The Impact of Alcohol-Related Disorders on Driver's Licence Restriction, Suspension and Loss:

A Longitudinal Study

FINAL REPORT

September 2008

Acknowledgements

The authors of this report would firstly, like to thank the mothers and their children who have participated in the Mater University of Queensland Study of Pregnancy (MUSP). Without their loyalty and commitment, this research would not have been possible.

The authors also thank the MUSP Team, the Mater Misericordiae Hospital, the Queensland Transport Department, and the Schools of Social Science, Population Health, and Medicine, at The University of Queensland for their support. We also acknowledge the contributions of Greg Shuttlewood, The University of Queensland who is responsible for managing the data for the MUSP.

This research was funded, initially, by a grant from the Centre for Accident Research and Road Safety – Queensland, QUT, and completed following receipt of a grant from the Alcohol Education and Rehabilitation Foundation (AERF). We are grateful to both funding agencies for their support.

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Background

Alcohol intake is the major proximate cause of road deaths among adult and youth. It is associated with approximately one-quarter of the fatalities among Australian drivers (ATSB, 2001). Despite strengthened legislation and enforcement, alcohol intoxication remains a leading cause of road fatalities.

A great deal of research has focused on young drivers, in particular young problem drivers; that is those who are risk takers and who commonly engage in high risk activities such as drink driving. However, it is unclear whether the antecedents of behaviours such as drink driving can be identified early in the life course of the individual.

Although males are more commonly involved in serious and fatal driving crashes, recent studies suggest that females, more specifically young females, are also increasingly exhibiting dangerous driving practices, particularly speeding. There is a subgroup of high risk taking young females who are exhibiting dangerous driving practices, so interventions need to consider gender differences in drink driving behaviours.

Given the evidence that drink driving is linked to problem behaviour and excessive alcohol use, it remains unclear whether the interrelationship between mental health problems and alcohol misuse contributes to both drink driving and dangerous driving. It has long been recognised that over 50% of those who experience alcohol-related problems also experience the co-occurrence of one or more mental health disorders (Blanchard, 2000).

The aim of this project is to investigate the contribution of alcohol abuse and early life course aggressive/delinquent behaviour to traffic infringements. The data used are from two sources: the Mater University of Queensland Study of Pregnancy (MUSP) which comprises of seven phases of data collection on mothers and their offspring from the prenatal period to 21 years post-delivery, and a data linkage with Queensland Transport driving records.

Methods

The data linkage to Queensland Transport in 2002 resulted in the creation of a dataset containing driving test, registration, licence and infringement information.

1. 7636 names from the MUSP study were supplied to Queensland Transport and were matched with Queensland Transport records using family name, first name, date of birth, and gender as matching criteria.
2. Matches were identified for 5,507 names representing approximately 72% of names supplied.
3. Matched names were assigned a unique ID number by Queensland Transport staff.

Finding

There were strong significant associations between a lifetime diagnosis of alcohol abuse and a range of self-reported driving offences. Street racing (getting involved with unofficial races) and other risky behaviours were also strongly associated with alcohol abuse. Similar to alcohol abuse, there were significant associations between a lifetime diagnosis of alcohol dependence, drug driving and a range of driving offences. For almost every self reported offence (speeding, driving unsafe cars, ignoring traffic signals) those who had ever had a Composite International Diagnostic Interview (CIDI) diagnosis of alcohol abuse committed substantially more offences.

A similar pattern was evident for self reports of having committed a range of driving offences. Those who had ever had a diagnosis of alcohol abuse were much more likely to drive over the limit, to drive after using illegal drugs, tailgate, chase another driver, ignore the speed limits or run red lights. While the patterns for those who had ever had a CIDI diagnosis of alcohol dependence were much the same, the differences here tended to be smaller and generally not statistically significant. The data suggested that a diagnosis of alcohol abuse was much more predictive of driving offences than a diagnosis of alcohol dependence.

The linked data were used to assess the predictive value of early life course aggressive behaviour (at ages 5 and 14) on driving offences recorded by the Department of Transport. For a number of offences (speeding, serious traffic violations, drink driving) aggressive behaviour at 5 years of age predicted longer term outcomes, but the predictions were not very strong. A similar pattern was evident using 14 year aggression scores to predict driving infringements – although the pattern of association was more

apparent for males than females. However, delinquent behaviour at 14 years of age provided strong and consistent predictions of subsequent driving violations.

Generally, measures of the child's cognitive development (IQ) provided little prediction of that person's subsequent infringements.

Conclusions and Implications

A CIDI diagnosis of alcohol abuse (but not dependence) was associated with a wide range of offending behaviours. In addition, delinquent behaviour reported at the 14 year follow-up provided strong predictions of a wide range of driving offences. Due to its longitudinal nature, the unique contribution of this large scale, population-based, prospective study was its ability to examine links between driving behaviour and earlier childhood and adolescence characteristics. The findings raised some important questions about the value of childhood and early adolescent screening to help identify those at particular risk of developing and displaying certain maladaptive and dangerous behaviours in adulthood. These findings suggested that antecedents of some types of risky and unlawful driving behaviour at age 21 may be evident in early adolescence; if this is the case, then interventions targeting childhood and early adolescent precursors may have a positive, flow-on effect on later driving behaviour.

An advantage of developing an intervention based on factors that are evident before the behaviour has commenced, is that it may be possible to prevent the outcome behaviour from occurring. If young adolescents with behavioural problems (i.e. aggression and delinquency), who have high alcohol use, could be identified and access appropriate services during adolescence, then the problem of persistent unsafe drinking and driving among young adults may be reduced.

INTRODUCTION

This Report was prepared by The Mater-University of Queensland Study of Pregnancy (MUSP) research group for the Alcohol Education & Rehabilitation Foundation Ltd. The study was designed to use data from MUSP, a longitudinal pregnancy cohort of mothers and their children, to address two Alcohol Education and Rehabilitation Foundation (AERF) priorities:

1. The contribution of alcohol misuse to people's personal and social problems including:
    a. Legal problems such as fines and restrictions, suspension and loss of driver's licence
    b. Drink driving and driving violations
    c. Road collisions/injuries
2. Early life predictors of subsequent alcohol use and drink driving behaviour

Research Team

Professor Gail M. Williams, PhD.
Professor Jake M. Najman, PhD.
Dr. Michael O'Callaghan,
Dr. Williams Bor,
Dr. Alexandra Clavarino, PhD.
Ms Tahmina Ahmed, MPH
Ms Shelby Marrington, Hon Psych

LITERATURE REVIEW

Alcohol-related disorders are a significant health problem among Australian youth. Recent data have shown that approximately 39% of Australians aged 14 -24 years have engaged in risky or high-risk drinking sessions on a monthly basis (AIHW, 2006) and that 8.3% had engaged in daily drinking (AIHW, 2002). The prevalence of risky alcohol consumption is of particular concern in relation to those aged 18-24 years. Estimates show that about 42% of males and 30% of females in this age group sometimes drink at levels that are considered risky according to Australian National Guidelines (Heale, 2000; NHMRC., 2001)

When driving, alcohol affected individuals pose a risk not only to themselves but also to others. Alcohol intake is the major proximate cause of road deaths among adult and youth and is associated with approximately one-quarter of the fatalities among Australian drivers (ATSB, 2001). According to the Australian Transport Safety Bureau (2001) there has been a significant drop in the incidence of drink driving over the 18 years from 1981 to 1998. This is primarily due to strengthened legislation and enforcement. In 1981 approximately 44% of all drivers and motorcycle riders killed in Australian road crashes had a blood alcohol concentration of 0.05 gm/100ml or greater. By 1998 this had reduced to approximately 26%. Despite this, alcohol intoxication still remains a leading cause of road fatalities.

Blood alcohol level is associated with the likelihood of having a road accident. Higher levels of alcohol in the blood are associated with an increased likelihood of crashing. Drivers with a blood alcohol level of 0.05 grams/100mL or more are twice as likely to have a car crash compared to drivers who have no blood alcohol reading. In contrast, drivers with a blood alcohol level of 0.08 grams/100mL or more are seven times more likely to be involved in a car crash (AIHW., 2002). The information obtained by simply

studying crashes does not, however, directly address the behaviours that precede and contribute to drink driving and to crashes involving alcohol use (Bingham, Shope, & Raghunathan, 2006).

A great deal of research has focused on young drivers, particularly those who are risk takers and who commonly engage in high risk activities including drink driving. A number of factors are associated with drink driving. A review by Donovan et al, (1983) classified predictors of drink driving as being related to excessive alcohol use, personality traits, emotional distress, driving-related attitudes and the socioeconomic characteristics of those involved ((Donoval, Marlatt, & Salsberg, 1983; Donovan, Marlatt, & Salsberg, 1983). More recent studies have identified factors such as being male, being young, having antisocial and other problem behaviours (MacDonald & Mann, 1996; Smart et al., 2005) as risk factors for drink driving.

Gender

Although males are more commonly associated with fatal and serious driving accidents, recent studies (Dobson, Brown, Ball, Powers, & McFadden, 1999; Elliott, Shope, Raghunathan, & Waller, 2006) suggest that females, particularly young females, are increasingly exhibiting dangerous driving practices such as speeding (Dobson et al., 1999). Although females tend to have lower risk-taking profiles than males, a sub-group of females appear to exist who deviate from the general population of young female drivers with respect to their levels of alcohol use, alcohol misuse and marijuana use combined with risky driving behaviour. Therefore, interventions need to consider gender differences in addressing drink driving behaviours (Elliott et al., 2006).

Age

Data from Western Australia suggest that younger drivers make the greatest contribution to this State's drink driving arrests when compared to older drivers. About 45% of those arrested for drink driving between 1984 and 1994 were under 25 years and approximately 60% were under 30 years (Bureau., 2004). Younger drivers were also disproportionately represented among those with multiple drink driving offences, with under 25 year olds accounting for 65% of all repeat offenders (Bureau., 2004).

Drivers aged under 25 years accounted for 27% of all driver deaths in Australia in 2005 and 32% of deaths for all road users (ATSB, 2006). Alcohol use by younger persons continues to disproportionately contribute to young persons' road crash fatalities. Alcohol use and dependence as well as road traffic accidents are leading contributors to the disease burden for young Australians aged between 15 and 24 years, with alcohol use and dependence each accounting for 9% of total disease burden (Mathers, Vos, & Stevenson, 1999). In 2004 one in seven people aged 14 years and over admitted to driving a vehicle while under the influence of alcohol (AIHW., 2005).

Individual attributes and more generalised problem behaviours

There is considerable evidence to suggest that high risk drivers and those with multiple driving offences (including drink driving) have tended to show aggressive, inattentive and hyperactive characteristics as children and adolescents (Barkely, Murphy, & Dupaul, 2002; Begg, Langley, & Stephenson, 2003; Smart et al., 2005). That is, there is some indication that the antecedents of behaviours such as drink driving can be identified early in the life course of the individual, well before they actually drive a car. It seems that the co-occurrence of anti-social behaviour and alcohol use during

adolescence is consistent. A recent study by the Australian Temperament Study recently reported that:

> "High risk drivers had displayed higher levels of …problem behaviours (unsafe driving, substance use and antisocial behaviour) during adolescence. These trends were particularly notable for antisocial behaviour (40% of risky drivers had consistently engaged in antisocial behaviour across adolescence) and for alcohol use (one-third had been consistently high alcohol users across adolescence)" (Smart et al., 2005):xix.

Using a large number of predictors, MacDonald and Mann (MacDonald & Mann, 1996) concluded that problem drinking and antisocial attitudes are the most likely causes of drink driving.

Each of these imply different strategies for the reduction of drink driving. The first emphasises the causative role of excessive alcohol consumption while the second emphasises problem behaviours (Jessor, 1987) which are perceived to make an independent contribution to drink driving behaviour. The former promotes efforts to reduce alcohol abuse, while the latter promotes the notion that problem drivers require interventions in order for drink driving to be reduced.

The problem driver theory is supported by research suggesting that those with drink driving convictions are twice as likely to have motor vehicle violations compared to those without drink driving convictions, as well as a history of antisocial behaviour. Donovan (1993) found that drink driving in combination with other factors such as problem drinking, marijuana and other illicit drug use and delinquent behaviour accounted for 57% of the variance in young adult drink driving. Drink driving appears to constitute a component of a more comprehensive problem, that of problem driving (Donovan, 1993; Shope & Bingham, 2002; Smart et al., 2005).

Personality factors such as perceived ability to be able to drive after drinking, environmental factors such as friends' models of drinking and driving, and demographic characteristics (sex, age, and family structure) have all be identified as important etiological factors in drinking and driving among secondary school students (Klein, Antheneui, Bacon, Smith, & Schuckit, 1994). Decisions to drink and drive have also been shown to have a practical basis, particularly the perceived low probability of detection, the need for transportation and the specific situation at the time of drinking and driving (Aberg, 1993).

Given the evidence that drink driving is linked to problem behaviour and excessive alcohol use, it remains unclear whether the interrelationship between mental health problems and alcohol misuse contributes to both drink driving and dangerous driving. It has long been recognised that over 50% of those who experience alcohol-related problems also experience the co-occurrence of one or more mental health disorders (Blanchard, 2000), although this association is not well understood (Prescott, Aggen, & Kendler, 2000; Wang & Patten, 2002). Some studies indicate that common mental health disorders, particularly anxiety and depression in childhood, precede and predict alcohol-related disorders in early adulthood (Miller, Miller, Verhegge, Linville, & Pumariega, 2002; Pitkanen, 1999). Other studies appear to support the reverse - that heavy alcohol consumption and dependence may cause depression (Wang, 2001; Wang & Patten, 2002), while others suggest that there is no causal relationship between the two disorders (Prescott et al., 2000).

Although there is a good deal of evidence supporting problem behaviour theory as a basis to drink driving behaviour, there is a need to more fully understand the etiological

factors involved in problem behaviour in the first instance before examining its relationship with drink driving.

METHODS

The data for this report came from two sources: the Mater University of Queensland Study of Pregnancy (MUSP) which comprises seven phases of data collection on mothers and their offspring from the prenatal period to 21 years post-delivery, and a data linkage with Queensland Transport driving records.

Data Collection

MUSP

The MUSP study began when 8,556 consecutive pregnant women were approached to join the study between 1981 and 1983 when they attended their first antenatal obstetric visit at the Mater Mothers Hospital, South Brisbane, Queensland. Of those approached, 8,458 agreed to participate in the study. Subsequently 7,223 live singletons, 59 sets of twins and 1 set of triplets were delivered at the study hospital. Follow-ups of these mother and child sets have taken place at three to five days, six months, five years, 14 years and 21 years post-delivery, with the 21 year follow-up being completed in December 2004.

During the most recent data collection (21years) the study children were interviewed in their homes. Comprehensive questionnaires (570 items) were completed by the participants. Topics covered included physical and mental health, driving behaviour, risk-taking behaviour, Internet use, quality of the mother-child relationship, health-related behaviour, sleep quality, substance use and socio-demographic characteristics.

Data linkage and management of linked data

The data linkage to Queensland Transport in 2002 resulted in the creation of a de-identified dataset containing driving test, registration and licence and infringement information on the MUSP study children. The linkage was undertaken in the following manner:

1. 7636 names were supplied to Queensland Transport and were matched with Queensland Transport records using family name, first name, date of birth, and gender as matching criteria.
2. Matches were identified for 5,507 names representing approximately 72% of names supplied.
3. Matched names were assigned a unique ID number by Queensland Transport staff.
4. Four de-identified data files were provided by Queensland Transport covering: driving test data; vehicle registration data; license data and infringement data. Combining the participant files produced a combined file with 5,322 participants or 69.7% of the names supplied.
5. A subset of variables for the matched names was taken from the MUSP dataset comprising a series of numeric value variables related to maternal and child health, socio-demographic characteristics and child behaviour.
6. These variables were attached to the de-identified records at Queensland Transport by Queensland Transport staff (the numeric values have no interpretable meaning to Queensland Transport).
7. Linked data were supplied to MUSP under the Queensland Transport identification numbers to ensure that the de-identified data could not be matched to the original data set held by MUSP.

Measures

Frequency and Quantity of Alcohol Use

Three items measured frequency and quantity of alcohol consumed. Participants were asked at the 21 year follow-up: "at what age did you start drinking alcohol (i.e. more than just a few sips)", "How often do you drink alcohol" (responses ranged from 1 Never drink; 2 Daily; 3 a few times a week; 4 a few times a month; 5 a few times a year; 6 rarely). "How much alcohol do you usually drink at those times" (responses were coded on a 6 point scale: 1 Never drink; 2 less than one glass; 3 one or two glasses; 4 three or four glasses; 5 five or six glasses; 6 seven or more glasses).

Problems associated with alcohol use

An eight item scale measuring self-assessed problems caused by alcohol use was also included in the 21 year follow-up questionnaire. Respondents were asked "to what extent has alcohol impacted on your life over the last four weeks? These items were all scored on a five point Likert scale ranging from 1 "have never drunk alcohol" to 5 "severely" affected by alcohol. The responses were dichotomised so that those reporting that they never drank alcohol and those reporting that it had no effect on their lives were coded 1 (no impact); those reporting a mild, moderate or severe impact were coded 2 (some impact).

Alcohol Abuse and Dependence

The computerised lifetime version of the Composite International Diagnostic Interview (CIDI-Auto) was administered during interviews at the 21 year follow-up. This provides

ICD-10 and DSM-IV diagnoses of alcohol abuse and dependence (as well as other mental disorders (Andrews & Peters, 1998; Organization., 1993). DSM-IV diagnoses were used within the current study.

The Driver Behaviour Questionnaire (Reason, Manstead, Stradling, Baxter, & Campbell, 1990)

Self-reported drink driving frequency and dangerous, aggressive, or impulsive driving behaviour were measured using a modified version of an 8-item traffic violations subscale derived from the Driver Behaviour Questionnaire (Dobson et al., 1999; Parker, Reason, Manstead, & Stradling, 1995). Amendments were made to the wording to suit Australian road conditions and terminology. Four items were included to assess whether respondents drive after using illegal drugs, do not wear a seat belt or helmet, overtake another vehicle over double lines or drive while tired. These items were scored on a 6 point scale (1=never to 6 = nearly all the time).

Further Traffic Violations

At the 21 year follow-up respondents were asked whether they had ever committed or been charged for a series of 11 traffic violations. Using Parker and colleagues' (Parker, West, Stradling, & Manstead, 1995) definition, traffic violations are defined here as deliberate deviations from safe driving practice. These items were derived from lists of common road traffic violations. They were scored on a three point scale (1= don't drive; 2=No; 3=Yes) and covered speeding, driving an unsafe or unroadworthy vehicle, ignoring traffic lights, ignoring a police signal order or direction; ignoring a stop or give way sign; failing to keep left; failing to wear a helmet, seat belt or restraint; improper turns and ignoring traffic lane arrows on a roundabout.

Measurement of Traffic Violations – Linked Data

The linked data were exported from SPSS and converted into a set of SAS data tables. The data were cleaned to create uniform, analysable data from text files, specifically the violations text fields, (results shown in Table 1 below) and violations were then re-categorised. For example, speeding was recoded in 2 main categories; speeding less than 30 km per hour (kph) over the limit and speeding in excess of 30 kph above the signed speed limit. The cleaned fields were cross tabulated with the original text values to ensure that all violations were correctly included or excluded. The violation records were combined by person and linked to that person's file; groupings included summations of each of the cleaned violation variables. The resulting file contained the frequency of each variable for the individual person's record. For example, if an individual record has a value of 5 for "high level of speeding (<30 kph) it means that they had five speeding violations of over 40 kph above the signed speed limit. An identical person data set was produced where each violation variable was recoded with the values "0" for no violation and "1" for at least one violation.

The three variables derived from the linked data are speeding; serious traffic violations and drink driving. The items comprising each category are set out in Table 1.

Table 1: Definition of the outcome variables for the linked data

Variable name	Definition of variables from text files
Speeding : Low level of speeding (≥30 kph) High level of speeding (<30 kph)	Exceed speed limit in different zones by at least 15 kph Exceed speed limit in speed zone/ school zone by at least 15 kph < 30 kph Exceed speed limit by less than 15 kph Exceed speed limit in speed zone/ school zone by at least 30 kph < 45 kph Exceed 100 kph (default speed limit) by 15 kph < 30 kph Exceed 60 kph (default speed limit BUA) by 15 kph < 30 kph Exceed 50 kph (default speed limit BUA) by 15 kph < 30 kph
Serious traffic violations: Careless driving Disqualified driving Dangerous driving Fail to stop	Careless driving includes: Careless driving without due care and attention Disqualified driving includes: Disqualified driving Dangerous driving includes: Dangerous driving causing death Fail to stop includes: Fail to stop at red traffic light Fail to stop at stop sign at intersection Fail to stop at yellow traffic light or arrow Fail to stop at twin red lights Fail to stop at stop sign at a place Fail to stop at stop sign at level crossing
Drink driving	Drive under influence of liquor (under 0.15%) Prescribed concentration of alcohol Drive under influence of liquor (over 0.15%) Drive under influence of liquor (no reading) Fail to supply breath specimen Under influence liquor

Table 2 presents the frequencies for each of the variables described in Table 1. The most commonly reported infringement was speeding less than 30 kph above the signed speed limit (approximately 88%) with 2.84% being charged with drink driving.

Table 2: Frequencies of all the outcome variables derived from the Transport Infringement List

Variable name	Percent
Speeding (<15 kph over speed limit)	28.32
Speeding (15 to 30 kph over speed limit)	60.15
Speeding (30-45 kph over speed limit)	8.71
Speeding (45 kph over speed limit)	1.94
Speeding (but don't know how much over)	0.88
Careless driving	1.63
Disqualified driving	0.99
Dangerous driving	0.29
Fail to stop	2.97
Drink driving	2.84
Noise	5.01
Seat belt	4.13
Mobile phone	0.84
Unrestrained	0.23
Unlicensed	4.75
Fail to produce	1.49
Learner	9.90
Bicycle	9.95
Disobey	1.04
Fail give way	0.77
Drive non complying	0.61
Make U turn	0.06

Measurement of Child Development and Behaviour

Child predictors were assessed at three points in time; intermediate outcomes were measured at the 5-year and 14-year follow-ups but of major interest were the outcomes measured at the 21-year follow-up. However, the intermediate predictors provided a unique opportunity to examine behaviour, particularly aggressive/delinquent behaviour, and its relationship to drink driving outcomes at 21. Of further interest was the child's or adolescent's cognitive development at ages 5 and 14 and how this may be associated with drink driving behaviour at age 21.

Child/Youth Behaviour

The assessment of child/adolescent behaviour at the 5 and 14 year follow ups, was undertaken using the Child Behaviour CheckList (CBCL) developed by Achenbach and Edelbrock (Achenbach, 1991; Achenbach & Edelbrock, 1984). The CBCL constitutes 8 subscales of child behaviour problems – consisting of withdrawn, anxious/depressed, aggressive behaviour, intrusive behaviour, delinquent behaviour, somatic complaints, thought problems and attention problems. This instrument identifies behaviours and psychiatric morbidity that are perceived as significant by parents, and cause parents and others to seek treatment for the behaviour. Both the CBCL and the YSR (Youth Self Report of the CBCL) are widely used measures of child and adolescent behaviour problems in both clinical and research contexts. They are reliable instruments with good construct and discriminant validity (Achenbach, 1991). The items were assessed using a three point Likert scale (1= often, 2= sometimes, and 3= never). Respondents scoring above the 90^{th} percentile were classified as having behaviour problems (aggression or delinquency).

Table 3: Items from the CBCL (5 years) and YSR (14 years) measuring aggression and delinquency

Aggression at 5	Aggression at 14	Delinquency at 14
Argues a lot	Argues a lot	Doesn't feel guilty after misbehaving
Demands a lot of attention	Demands a lot of attention	Hangs round with kids who get in trouble
Destroys his or her own things	Destroys his or her own things	Lying or cheating
Destroys other things	Destroys other things	Prefers being with older kids
Disobedient and screams a lot at home	Disobedient at home	Runs away from home,
Gets in to many fights	Disobedient at school	Sets fires
Screams a lot	Gets in to many fights	Steals at home
Sudden changes in mood or feelings	Bragging, boasting	Steals outside home
Stubborn, sullen or irritable	Cruelty, bullying or meanness to others	Swearing or obscene language
Temper tantrums or hot temper	Screams a lot	Thinks about sex too much
Lying or being dishonest	Sudden changes in mood or feelings	Truancy or skips school
	Stubborn, sullen or irritable	Uses alcohol or drugs for non medical
	Easily jealous	Vandalism
	Physically attacks people	
	Showing off or clowning	
	Talks too much	
	Teases a lot	
	Threatens people	
	Unusually loud	
	Temper tantrums or hot temper	

Peabody Picture Vocabulary Test (PPVT-III-R) 5 years

The Peabody picture vocabulary test, which is used to measure children's verbal comprehension, was administered at the 5 year follow-up. It was applied in the current study because it provides an easily administered assessment of verbal intelligence and predicts academic achievement. While this test raises concerns about bias, it is appropriate, when other tests have also been administered (Stockman, 2000).

Wide Range Achievement Test (WRAT) – 14 years

The Wide Range Achievement Test (WRAT) is an age-normed test that assesses a child's school performance, particularly in relation to reading and word decoding skills. For this study only the reading component was used at the 14 year follow-up. Concerning validity, WRAT-R subtests have moderate to high correlations with Woodcock-Johnson achievement subtests (McGrew, 1994). Construct validity was assessed by person and item-separation values and by increasing raw scores with age. The WRAT manual also reports very high correlations (.91 to .99) between the WRAT and WRAT-R. The subtests of the WRAT-R are well normed. The item was scored and categorised on the basis of tertiles. The top 25% was considered to represent good scores, the middle 50% was considered to be average and the lower 25% was considered to have poor WRAT scores.

Raven's Standard Progressive Matrices (Raven's SPM) – 14 years

Raven's SPM were administered to the adolescent at the 14 year follow-up and to both the mother and child at the 21 year follow-up. The Raven's SPM is a widely used test of non-verbal reasoning developed to assess the general intelligence of people aged 5 years and over. The test has been revised many times (Raven, 1989; Raven, Court, & Raven, 1990, 1996) and presently a re-standardized version of the Raven's test is available for use in Australian context (de Lemos, 1989a, 1989b). Cut-offs for the Raven were the

same as for the WRAT, that is those scoring in the top 25% were considered to have good scores, the middle 50% were considered to be average and the lower 25% were considered to have poor Raven scores.

Young Adult Mental Health

Diagnostic Assessment

The Composite International Diagnostic Interview (CIDI-Auto) (Kessler & Ustun, 2000) was used to assess alcohol abuse and alcohol dependence at 21 years. It is a fully structured, diagnostic interview designed to assess mental disorders. It comprises a computer assisted interview and computerised algorithms to provide lifetime and current (12 month and 1 month) diagnoses according to the accepted International Classification of diseases-10 (ICD-10) and the Diagnostic and Statistical Manual of mental disorders (DSM-IV) criteria. CIDI-Auto incorporates measures of the severity of alcohol abuse and dependence as well as the influence that these may have on daily functioning (de Girolamo & Bassi, 2003).

Diagnostic Algorithms

This study used the lifetime diagnosis for DSM-IV alcohol dependence which was made if an individual met a minimum of three out of seven possible diagnostic criteria occurring in any chosen, 12-month period. Similarly, a lifetime diagnosis of alcohol abuse was made if the individual met the requirement of possessing one (or more) out of the possible four abuse symptoms occurring within a 12-month period (American, 1994). Refer to Appendices for the DSM-IV criteria.

Data analysis

Section 2: Alcohol Abuse and Alcohol Dependence as diagnostic categories (CIDI)

The Mantel-Haenszel (M-H) test (a summary chi-square) and the Cramer's V test were used to measure the strength of association between the different self-reported traffic and driving offences, and a DSM-IV diagnosis of alcohol abuse and/or dependence.

Section 3: The linked data – Early life indicators of drink driving and driving violations

Each cognitive development item (Raven, WRAT, and Peabody) was graded on three points (good, average, and poor). All scores for the cognitive development were divided into tertiles with the first 25% as good, middle 50% as average, and last 25% as poor. In the dataset, the mothers' education was broadly classified into opportunity deaf school, primary school, started secondary school, completed grade 10, completed grade 12, college including technical and dental, university, and others. These data were collapsed into three categories of did not complete grade 10, completed grade 10, and completed further or higher. Calculation of driving and non driving infringement rates per year of driving duration was done for male and female young drivers. Sex of children, education of mother, mother's mental health, mother's marital status (at age 14), whole family's income (at age 5), and mother's age (at age 14) were taken as confounding variables and were adjusted in the univariate and multivariate analysis. The number of driving, non-driving, and drink driving infringements were analysed by negative binomial regression, with behaviour problems and cognitive development categories as predictors. Crude rate ratios and 95% confidence intervals were finally adjusted for sex of children, education of mother, mother's mental health, mother's marital status (at age 14), whole family's income (at age 5), and mother's age (at age 14).

RESULTS

The results are presented in three sections. The first describes the demographic characteristics of the sample. The second uses responses to the CIDI-Auto and examines the impact of alcohol abuse and dependence on drink driving, as well as other driving offences. The final series of tables present the linked data and show multivariable models of early life predictors of drink driving and driving violations. Sections 1 and 2 comprise the cross-sectional data and Section 3 the longitudinal data which has been linked to Queensland Transport records. Frequencies vary somewhat from table to table because not all respondents provided data for all questions.

SECTION 1: The demographic characteristics of the sample

The data presented are from a cross-sectional sample comprising 3797 respondents with evaluable data at the 21 year follow-up, and a longitudinal sample comprising 3854 respondents with data used from early childhood to 21 years. This longitudinal data was linked with Queensland Transport records and consolidated in a de-identified file.

The following table describes the demographic characteristics of the 3797 respondents with evaluable data used in this study. The majority of young adults were male (55.6%) with approximately 20% reporting a low weekly family income. Most of their mothers were married and had completed at least year 10 of schooling. The majority of respondents were aged approximately 20 at the time of the record linkage (with a mean age of 19.5 for boys and 19.6 for girls). Most (approximately 70%) obtained their provisional driving license at 17 years (mean age of 17.4 years for boys and 17.5 years for girls) and at the time of the record linkage had been driving for between one and three years (mean duration of driving for boys was 1.8 years and for girls was 1.7 years).

Table 4: Demographic characteristics of the sample

Variables	N 3797	%
Sex		
Male	2111	55.6
Female	1686	44.4
Family income/ wk at 5 yrs		
$0-299	601	20.2
$300-399	716	24.0
$400-499	728	24.4
$500+	938	31.4
Missing values	(814)	
Mothers marital status at 14 yr follow up		
Married	2718	88.9
Others	339	11.1
Missing values	(740)	
Mother's education at first clinic visit		
Below grade 10	608	16.3
Completed grade 10	2075	55.7
Completed grade 12 & above	1044	28.0
Missing values	(70)	
Age of record linkage		
18	651	17.2
19	990	26.1
20	1589	41.9
21	567	14.9
Age of provisional licence		
16	14	0.4
17	2653	69.9
18	739	19.5
19	286	7.5
20	104	2.7
21	1	0.03
Age of open licence		
18	4	0.4
19	7	0.7
20	949	90.0
21	79	7.5
22	10	1.0
23	5	0.5
Duration of driving (years)		
0	506	13.3
1	1089	28.7
2	1075	28.3
3	1005	26.5
4	122	3.2

SECTION 2: Alcohol Abuse and Alcohol Dependence as diagnostic categories (CIDI)

This section examines the association between alcohol misuse and traffic infringements and fines, and loss or suspension of driver's licence as well as its effect on drink and drug driving. It employs the CIDI-Auto to assess the onset of alcohol abuse and dependence from adolescence to 21 years according to DSM-IV criteria. A DSM-IV Lifetime diagnosis was calculated from the CIDI scale using the level "criteria met, exclusion criteria not met" as the diagnostic definition. Alcohol dependence used DSM-IV code 303.9 and Alcohol abuse conformed to DSM-IV code 305. Of the 2555 young adults who completed the CIDI-Auto at age 21 years, approximately 25% (n=640) met the criteria for alcohol use disorders and approximately 9% also met the criteria for alcohol dependence.

The following series of 4 tables examine the extent to which a diagnosis of alcohol abuse and dependence was associated with self reported behaviour or being charged with selected driving offences, as well as on drink driving and drug driving over the past 4 weeks.

Table 5: Extent to which a CIDI - DSM-IV diagnosis of alcohol abuse is associated with self report of perpetration and being charged with selected driving violations

Extent of influence of diagnosed alcohol abuse on driving offences over the past 4 weeks		DSM-IV Diagnosis of Alcohol Abuse		M-H p-value trend	Cramer's V†
		No % (n = 1894*)	Yes % (n = 625*)		
Speeding	Ever done	73.9	83.7	<.0001	0.100
	Ever charged	36.3	53.8	<.0001	0.154
Improper turns	Ever done	39.8	57.0	<.0001	0.150
	Ever charged	1.7	5.6	<.0001	0.103
Ignored a stop or give way sign	Ever done	31.8	45.2	<.0001	0.122
	Ever charged	2.1	3.0	0.1593	0.028
Driven unsafe/un-roadworthy vehicle	Ever done	20.0	41.6	<.0001	0.214
	Ever charged	4.1	13.7	<.0001	0.170
Failed to give way, other than by ignoring a traffic sign	Ever done	18.9	33.3	<.0001	0.149
	Ever charged	0.8	1.9	0.0180	0.047
Failed to keep left	Ever done	19.9	32.4	<.0001	0.129
	Ever charged	0.6	1.6	0.0247	0.045
Ignored traffic lane arrows on roundabout	Ever done	14.5	30.0	<.0001	0.174
	Ever charged	0.2	0.6	0.0989	0.033
Failed to wear helmet, seat belt or restraint	Ever done	16.4	42.8	<.0001	0.271
	Ever charged	3.4	12.9	<.0001	0.177
Ignored red traffic lights	Ever done	14.4	30.6	<.0001	0.180
	Ever charged	3.6	5.3	0.0731	0.036
Ignored Police signal, order or direction	Ever done	2.1	7.5	<.0001	0.128
	Ever charged	0.4	3.0	<.0001	0.114

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

There were significant associations between a DSM-IV lifetime diagnosis of alcohol abuse (by age 21) and all types of risky driving behaviour. The strongest associations (over the past 4 weeks) were not wearing a helmet, seatbelt or restraint (M-H <.0001 Cramers V 0.271), and driving an unsafe or unroadworthy vehicle (M-H <.0001 Cramers V 0.214).

Table 6 shows significant associations between a lifetime diagnosis of alcohol abuse and the listed range of driving offences. Not surprisingly, driving over the blood alcohol limit and driving after using illegal drugs are both behaviours strongly associated with a lifetime diagnosis of alcohol abuse. Street racing (getting involved with unofficial races) and other risky behaviours also showed a strong association.

Table 6: Extent to which a CIDI - DSM-IV diagnosis of alcohol abuse is associated with self report of selected driving behaviours some of the time [#]

How often do you-		DSM-IV Diagnosis of Alcohol Abuse		M-H p-value trend	Cramer's V[†]
		No (n = 1894*)	Yes (n = 625*)		
Alcohol & Drugs	Drive over the blood alcohol limit	2.9	16.3	<.0001	0.239
	Drive after using illegal drugs	4.1	21.8	<.0001	0.275
Behaving badly	Become impatient with a slow driver	40.9	55.0	<.0001	0.123
	Indicate hostility to a driver who annoys you	23.0	37.3	<.0001	0.140
	Tail gate	21.9	34.9	<.0001	0.130
	Get involved with unofficial races	12.5	27.8	<.0001	0.179
	Give chase to a driver with the intention of giving him/her a piece of your mind	4.0	11.7	<.0001	0.140
Driving Offence	Ignore the speed limits	45.0	61.1	<.0001	0.140
	Not wear a seat belt or helmet	5.2	15.5	<.0001	0.167
	Overtake another vehicle over double lines	3.0	10.6	<.0001	0.153
	Run red lights	3.5	7.5	<.0001	0.084
Tired	Drive while tired	31.7	42.7	<.0001	0.100

Those who reported these violations "occasionally", "quite often", "frequently" and "nearly all the time" were coded as "some of the time".

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

In our sample only a small number of participants were diagnosed with alcohol dependence. However, these participants were associated with a range of risk taking behaviours over the past 4 weeks. The strongest of these were: failing to wear a helmet, seat belt or restraint (M-H <.0001; Cramers V .099) and driving an unsafe or unroadworthy vehicle (M-H <.0001; Cramers V = 0.091).

Table 7: Extent to which a CIDI - DSM-IV diagnosis of alcohol dependence is associated with self report of perpetration of and being charged with selected driving violations

Extent of influence of diagnosed alcohol dependence on driving offences over the past 4 weeks		DSM-IV Diagnosis of Alcohol Dependence		M-H p-value trend	Cramer's V†
		No (n = 2299*)	Yes (n = 223*)		
Speeding	Ever done	76.0	79.8	0.1991	0.026
	Ever charged	40.2	45.5	0.1220	0.031
Improper turns	Ever done	43.5	50.5	0.0462	0.040
	Ever charged	2.7	2.7	0.9956	-0.000
Ignored a stop or give way sign	Ever done	34.6	40.1	0.1025	0.033
	Ever charged	2.2	3.1	0.3813	0.017
Driven unsafe/un-roadworthy vehicle	Ever done	24.2	38.1	<.0001	0.091
	Ever charged	6.2	9.0	0.1111	0.032
Failed to give way, other than by ignoring a traffic sign	Ever done	21.6	31.7	0.0006	0.068
	Ever charged	1.0	1.4	0.6764	0.008
Failed to keep left	Ever done	22.3	30.2	0.0077	0.053
	Ever charged	0.9	0.9	0.9666	0.001
Ignored traffic lane arrows in roundabout	Ever done	18.2	19.8	0.5510	0.012
	Ever charged	0.4	0.0	0.3776	-0.018
Failed to wear helmet, seat belt or restraint	Ever done	21.7	36.3	<.0001	0.099
	Ever charged	5.5	8.0	0.1232	0.031
Ignored red traffic lights	Ever done	18.0	22.5	0.1000	0.033
	Ever charged	3.9	5.4	0.2900	0.021
Ignored Police signal, order or direction	Ever done	3.2	6.3	0.0149	0.049
	Ever charged	1.0	1.8	0.2376	0.024

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

Similar to alcohol abuse, there are significant associations between a lifetime diagnosis of alcohol dependence and all driving offences. A diagnosis of alcohol dependence is most strongly associated with both drug driving (M-H <0.0001; Cramers V = 0.106) and drink driving (M-H <0.0001; Cramers V = 0.099). It is also associated with hostility towards other drivers and giving chase to other drivers.

Table 8: Extent to which a CIDI - DSM-IV diagnosis of alcohol dependence is associated with self report of selected driving behaviours some of the time [#]

How often do you-		DSM-IV Diagnosis of Alcohol Dependence		M-H p-value trend	Cramer's V[†]
		No (n = 2297*)	Yes (n = 223*)		
Alcohol & Drugs	Drive even over the blood alcohol limit	5.5	13.9	<.0001	0.099
	Drive after using illegal drugs	7.5	17.9	<.0001	0.106
Behaving badly	Become impatient with a slow driver	43.8	50.9	0.0414	0.041
	Indicate hostility to a driver who annoys you	25.6	35.4	0.0016	0.063
	Tail gate	24.8	28.6	0.2162	0.025
	Get involved with unofficial races	15.9	21.0	0.0471	0.040
	Give chase to a driver with the intention of giving him/her a piece of your mind	5.4	11.6	0.0002	0.076
Driving Offence	Ignore the speed limits	48.7	51.3	0.4570	0.015
	Not wear a seat belt or helmet	7.3	12.1	0.0112	0.051
	Overtake another vehicle over double lines	4.6	7.6	0.0430	0.040
	Run red lights	4.3	6.3	0.1800	0.027
Tired	Drive while tired	34.0	38.8	0.1458	0.029

Those who reported these violations "occasionally", "quite often", "frequently" and "nearly all the time" were coded as "some of the time".

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

The following two tables examine the extent to which a diagnosis of alcohol abuse or dependence influences loss or restriction of licence as well as being charged with unauthorised use of vehicles in the past 12 months.

Table 9: Extent to which a CIDI – DSM-IV diagnosis of alcohol abuse lifetime is associated with self report of loss or restriction of driving licence and other driving offences

Extent of association between Alcohol Abuse Lifetime and driving licence & other driver's offences	DSM-IV Diagnosis of Alcohol Abuse		M-H p-value trend	Cramer's V†
	No % (n = 1870*)	Yes % (n = 625*)		
Driver's licence restricted, cancelled, suspended, or gone to court to appeal	12.7	37.1	<.0001	0.271
In the past 12 months -				
• Driven an unregistered car or motorbike	7.2	21.8	<.0001	0.204
• Driven a car or motorbike without a licence	9.0	28.4	<.0001	0.242
• Taken someone else's car or motorbike without asking their permission	2.0	4.7	0.0003	0.072

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

There is a strongly significant association between a lifetime diagnosis of alcohol abuse and loss or restriction of a driving licence. That is, people who have an alcohol abuse diagnosis are 3 times more likely to have had their licence restricted or suspended. This pattern can also been seen with other reported driving offences such as driving unlicensed and driving an unregistered vehicle.

Table 10: Extent to which a CIDI – DSM-IV diagnosis of alcohol dependence lifetime is associated with self report loss or restriction of driving licence and other driving offences

Extent of association between alcohol dependence lifetime and driving licence & other driver's offences	DSM-IV Diagnosis of Alcohol Dependence		M-H p-value trend	Cramer's V†
	No % (n = 2270*)	Yes % (n = 224*)		
Driver's licence restricted, cancelled, suspended, or gone to court to appeal	17.9	27.4	0.0006	0.069
In the past 12 months –				
• Driven an unregistered car or motorbike	10.2	17.4	0.0009	0.067
• Driven a car or motorbike without a licence	12.8	24.6	<.0001	0.097
• Taken someone else's car or motorbike without asking their permission	2.4	4.9	0.0275	0.044

* Number changes slightly due to missing values.

† Cramer's V = the closer to 1, the stronger the association.

There is a slightly different pattern for those with a diagnosis of lifetime alcohol dependence, with the strongest association being unlicensed driving (M-H=<.001 Cramers V 0.097) within the past 12 months. This group was approximately twice as likely to drive without a licence.

SUMMARY

Alcohol abuse rather than alcohol dependence was the most common diagnosis for young adults aged approximately 21 years. For young adults with a CIDI-DSM-IV lifetime diagnosis of alcohol abuse there was a strong association with engaging in a range of risky driving behaviours, which put themselves (and others) at risk of injury or death. They were 5 times more likely to drive when over the blood alcohol limit and also under the influence of illegal drugs. Alcohol abuse was also associated with being charged with other driving violations, particularly speeding, driving an unsafe

or unroadworthy vehicle, and failure to wear a seatbelt/restraint; suggesting that these young adults are likely to be arrested and charged with traffic offences. A strong association was also evident between street racing and other driving violations, and alcohol abuse. Finally, people who have an alcohol abuse diagnosis are 3 times more likely to have had their licence restricted or suspended, and to have driven an unregistered vehicle or without a licence. Overall the findings suggest that having an alcohol abuse problem is strongly associated with a wide range of driving violations and offences, which consequently affects young adults' capacity to retain their licences. On the other hand a diagnosis of alcohol dependence is rare in this age group and this is reflected in the tables. For these young people the strongest relationships are with driving over the blood alcohol limit and driving after using illegal drugs. There seems to be a consistent relationship between drink driving and drug driving.

SECTION 3: The linked data – early life indicators of drink driving and driving violations

This section examines the influence of early life course predictors on drink driving, speeding and other driving offences in young adulthood.

Table 11: Number, rates and ratio of infringements in CBCL aggressive and non-aggressive study population at the age of 5

Infringement		CBCL Aggressive at 5					
		Males			Females		
		Aggressive (n=401)	Not Aggressive (n=1323)	Ratio	Aggressive (n=222)	Not Aggressive (n=1186)	Ratio
Speeding ≤30 kph	Number	390	1317		144	548	
	Mean no. p/person	0.97	0.99		0.65	0.46	
	Rate*	55.2	53.2	1.04	36.7	26.6	1.38
Speeding >30kph	Number	66	161		6	31	
	Mean no. p/person	0.16	0.12		0.03	0.03	
	Rate*	9.3	6.5	1.43	1.5	1.5	1.0
Serious traffic violations	Number	90	215		19	54	
	Mean no. p/person	0.22	0.16		0.09	0.05	
	Rate*	12.7	8.7	1.46	4.8	2.6	1.85
Drink driving	Number	38	97		9	20	
	Mean no. p/person	0.09	0.07		0.04	0.02	
	Rate*	5.4	3.9	1.38	2.3	1.0	2.30

*Rate means number of infringements per 100 driver-years.

Table 11 shows the relationship between aggression at 5 years and being charged with speeding, drink driving and other serious traffic violations at the 21 year follow-up. Males, regardless of whether they were aggressive or not at 5 years, tend to be charged more commonly with traffic offences than do females. Among males who were considered aggressive at age 5, the rate is even higher for those charged with speeding offences of greater than 30 kph than for females. Females who are aggressive at age 5 years are charged with serious traffic violations and drink driving at almost twice the rate of non-aggressive females.

Table 12: Number, rates and ratio of infringements in CBCL (YSR) aggressive and non-aggressive study population at the age of 14

Infringement		**CBCL Aggressive at 14**					
		Males			**Females**		
		Aggressive (n=290)	**Not Aggressive** (n=1431)	**Ratio**	**Aggressive** (n=157)	**Not Aggressive** (n=1265)	**Ratio**
Speeding ≤30kph	Number	341	1352		102	597	
	Mean no. p/person	1.18	0.94		0.65	0.47	
	Rate*	68.6	50.1	1.37	37.4	26.8	1.40
Speeding >30kph	Number	52	165		5	36	
	Mean no. p/person	0.18	0.12		0.03	0.02	
	Rate*	10.5	6.1	1.72	1.8	1.6	1.13
Serious traffic violations	Number	102	208		12	50	
	Mean no. p/person	0.35	0.15		0.08	0.04	
	Rate*	20.5	7.7	2.66	4.4	2.2	2.0
Drink driving	Number	30	99		2	23	
	Mean no. p/person	0.10	0.07		0.01	0.02	
	Rate*	6.0	3.7	1.62	0.7	1.0	0.70

*Rate means number of infringements per 100 driver-years.

A similar pattern can be seen in Table 12 for both males and females who were aggressive at age 14. It is more common for males (at age 21) to be charged with driving offences than females, across all infringement categories. Males who were aggressive at age 14 had higher rates of infringements (at age 21) across all categories than did non-aggressive males. There was also a reasonably consistent association between females who were aggressive at age 14 and increased rates of speeding and serious traffic violations. However, with respect to drink driving the trend is reversed, with non-aggressive females (at age 14) being more likely to be charged with drink driving (at age 21) than aggressive females. Though the small number of females charged with drink driving may account for the relationship observed here.

Table 13: Number, rates and ratio of infringements among delinquent and non-delinquent study population at the age of 14

Infringement		Delinquent at 14					
		Males			Females		
		Delinquent (n=381)	Not Delinquent (n=1340)	Ratio	Delinquent (n=129)	Not Delinquent (n=1293)	Ratio
Speeding ≤30kph	Number	438	1255		89	610	
	Mean no. p/person	1.15	0.94		0.69	0.47	
	Rate*	63.5	50.1	1.27	41.2	26.7	1.54
Speeding >30kph	Number	72	145		5	36	
	Mean no. p/person	0.19	0.11		0.04	0.03	
	Rate*	10.4	5.8	1.79	2.3	1.6	1.44
Serious traffic violations	Number	125	185		11	51	
	Mean no. p/person	0.33	0.14		0.09	0.04	
	Rate*	18.1	7.4	2.45	5.1	2.2	2.32
Drink driving	Number	50	79		6	19	
	Mean no. p/person	0.13	0.06		0.05	0.01	
	Rate*	7.2	3.2	2.25	2.8	0.8	3.50

*Rate means number of infringements per 100 driver-years.

Table 13 shows that males, whether delinquent or not at age 14, had higher rates of traffic offences than did delinquent females when assessed at the 21 year follow-up. Not surprisingly, delinquent males were the most common offenders. Delinquent females (at age 14) had higher rates of offending (at age 21) than did non-delinquent females. Delinquent males and females were twice more likely to commit serious traffic violations than their non-delinquent counterparts. With respect to drink driving, delinquent females (at age 14) were in fact 3½ more likely to have committed a drink

driving offence at the 21 year follow-up than did non-delinquent females and delinquent males were twice more likely than non-delinquent males.

Table 14: Number and rate of infringements and Peabody scores in study population at the age of 5

Infringement		Cognitive development					
		Males			Females		
		Good Peabody score (n=531)	Avg Peabody score (n=374)	Poor Peabody score (n=483)	Good Peabody score (n=464)	Avg Peabody score (n=303)	Poor Peabody score (n=343)
Speeding ≤30kph	Number	532	415	489	262	178	164
	Mean no. p/person	1.00	1.11	1.01	0.56	0.59	0.48
	Rate*	49.9	57.5	54.6	29.8	31.9	26.1
Speeding >30kph	Number	54	48	86	22	4	8
	Mean no. p/person	0.10	0.13	0.18	0.05	0.01	0.02
	Rate*	5.1	6.6	9.6	2.5	0.7	1.3
Serious traffic violations	Number	77	72	102	23	15	19
	Mean no. p/person	0.15	0.19	0.21	0.05	0.05	0.06
	Rate*	7.2	1.0	11.4	2.6	2.7	3.0
Drink driving	Number	35	38	40	6	11	5
	Mean no. p/person	0.07	0.10	0.08	0.01	0.04	0.01
	Rate*	3.3	5.3	4.5	0.7	2.0	0.8

*Rate means number of infringements per 100 driver-years.

The gender difference in offending (regardless of type of offence) is evident regardless of Peabody scores. However, males with good Peabody scores have slightly lower rates of offending compared to those males with poor Peabody scores. The distinction is not as clear for females (refer to Table 14).

Table 15: Ratio of infringements for Peabody scores in study population at the age of 5

Infringement	Cognitive development					
	Males			Females		
	Good Peabody score	Avg Peabody score	Poor Peabody score	Good Peabody score	Avg Peabody score	Poor Peabody score
Speeding ≤30kph	—	1.15	1.09	—	1.07	0.88
Speeding >30kph	—	1.29	1.88	—	0.28	0.52
Serious traffic violations	—	0.13	1.58	—	1.04	1.15
Drink driving	—	1.16	1.36	—	2.86	1.14

Note: Ratios of infringements for Average and Poor PEABODY scores are compared with Good PEABODY scores.

Table 15 shows that males with average or poor Peabody scores at age 5 appear to be consistently more likely to offend when assessed at the 21 year follow-up. This pattern is not as clear for females.

Table 16: Number and rate of infringements and Raven scores in study population at the age of 14

		Good Raven score (n=292)	**Avg Raven score** (n=686)	**Poor Raven score** (n=357)	**Good Raven score** (n=302)	**Avg Raven score** (n=618)	**Poor Raven score** (n=198)
Speeding ≤30kph	Number	271	735	350	170	306	96
	Mean no. p/person	0.93	1.07	0.98	0.56	0.50	0.48
	Rate*	49.4	54.8	54.9	32.3	27.8	27.6
Speeding >30kph	Number	39	85	50	13	19	6
	Mean no. p/person	0.13	0.12	0.14	0.04	0.03	0.03
	Rate*	7.1	6.3	7.8	2.5	1.7	1.7
Serious traffic violations	Number	41	104	70	10	28	7
	Mean no. p/person	0.14	0.15	0.20	0.03	0.05	0.04
	Rate*	7.5	7.8	11.0	1.9	2.5	2.0
Drink driving	Number	11	46	34	5	8	4
	Mean no. p/person	0.04	0.07	0.10	0.02	0.01	0.02
	Rate*	2.0	3.4	5.3	0.9	0.7	1.1

*Rate means number of infringements per 100 driver-years.

Males with good Raven scores have slightly lower rates of lower speeding offences (<30 kph over the speed limit), serious traffic violations and drink driving convictions compared to those with poor Raven scores. Again the trend is not so clear for females and appears to be reversed for speeding offences. That is, females with greater Raven scores have higher rates of offending (see Table 16).

Table 17: Ratio of infringements for Raven scores in study population at the age of 14

Infringement	Males			Females		
	Good Raven score	Avg Raven score	Poor Raven score	Good Raven score	Avg Raven score	Poor Raven score
Speeding ≤30kph	—	1.11	1.11	—	0.86	0.85
Speeding >30kph	—	0.89	1.10	—	0.68	0.68
Serious traffic violations	—	1.04	1.47	—	1.32	1.05
Drink driving	—	1.70	2.65	—	0.78	1.22

Note: Ratios of infringements for Average and Poor Raven scores are compared with Good Raveb scores.

Table 17 shows that males with average or poor Raven scores at age 14 were consistently more likely to commit driving offences when assessed at the 21 year follow-up. Again the trend is not so clear for females. It is interesting to note once again that females with good Raven scores at age 14 seem to have higher rates of speeding offences when assessed at the 21 year follow-up.

Table 18: Number and rate of infringements and WRAT scores in study population at the age of 14

Infringement		Cognitive development					
		Males			Females		
		Good WRAT score (n=304)	**Avg WRAT score** (n=705)	**Poor WRAT score** (n=324)	**Good WRAT score** (n=297)	**Avg WRAT score** (n=611)	**Poor WRAT score** (n=208)
Speeding ≤30 kph	Number	324	673	356	156	285	129
	Mean no. p/person	1.07	0.95	1.10	0.53	0.47	0.62
	Rate*	58.9	50.3	56.0	32.6	25.6	33.6
Speeding >30kph	Number	34	100	40	10	22	6
	Mean no. p/person	0.11	0.14	0.12	0.03	0.04	0.03
	Rate*	6.2	7.5	6.3	2.1	2.0	1.6
Serious traffic violations	Number	35	118	61	12	24	9
	Mean no. p/person	0.12	0.17	0.19	0.04	0.04	0.04
	Rate*	6.4	8.8	9.6	2.5	2.2	2.3
Drink driving	Number	16	48	27	4	8	5
	Mean no. p/person	0.05	0.07	0.08	0.01	0.01	0.02
	Rate*	2.9	3.6	4.2	0.8	0.7	1.3

*Rate means number of infringements per 100 driver-years.

The results of the WRAT (a reading skills test) indicate that males with good WRAT scores at age 14 have slightly lower rates of serious traffic violations than to those with average or poorer scores.

Table 19: Ratio of infringements for WRAT scores in study population at the age of 14

Infringement	Males			Females		
	Good WRAT score	Avg WRAT score	Poor WRAT score	Good WRAT score	Avg WRAT score	Poor WRAT score
Speeding ≤30kph	—	0.85	0.95	—	0.79	1.03
Speeding >30kph	—	1.21	1.02	—	0.95	0.76
Serious traffic violations	—	1.38	1.50	—	0.88	0.92
Drink driving	—	1.24	1.45	—	0.88	1.62

Note: Ratios of infringements for Average and Poor WRAT scores are compared with Good WRAT scores.

As with other cognitive development findings, males with good WRAT scores at age 14 commit slightly lower rates of traffic offences than to those with average or poorer scores. However, this trend is not evident for females with the ratio of offences appearing to be reversed. That is, females with good WRAT scores at age 14 seem to have slightly higher rates of traffic offences at the 21 year follow-up.

In Tables 20 - 23 the rates* of infringement in each of the four categories have been examined by each of the behavioural and cognitive variables measured at ages 5 and 14. The final model (Adjustment 1) was adjusted for all potential confounders (sex of child, mother's education at first clinic visit; mother's mental health, mother's marital status at age 14, whole family income at age 5 and mother's age at 14).

* Rate means number of infringements per 100 driver-years.

Table 20: Multivariate analysis at 5 and 14 years for speeding ≤ 30 km

		Crude		Adjusted 1	
		N	**RR (95% CI)**	**N**	**RR (95% CI)**
Speeding ≤30kph	Aggression at 5	3132	1.25; 1.07-1.46	2720	1.10; 0.93-1.30
	at 14	3143	1.55; 1.31-1.83	2731	1.50; 1.25-1.79
	Delinquency at 14	3143	1.62; 1.38-1.90	2731	1.42; 1.20-1.68
	Raven (Low vs Mid)	2453	1.12; 0.94-1.33	2157	1.00; 0.83-1.19
	(High vs Mid)	2453	0.97; 0.81-1.14	2157	0.98; 0.82-1.16
	WRAT (Low vs Mid)	2449	1.21; 1.01-1.43	2153	1.19; 0.99-1.42
	(High vs Mid)	2449	1.17; 0.99-1.38	2153	1.17; 0.98-1.39
	Peabody (Low vs mid)	2498	0.95; 0.80-1.14	2182	0.87; 0.72-1.04
	(High vs Mid)	2498	0.84; 0.71-0.99	2182	0.83; 0.70-0.99

Abbreviations**: Adjusted 1,** adjusted for sex of children, maternal education, mother's mental health, mother's marital status at 14, whole family's income at 5 and mother's age at 14. **N** = Number of observations used.

Table 20 shows that aggression at age 14 (RR1.50 OR 1.25-1.79) and delinquency at age 14 (RR 1.42 OR 1.20-1.68) are consistent predictors of speeding offences ≤ 30 kph over the speed limit. Aggression at age 5 and a low WRAT score are shown to be predictors of low level speeding offences in the crude analysis but this disappears after adjustment for all confounders. Conversely, the analysis shows that a high score on the Peabody (at age 5 years) was found to have a protective relationship with speeding offence ≤ 30 kph over the speed limit. That is, young adults who had a high Peabody score were less likely to commit a speeding offence ≤ 30 kph (RR 0.83 CI 0.70-0.99).

Table 21: Multivariate analysis at 5 and 14 years for speeding >30km

		Crude		Adjusted 1	
		N	**RR (95% CI)**	**N**	**RR (95% CI)**
Speeding >30kph	Aggression at 5	3132	1.61; 1.13-2.32	2720	1.11; 0.74-1.67
	at 14	3143	2.17; 1.45-3.23	2731	1.75; 1.13-2.72
	Delinquency at 14	3143	2.66; 1.85-3.81	2731	1.89; 1.28-2.77
	Raven (Low vs Mid)	2453	1.35; 0.89-2.06	2157	1.12; 0.72-1.75
	(High vs Mid)	2453	1.11; 0.73-1.70	2157	1.40; 0.90-2.19
	WRAT (Low vs Mid)	2449	0.82; 0.53-1.27	2153	0.71; 0.44-1.12
	(High vs Mid)	2449	0.79; 0.51-1.21	2153	0.72; 0.45-1.16
	Peabody (Low vs mid)	2498	1.70; 1.09-2.64	2182	1.38; 0.87-2.19
	(High vs Mid)	2498	0.91; 0.58-1.42	2182	0.98; 0.62-1.55

Abbreviations**: Adjusted 1,** adjusted for sex of children, maternal education, mother's mental health, mother's marital status at 14, whole family's income at 5 and mother's age at 14. **N** = Number of observations used.

A similar pattern can be observed for speeding in excess of 30 kph over the limit (see Table 21) with both aggression and delinquency at age 14 consistent predictors. A low Peabody score is shown to be a predictor in the crude analysis but after adjusting for all confounders this relationship disappears.

Once again Table 22 shows that both aggression and delinquency at age 14 are predictors of serious traffic violations. In the fully adjusted model, children who were considered to be aggressive or delinquent at age 14 were almost three times as likely to be involved in serious traffic violations (RR 1.75 CI 1.13-2.72 and RR 1.89 CI 1.28-2.77 respectively). These findings are consistent with those reported by the study undertaken by the Australian Institute of Family Studies (Smart et al., 2005). With respect to cognitive development a low Raven score was found to be a predictor of

serious traffic violation in the crude analysis; however this relationship disappeared in the fully adjusted model.

Table 22: Multivariate analysis at 5 and 14 years for serious traffic violations

		Crude		Adjusted 1	
		N	**RR (95% CI)**	**N**	**RR (95% CI)**
Serious traffic violations	Aggression at 5	3132	1.85; 1.32-2.61	2720	1.38; 0.95-2.01
	at 14	3143	3.28; 2.32-4.63	2731	2.91; 2.00-4.23
	Delinquency at 14	3143	3.88; 2.80-5.36	2731	2.96; 2.08-4.22
	Raven (Low vs Mid)	2453	1.61; 1.08-2.39	2157	1.24; 0.82-1.88
	(High vs Mid)	2453	0.86; 0.56-1.31	2157	0.94; 0.60-1.48
	WRAT (Low vs Mid)	2449	1.15; 0.77-1.73	2153	1.10; 0.72-1.68
	(High vs Mid)	2449	0.75; 0.49-1.16	2153	0.99; 0.63-1.55
	Peabidt (Low vs mid)	2498	1.24; 0.82-1.88	2182	0.84; 0.54-1.31
	(High vs Mid)	2498	0.66; 0.44-1.01	2182	0.69; 0.45-1.06

Abbreviations**: Adjusted 1,** adjusted for sex of children, maternal education, mother's mental health, mother's marital status at 14, whole family's income at 5 and mother's age at 14. **N** = Number of observations used.

A consistent pattern was also identified (refer to Table 23) in relation to drink driving, with delinquency at age 14 being the strongest predictor. Young adults who were considered to be delinquent at age 14 were more than four times more likely to commit drink driving offences (RR 2.71 CI 1.61-4.55). Interestingly, aggression at age 14 was found to be a predictor of drink driving in the crude analysis, however after adjusting for possible confounders this relationship disappeared. Once again, a high score on the Peabody at age 5 was found to be protective for drink driving (RR 0.53 CI 0.30-0.94).

Table 23: Multivariate analysis at 5 and 14 years for drink driving

		Crude		Adjusted 1	
		N	**RR (95% CI)**	**N**	**RR (95% CI)**
Drink driving	Aggression at 5	3132	1.84; 1.12-3.03	2720	1.48; 0.86-2.54
	at 14	3143	2.15; 1.22-3.80	2731	1.67; 0.91-3.06
	Delinquency at 14	3143	4.05; 2.52-6.51	2731	2.71; 1.61-4.55
	Raven (Low vs Mid)	2453	2.07; 1.17-3.67	2157	1.73; 0.95-3.16
	(High vs Mid)	2453	0.66; 0.33-1.30	2157	0.72; 0.35-1.48
	WRAT (Low vs Mid)	2449	1.57; 0.86-2.88	2153	1.47; 0.78-2.78
	(High vs Mid)	2449	0.87; 0.45-1.66	2153	0.84; 0.41-1.70
	Peabody (Low vs mid)	2498	0.96; 0.54-1.71	2182	0.68; 0.38-1.22
	(High vs Mid)	2498	0.55; 0.31-0.97	2182	0.53; 0.30-0.94

Abbreviations**: Adjusted 1,** adjusted for sex of children, maternal education, mother's mental health, mother's marital status at 14, whole family's income at 5 and mother's age at 14. **N** = Number of observations used.

SUMMARY

This final section has examined the influence of early life course predictors on drink driving, speeding offences and other driving offences in young adulthood. The influence of gender was evident across all indicators, with males being charged with traffic offences more commonly than females. However, males and females who were measured as being aggressive and delinquent at age 14 were shown to be twice more likely to have committed a serious driving offence at the 21 year follow-up. In addition, delinquent males were found to be twice more likely to have driven drunk at age 21, and females 3½ times more likely. While there are some associations between males who score higher on the range of cognitive development measures at ages 5 and 14, and lower levels of drinking offences at age 21, these associations are small.

The final table (Table 24) summarises the multivariate childhood predictors of various driving offences. These predictors are quite consistent across the different offences with aggression and delinquency at age 14 being consistently associated with driving offences. In terms of drink driving and also low levels of speeding offences, higher scores on the Peabody Picture Vocabulary Test, a measure of verbal intelligence and an indicator of academic achievement, were protective. That means that those scoring higher on this measure were less likely to be involved in drink driving offences or in speeding < 30 kph over the signed speed limit.

Table 24: Outcome and predictor variables of stage one and multivariate analysis.

Outcome	Multivariate predictors
Speeding ≤ 30 kph	Aggression at age 14 Delinquency at age 14 High Peabody (protective)
Speeding > 30 kph	Aggression at age 14 Delinquency at age 14
Serious traffic violations	Aggression at age 14 Delinquency at age 14
Drink Driving	Delinquency at age 14 High Peabody (protective)

Discussion of Findings and Implications

While research suggests that young drivers do *not* drive under the influence of alcohol more frequently than older drivers, it appears that when they do, they are at higher risk of being involved in a car crash even with low or moderate blood alcohol levels (Cavallo & Triggs, 1996; Palamara, Legge, & Stevenson, 2001; Zador, Krawchuk, & Voas, 2000). With recent data showing that approximately 39% of Australians aged 14-24 years engage in risky or high-risk monthly drinking sessions (AIHW., 2006) and 8.3% engage in daily drinking (AIHW., 2002), it is not surprising that alcohol-related disorders are a significant health problem among today's Australian youth. Alcohol affected individuals pose a risk not only to themselves but also to others when they drink and drive.

Contribution of alcohol misuse to traffic violations and drink and drug driving.

This study examined the extent, to which a lifetime diagnosis of alcohol abuse or dependence influenced young drivers' involvement in a range of driving violations (risky behaviours), and being charged with certain driving offences; and how the diagnosis is also related to losing or having their licence restricted. The results show a strong relationship between having a CIDI-DSM lifetime diagnosis of alcohol abuse and engaging in risky driving behaviour. The majority of young adults in the sample (approximately 21 years old) who were diagnosed with alcohol abuse self-reported a high level of illegal driving behaviours, such as not wearing a helmet or seat belt/restraint, driving an unsafe or unroadworthy vehicle, ignoring red traffic lights, ignoring traffic arrows on roundabouts, failing to give way, street racing, driving without a licence, and driving an unregistered vehicle. They also reported frequently driving whilst under the influence of alcohol or illegal drugs. This evidence suggests

that young adults with an alcohol abuse problem are more likely to engage in a range of risky driving behaviours which not only put themselves at risk of injury or death but other road users as well. These findings are further supported by self-reported data which shows that a significant number of young adults in the study, with a diagnosis of alcohol abuse, had actually been charged with a number of driving violations and had also had their licences restricted or taken away.

On the other hand a lifetime diagnosis of alcohol dependence is rare in this age group and this is reflected in our sample with only a small number of participants being diagnosed with alcohol dependence. However, for those with the diagnosis there was also a relationship with engaging in risky driving behaviours, the strongest of these being failing to wear a helmet or seat belt/restraint, driving an unsafe or unroadworthy vehicle, driving without a licence, being hostile towards another driver, giving chase to other drivers, and driving while under the influence of alcohol or illegal drugs. A consistent relationship was noted between drink driving and drug driving with both alcohol abuse and dependence showing strong associations. Again the self-reported data showed that out of the few young adults within the study, who have a diagnosis of alcohol dependence, a significant number have also had their licences restricted or taken away.

The influence of early life course predictors on drink driving and traffic violations at age 21.

Previous attempts to understand and develop countermeasures for drink driving behaviour can be characterised by a focus on either the person (i.e. individual characteristics) or the environment (e.g. friends' models of drinking and driving) as

the cause of the behaviour. Individual characteristics such as aggressiveness, hostility, sensation seeking, normlessness, disinheriting, susceptibility to boredom, impaired risk perception, and perceived invulnerability, have been shown to be associated with higher rates of risky driving behaviours and negative driving outcomes (Burns & Wilde, 1995; Greene et al., 2000; Iversen & Rundmo, 2002; Jonah, 1997; van Beurden, Zask, Brooks, & Dight, 2005; Wells-Parker et al., 2002). More notable however, is the evidence that suggests that high risk drivers tend to show aggressive, inattentive and hyperactive characteristics as children and adolescents (Barkely et al., 2002; Begg et al., 2003; Smart et al., 2005). This suggests that there is some evidence to indicate that the antecedents of behaviours such as drink driving can be identified early in the life course of the individual. The current study also investigated whether early life course measures, in particular aggression (at age 5 and 14) and delinquency (at age 14), as well as a number of cognitive development measures, could predict drink driving, speeding offences and other driving offences in young adulthood.

Early life course measures of aggression and delinquency (at age 14) were found to predict different driving offences at age 21. These predictors are quite consistent across the different offences of drink driving, speeding and other serious driving offences. In particular, it appears that both males and females, who were considered aggressive or delinquent at age 14, are charged with serious driving violations at almost three times the rate of non-aggressive or non-delinquent counterparts (measured at age 14). These findings are consistent with those reported by the study undertaken by the Australian Institute of Family Studies (Smart et al., 2005). In terms of drink driving, young males who were considered delinquent at age 14, have double the offending rate of drinking driving than young males who were not

delinquent at age 14. Interestingly, this number is much greater for females with delinquent females being 3½ times more likely to have driven under the influence of alcohol at the 21 year follow-up. While there was a clear influence of gender across all driving indicators, with young male adults being charged with driving and drink driving offences more than young female adults, this result reflects the significant shift in the increasing amount of young females who are drink driving.

While the majority of the cognitive developmental measures tested at ages 5 and 14 showed a predictive relationship with drinking and risky driving behaviours at age 21, the only notable association found were the protective properties with high scores on the Peabody Picture Vocabulary Test (a measure of verbal intelligence and an indicator of academic achievement). That is, with respect to drink driving and also low levels of speeding offences, those scoring higher on this measure (at age 5) were less likely to be involved in drink driving offences or in low level speeding as young adults.

Conclusions and Implications

Due to its longitudinal nature, the unique contribution of this large scale, population-based prospective study was its ability to examine links between driving behaviour and earlier childhood and adolescent characteristics. The findings raise some important questions about the value of screening in childhood and early adolescence to help to identify those at particular risk of developing and displaying certain maladaptive and dangerous behaviours in adulthood. More precisely, these findings suggest that antecedents of some types of risky and unlawful driving behaviour at age 21 may be noticeable in early adolescence, years before a person first drives a car or

motorcycle. If this is the case, then interventions targeting childhood and early adolescent precursors may have a positive, flow-on effect on later driving behaviour.

An advantage of developing an intervention based on factors that are evident before the behaviour has commenced, is that it may be possible to prevent the outcome behaviour from occurring. In the present case, if interventions were developed for young adolescents identified with behavioural problems (i.e. aggression and delinquency) and high alcohol use, the problem of persistent unsafe drinking and driving among young adults may be decreased.

APPENDIX 1: Diagnostic and Statistical Manual-IV (DSM-IV) Substance Abuse criteria

The American Psychiatric Association has developed strict criteria for the clinical diagnosis of abuse and dependence. The *Diagnostic and Statistical Manual-IV (DSM-IV)* defines **abuse** as:

- A maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by one (or more) of the following, occurring within a 12-month period:
    1. recurrent substance use resulting in a failure to fulfil major role obligations at work, school, home (e.g., repeated absences or poor work performance related to substance use; substance-related absences, suspensions, or expulsions from school; neglect of children or household)
    2. recurrent substance use in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by substance use)
    3. recurrent substance-related legal problems (e.g., arrests for substance-related disorderly conduct)

4. continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (e.g., arguments with spouse about consequences of intoxication, physical fights)

- The symptoms have never met the criteria for Substance Dependence for this class of substances.

American Psychiatric Association (1994). *DSM-IV*, *Diagnostic and Statistical Manual of Mental Disorders*, (4th ed.) Washington DC: American Psychiatric Association (AMA).

APPENDIX 2: Diagnostic and Statistical Manual-IV (DSM-IV) Substance Dependence criteria

The *Diagnostic and Statistical Manual-IV (DSM-IV)* defines **dependence** as:

- A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following, occurring at any time in the same 12-month period:
    1. tolerance, as defined by either of the following:
        - a need for markedly increased amounts of the substance to achieve intoxication or desired effect
        - markedly diminished effect with continued use of the same amount of substance
    2. withdrawal, as manifested by either of the following:
        - the characteristic withdrawal syndrome for the substance
        - the same (or a closely related) substance is taken to relieve or avoid withdrawal symptoms
    3. the substance is often taken in larger amounts or over a longer period than was intended
    4. there is a persistent desire or unsuccessful efforts to cut down or control substance use

5. a great deal of time is spent in activities to obtain the substance, use the substance, or recover from its effects
6. important social, occupational or recreational activities are given up or reduced because of substance use
7. the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (e.g., continued drinking despite recognition that an ulcer was made worse by alcohol consumption)

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