evidence for this was still unclear. In the present study, there was little overlap between those who persisted in unsafe drinking and driving and those who persisted in driving after using cannabis, with only six (1%) of the males and no females belonging in both persistent groups.

The results also show little similarity between the persistent drinking driver and the persistent cannabis using driver. Unlike the alcohol-related outcomes, the young adults who persisted in driving after using cannabis differed from the others on a wide range of factors, and at the univariate level this included several measures for the females and virtually all of the behavioural measures for the males. One possible reason for the association for some of these measures is that cannabis use is illegal in New Zealand, therefore, contacts with the police may have been related to the possession or use of cannabis, and therefore, may not have been entirely independent of the outcome. Similarly, cannabis dependence at age 21 was highly predictive of persistent driving after using cannabis. This applied to both males and females, but given the relatively small number of females who persisted in driving after using cannabis it was not appropriate to conduct multivariate analyses. It was not possible, therefore, to assess the size of this effect after controlling for the other factors in the model. Among the males, however, the numbers were adequate and the final results showed that the only significant predictor of persistent driving after cannabis-use, that was not directly related to cannabis use, was low constraint. This is characterised by impulsivity and incautious behaviour and has been shown in a previous study to be a significant predictor of traffic crashes involving injury among the males in this cohort (Begg et al., 1999). However, the role of cannabis as a causal factor in traffic crashes is equivocal and a recent study of young adult crashes found increased risk of at-fault crashes associated with increased cannabis use, but it was considered that this increased risk reflected the characteristics of young people who used cannabis, rather than the effects of cannabis on driver performance (Fergusson and Horwood, 2001). The results from the present study support this conclusion.

Acknowledgements

This research was funded by the Alcohol Advisory Council of New Zealand, the Health Research Council of New Zealand (HRC), and the Road Safety Trust. The Injury Prevention Research Unit is funded by the HRC and the Accident Compensation Corporation of New Zealand. The DMHDS is funded by the HRC and the US National Institute of Mental Health. The authors wish to thank Maria Hutchinson-Cervantes, Judith Clarke, Judith Sligo, Melanie Parry, and Lyn Smith for collecting, coding, and checking the data. We also acknowledge Drs Phil Silva and Richie Poulton for their contributions as Directors of the DMHDS, and most importantly the members of the DMHDS cohort for their ongoing co-operation.

References

Bailey, J.P.M., Carpinter, A., 1991. Beyond the Limit: Drinking and Driving in New Zealand, DSIR Chemistry, Petone.

Bates, M.N., Blakely, T.A., 1999. Role of cannabis in motor vehicle crashes. Epidemiol. Rev. 21, 222–232.

Begg, D.J., Langley, J.D., 1999. Road traffic practices among a cohort of young adults in New Zealand. New Zealand Med. J. 112, 9–12.

Begg, D.J., Langley, J.D., 2001. Changes in risky driving behaviour among young adults. J. Safety Res. 32, 491–499.

Begg, D.J., Langley, J.D., Chalmers, D.J., 1990. Road crash experiences in the fourteenth and fifteenth years of life: an overview. New Zealand Med. J. 103, 174–176.

Begg, D.J., Langley, J.D., Reeder, A.I., Chalmers, D.J., 1995. The New Zealand Graduated Driver Licensing System: teenagers attitudes towards and experiences with this car driver licensing system. Injury Prevent. 1, 177–181.

Begg, D.J., Langley, J.D., Williams, S.M., 1999. A longitudinal study of lifestyle factors as predictors of injuries and crashes among young adults. Accid. Anal. Prevent. 31, 1–11.

Beirness, D.J., Mayhew, D.R., Simpson, H.M., 1997. DWI Repeat Offenders: A Review and Synthesis of the Literature. Traffic Injury Research Foundation, Ottawa.

Brener, N.D., Collins, J.L., Kann, L., Warren, C.W., Williams, B.I., 1995. Reliability of the youth risk behavior survey questionnaire. Am. J. Epidemiol. 141, 575–580.

Caspi, A., Begg, D., Dickson, N., Harrington, H., Langley, J., Moffitt, T., Silva, P., 1997. Personality differences predict health-risk behaviors in young adulthood: evidence from a longitudinal study. J. Pers. Soc. Psychol. 73, 1052–1063.

Caspi, A., Moffitt, T.E., Thornton, A., Freedman, D., Amell, J., Harrington, H.-L., Smeijers, J., Silva, P.A., 1996. The life history calendar: a research and clinical assessment for collecting retrospective event-history data. Int. J. Methods Psychiatr. Res. 6, 101–114.

Farrow, J.A., Brissing, P., 1990. Risk for DWI: a new look at gender differences in drinking and driving influences, experiences, and attitudes among new adolescent drivers. Health Educ. Q. 17, 213–221.

Feehan, M., McGee, R.O., Nada Raja, S., Williams, S.M., 1994. DSM-III-R disorders in New Zealand 18-year-olds. Aust. New Zealand J. Psychiatry 28, 87–99.

Fergusson, D.M., Horwood, L.J., 2001. Cannabis use and traffic accidents in a birth cohort of young adults. Accid. Anal. Prevent. 33, 703–711.

Guppy, A., Adams-Guppy, J.R., 1995. Behavior and perceptions related to drink-driving among an international sample of company vehicle drivers. J. Stud. Alcohol 56, 348–355.

Harrell, F., Lee, K., Mark, D., 1996. Tutorial in biostatistics. Multivariable prognostic models: issues in developing models, evaluating assumptions and adequacy, and measuring and reducing errors. Stat. Med. 15, 361–387.

Krueger, R.F., Schmutte, P.S., Caspi, A., Moffitt, T.E., Campbell, K., Silva, P.A., 1994. Personality traits are linked to crime: evidence from a birth cohort. J. Abnorm. Psychol. 103, 328–338.

Moffitt, T.E., Silva, P.A., Lynam, D.R., Henry, B., 1994. In: Junger-Tas, J., Terlouw, G.J., Klein, M. (Eds.), Delinquent Behavior among Young People in The Western World. Ministry of Justice of the Netherlands, Den Haag.

Morrison, L., Begg, D. Langley, J. Personal and situational influences on drink driving and sober driving among a cohort of young adults. Injury Prevent., in press.

Newman, D.L., Moffitt, T.E., Caspi, A., Magdol, L., Silva, P.A., Stanton, W.R., 1996. Psychiatric disorder in a birth cohort of young adults: prevalence, comorbidity, clinical significance, and new case incidence from ages 11 to 21. J. Consult. Clin. Psychol. 64, 552–562.

Reeder, A.I., Alsop, J.C., Begg, D.J., Nada-Raja, S., McLaren, R.L., 1998. A longitudinal investigation of psychological and social predictors of traffic convictions among young New Zealand drivers. Transportation Res. (Part F) 1, 25–45.

Reeder, A.I., Chalmers, D.J., Langley, J.D., 1995. Young on-road motorcyclists in New Zealand: age of licensure, unlicensed riding, and motorcycle borrowing. Injury Prevent. 1, 103–108.

Robins, L.N., Helzer, J.E., Croughan, J., Ratcliff, K.S., 1981. National Institutes of Mental Health Diagnostic Interview Schedule: its history, characteristics, and validity. Arch. Gen. Psychiatry 38, 381–389.

Silva, P.A., Stanton, W.R. (Eds.), 1996. From child to adult: The Dunedin Multidisciplinary Health and Development Study. Oxford University Press, Auckland.

Stewart, K., 2000. Preventing impaired driving around the world: lessons learned. Injury Prevent. 6, 80–81.