Vol 24 No 1, 2013

Journal of the Australasian College of Road Safety

Formerly RoadWise – Australia's First Road Safety Journal

Special Issue - Safer People

Peer-reviewed papers

- What factors delay driving retirement by individuals with dementia? (The doctors' perspectives)
- Influences on young drivers' reported driving behaviours and perceptions: a focus group study
- Do older rural drivers self-regulate their driving? The effects of increased driving importance and limited alternative transportation
- Validation of an in-vehicle monitoring device for measuring driving exposure and deceleration events

Contributed articles

- Towards survival on the road: a whole-of-life road safety program of learning for all road users
- Asperger's Syndrome: the implications for driver training methods and road safety
- Road safety management in Australia: a call for more coordinated action

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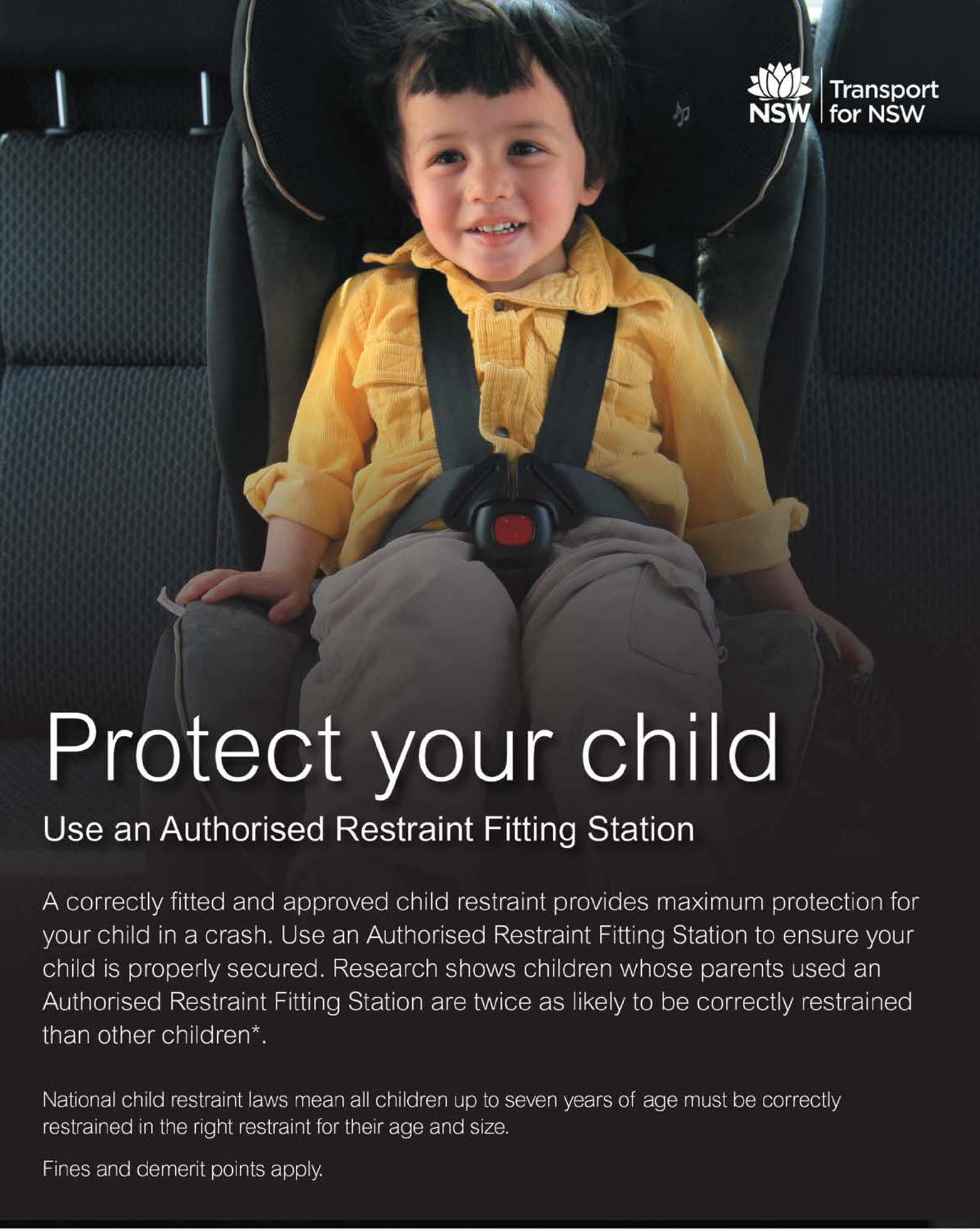

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* 'Incorrect child restraint use is reduced among restraint fitting station users' Brown J, Finch C.F, Hatfield J, Bilston L.E. Neuroscience Research Australia and University of New South Wales.

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Cover image

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From the President

Dear ACRS members,

Happy New Year to all our readers! This edition has a Safer People theme. Subjects covered include rural older drivers, younger drivers, road safety education and driver education for people with special needs, as well as an update on the progress with the Australian National Road Safety Strategy.

This year in Australia and New Zealand and around the world many will continue to work to support actions which reduce unnecessary road trauma. The focus this year in the UN Decade of Action on Road Safety is on pedestrians; a group of road users where in all countries deaths and injuries are too high.

The Second UN Global Road Safety Week in May will draw attention to the urgent need to better protect pedestrians worldwide, generate action on the measures needed to do so, and contribute to achieving the goal of the Decade of Action for Road Safety 2011-2020 - to save five million lives.

At the College we are planning to continue to promote the Decade of Action program in May in Canberra and through the Chapters.

There will be many opportunities for College members to learn from each other to reduce road trauma this year. There will be many conferences and events as we have a stimulating range of papers we plan to publish.

I am pleased that we are able to co-host with the NHMRC workshop in February to begin to build a National Road Safety Research Strategy.

In the last Journal I referred you to a paper I had written calling for improved collaboration in road safety. Many colleagues provided me with a range of comments and suggestions, such that I have re-written and updated it to take those views into account. This 'second' edition is included in this Journal and I still welcome comments and suggestions.

I believe we all need to look this year at how we can improve our coordination so that we can build synergy from listening to and learning from our activities.

Lauchlan McIntosh AM FACRS
ACRS President

Diary

27 Feb – 1 March
Melbourne Conference Centre. 9th Annual Australian Roads Summit.
Conference: http://acevents.com.au/roads/

4 – 5 March
Sydney Convention and Exhibition Centre 4th Road Safety International Conference (Sydney) March 2013.
Conference: http://www.roadsafety-4conference.com/

10 – 13 March
Gold Coast Convention and Exhibition Centre. Asia Pacific Cycle Congress (Gold Coast) Mar 2013.
Conference: http://www.cyclecongress.com/

15 – 17 May 2013
Beijing, China. Road Safety on 4 Continents Conference. http://www.vti.se/RS4C

College news

National Office News

Welcome to New Corporate Members

We welcome our new bronze members:

City of Kingston, Cheltenham in Melbourne

Curtin-Monash University Accident Research Centre, Perth, WA.

Chapter Reports

Western Australia

On December 3 a joint Curtin Monash Accident Research Centre/Australasian College of Road Safety/Murdoch University seminar was held entitled:

"The association between sleepiness, long distance commuting and night work on driver performance"

The seminar was presented by Lee Di Milia, Professor of Management at Central Queensland University. Professor Di Milia presented the findings and implications of current research investigating variables which impact on night worker driving performance. This was followed by a round table discussion on the implications for Western Australia.

Dr Paul Roberts, WA Chapter Chair

Australian Capital Territory

The ACT and Region Chapter made substantial progress in the second half of 2012 and are looking forward to an eventful and productive year.

Our focus initially is to undertake a series of seminars and workshops which are relevant to road users in Canberra and surrounding regions. We have invited representatives from neighbouring local government to join the Chapter and they are playing a positive role in our activities. We will seek to increase the regional participation as time goes on.

The Chapter has sought and obtained funding from the NRMA - ACT Road Safety Trust to conduct two initial seminars in the first half of 2013. The Chapter will lodge a submission for further seminar funding as part of the Trust's call for expressions of interest for its 2013 - 14 grants program. We will work closely with the Trust to promote and give practical expression to findings in research it has had undertaken on issues of importance to the ACT and the Region.

The first seminar to be held in March will address "The Culture of Speed". It will include presentations by Dr Soames Job; and Dr James Warn, ACT Policing; the ACT Government. Dr Warn co-authored a study commissioned by the Trust: "Towards a Holistic Framework for Road Safety" and considers that an attitudinal shift similar to that for smoking and AIDS is required in relation to speed and car use if the current level of road trauma is to be reduced.

In May or early June 2013, a second seminar will be held on Rural Road Safety. This will in part be based upon a report currently being undertaken by ARRB Group on rural road crashes involving ACT motorists and road users. Professor Mary Sheehan will present the opening address and will be supported by Victoria Pyta (ARRB) and speakers from local government in the region as well as police and perhaps the NSW Motorcycle Council.

The Chapter is grateful for the support it is receiving from the national office and individual members of the College during this phase of our rebuilding.

Keith Wheatley, ACT Chapter Secretary

Other news

Release of NSW School Bus Safety Report

The NSW School Bus Safety Community Advisory Committee recently released its report into school bus issues. The Committee recommends lap and sash seatbelts should be installed on all regional and rural school buses, outside lower-speed urban areas, within the next ten years. School buses provide a relatively safe form of travel, but incidents involving buses carrying school children do occur, and the risks associated with major incidents are not acceptable to the general community. There is a higher degree of risk when travelling in rural or regional areas, as buses travel at higher speeds on local roads where there may be more hazards. There are about 1,500 dedicated school buses in NSW, which carry more than 60,000 school children each day. The report is available to view or download at the following web address:

http://www.transport.nsw.gov.au/sites/default/files/b2b/bus/m236-school-bus-safety-report_web.pdf

Safe People: Progress with the National Road Safety Strategy

Graduated licensing systems (GLS):
The NRSS highlights the potential safety benefits from improved GLS for car drivers, which was a key topic at the 2012 National Road Safety Forum (http://www.infrastructure.gov.au/roads/safety/nrsf_2012/index.aspx). Various activity has recently occurred at a jurisdictional level, including:

- Victoria released an interim evaluation report showing very promising results from its current GLS.
- South Australia put out a public discussion paper on proposed changes to its GLS (and the Government's response is pending).
- NSW commenced the development of a safer driver's course as part of its GLS.
- Tasmania commenced a review of its GLS against best practice.
- A very large controlled trial of a new driver education intervention for P-plate drivers is proceeding in Victoria and NSW. Known as 'the P Drivers Project', this ambitious research project is jointly funded by the Australian, Victorian and NSW Governments, and several industry partners.
- At a national level, transport agencies have agreed to work collaboratively on the development of a best-practice GLS model. An initial review of the safety evidence is currently being finalised by Austroads.

Unlicensed driving:
Austroads is finalising a national project on measures to reduce the incidence of unlicensed driving. In the meantime, most jurisdictions are using automatic number plate recognition technology to increase detection of unregistered vehicles and unlicensed drivers – and some have also extended the use of vehicle sanctions as a deterrent.

Indigenous road safety:
A focus of the NRSS is on programs to support the driver licensing needs of Indigenous people. Each of the jurisdictions with large Indigenous populations has taken some action to address this need: NSW has several programs in place to support licence acquisition among Indigenous communities and is looking at further measures to support Indigenous licensing in rural and remote areas; Queensland has the Indigenous Driver Licensing Program which aims to reduce unlicensed driving in remote Indigenous communities in Far North Queensland. A book has also been developed to deliver information on road rules and driver licensing systems to Indigenous communities. Western Australia has developed a strategy to assist remote Indigenous communities to increase access for learner drivers to supervised driving instructors. South Australia has established the Aboriginal Driver Licensing Program Team and work has commenced on developing and implementing a range of program initiatives. The Northern Territory is active in a number of ways, including through the DriveSafe NT Remote pilot program, which is delivering driver training and licensing to people in remote Indigenous communities. National work is being undertaken through Austroads to develop various resources to support Indigenous licensing needs. This has seen the recent completion of a pre-licence toolkit to help educate people in remote communities about the road rules and safe driving behaviour.

Motorcycle safety:
The NRSS calls for a review of licensing arrangements for motorcycle riders, including graduated measures for novice riders and options to improve the safety of returning riders. Reviews have been initiated within several jurisdictions and Austroads has undertaken some national work on best-practice approaches to graduated licensing.

NSW is leading a major in-depth motorcycle crash study. Jurisdictions are considering options to develop/expand the existing NSW Consumer Rating and Assessment of Safety Helmets (CRASH) program into a national program. The NSW Motor Accidents Authority is coordinating a project to provide consumer information about other motorcycle safety clothing and equipment, with results to be shared nationally. Motorcycle safety will be a focus of the 2013 National Road Safety Forum being hosted by Tasmania.

Seatbelts:
The Commonwealth has introduced an Australian Design Rule (ADR) requiring new cars to be fitted with drivers' seatbelt reminder systems. The Commonwealth announced a four-year extension of its Seatbelts on Regional School Buses program, which provides seatbelt funding for buses servicing regional school routes. In the meantime, jurisdictions are progressively introducing seatbelt requirements for state-contracted school buses. The NSW Government is currently considering recommendations in this regard from its independent advisory committee on school bus safety. The NRSS calls for mandatory seatbelt wearing for taxi drivers. Most jurisdictions now have this requirement in place: NSW has announced that seatbelts will be mandatory from 14 January 2013 and Queensland is consulting with the taxi industry about changes to legislation.

Mobile phones:
The NRSS identifies a need for improved compliance with current mobile phone laws. While most jurisdictions are addressing this through regular publicity campaigns, NSW is working with police to investigate improved enforcement options. The Austroads work on graduated licensing is also looking at the scope for broader application of total mobile phone prohibitions (included hand-free usage) among novice drivers.

Drink/drug driving:
The NRSS calls for work to improve the effectiveness of random breath testing and roadside drug testing programs. This is being addressed to some extent at a jurisdictional level, though consideration is being given to national work (through Austroads) to support the implementation of best-practice enforcement programs. An Austroads project is underway to review BAC limits for different driver licence categories. Several NRSS actions concern measures to extend and strengthen the use of alcohol interlocks. Some relevant investigation activity is being undertaken at a jurisdictional level, however a key national project on interlock programs has commenced through Austroads.

Driver fatigue:
Most jurisdictions are conducting or developing public education campaigns on fatigue and most are investing in the expansion or upgrading of driver rest areas. In relation to in-vehicle detection technology, NSW has identified reliability as an issue and is continuing to monitor developments in the area. A pilot study to trial two systems based on ocular dynamics is planned for 2013.

Heavy vehicle drivers:
National work is in train to support the implementation of competency-based standards for heavy vehicle driver licensing. An operational pilot of electronic work diaries is being conducted to improve the management of driver work and rest requirements. This is a national project being led by NSW. The creation of the National Heavy Vehicle Regulator is expected to support the effective implementation of heavy vehicle fatigue management reforms. The Commonwealth has established the Road Safety Remuneration Tribunal, which is empowered to set appropriate pay and conditions for truck drivers in the interests of improved safety.

John Goldsworthy, Director – Road Safety Policy, Department of Infrastructure and Transport

Special Issue: Safer People

Peer-reviewed papers

What factors delay driving retirement by individuals with dementia? (The doctors' perspectives)

by J Carmody[1,4], J Granger[2], K Lewis[3,4], V Traynor[3,4] and D Iverson[3,4].

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Abstract

Introduction: An increasing number of individuals with dementia drive. Many argue that those with mild dementia are safe to do so. This study explored the attitudes, knowledge and behaviour of hospital-based doctors towards drivers with dementia. **Methods:** 20 doctors in a regional hospital in NSW were surveyed using a 20-item questionnaire. Descriptive statistics were applied to the data collected. **Results:** Half were unaware of the Austroads national guidelines; 60% incorrectly believed that they were legally obliged to report all unsafe drivers in NSW. Most felt that drivers with dementia delay driving retirement for a wide range of reasons. All participants expressed a desire for changes to current clinical practices. **Conclusion:** Drivers with dementia require guidance from their treating physicians. This study found that there is room for improvement in the attitudes, knowledge and practices of hospital-based doctors who treated drivers with dementia. Options for improved road safety and avenues for future research are discussed.

Keywords

Dementia, Doctors, Driving, Intervention, Retirement, Safety

Introduction

Background

In most OECD Member countries, older adults represent the fastest growing segment of the population, and in many, one in every four persons will be aged 65 or older by 2030 [1]. In 2030, the last of the 'Baby Boomers', individuals born between 1946 and 1965, will reach 65 years [2]. It is estimated that by 2030, 20% of the population will be 65 years or over [3]. Age is the leading risk factor for developing dementia [4] and the prevalence rate of dementia amongst those over 65 years is approximately 6.4% [5]. It would seem reasonable, therefore, to expect the number of drivers with dementia to rise [6, 7].

There is a large body of literature focusing on the complex issue of driving and dementia. However, there is a paucity of research regarding interventions which could address this increasingly important medical, social and ethical dilemma [8-10]. The aims of this study were to explore the knowledge, attitudes and behaviour of 20 doctors in a tertiary-referral hospital in regional NSW, Australia. Specifically, the objectives were to better understand factors which doctors perceived to delay driving retirement by individuals with dementia.

What is dementia?

Dementia refers to a deterioration of cognitive function which is severe enough to interfere with one's activities of daily living. As per the Diagnostic and Statistical Manual criteria, memory impairment is required to make a diagnosis of dementia and is a prominent early symptom [11]. Dementia is often accompanied by a decline in language function, ability to perform learned tasks, visuospatial skills and executive function (e.g. planning, judgement, sequencing, abstract thinking) [4].Of the numerous conditions that can cause dementia, the most frequent include Alzheimer's disease, vascular dementia, dementia with Lewy bodies, frontotemporal dementia and alcohol-related dementia [4]. It may develop abruptly following a stroke or gradually due to Alzheimer's disease.

For many, dementia is a progressive illness. For others, it is static (i.e. the clinical features plateau). Occasionally, individuals may improve as some forms are reversible [4, 11]. The prognosis is variable and is determined by the underlying cause and the treatments applied. Increased age is a recognised risk factor for developing dementia [4, 8]. The results of pooled epidemiological data from Europe established that the prevalence of dementia rises rapidly after the age of 65 years [5]. In 2011, it was estimated that 266,574 Australians have dementia and that by 2050 this number will have risen to 942,624 [12]. At present, a large proportion of older Australians hold a class C driver licence which allows the holders to drive cars, small trucks and even vehicles that accommodate up to 12 persons [13] (Figure 1). It is anticipated that the number of older drivers on our roads will increase as the population ages [6, 7].

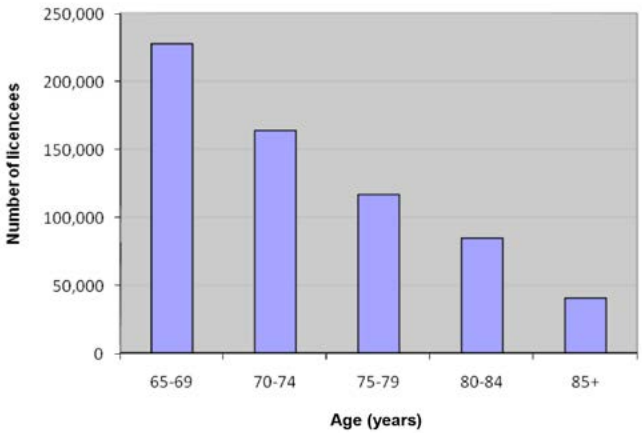

Figure 1. Numbers of class C licence holders by age group in NSW (as at December 2011) [13]

The impact of dementia on driving skills

Driving is widely acknowledged as being a complex task [14-16]. A variety of skills are necessary for safe driving including adequate memory, concentration, attention, processing speed, planning, judgement and visuospatial skills [17]. Unfortunately, dementia frequently undermines such abilities. Given the often progressive nature of this condition, most individuals with dementia are likely to become unsafe to drive. Furthermore, many have limited insight into the potential impact the condition can have upon their driving skills [17].

There is broad consensus that those with moderate or severe dementia should not drive [6, 14]. However, what remains unclear is how best to advise individuals with very mild or mild dementia regarding the decision to drive [9, 14]. Some authors favour immediate cessation of driving by all upon diagnosis [18-20]. There is evidence, however, that a large proportion of drivers with either very mild or mild dementia can pass an on-road driving test [17, 21]. Consequently, many argue that individuals with mild dementia may be safe to drive for a limited period [6, 14, 22].

Road safety issues for drivers with dementia

Two major road safety issues are worthy of consideration with regard to drivers with dementia: (i) risk of a car crash; and (ii) risk of getting lost. Either event has the potential to jeopardise the safety of the driver, passengers or members of the community.

Several studies have shown that individuals with dementia are at greater risk of a car crash compared to age-matched controls [19-21, 23-28]; reported relative crash risks range from 2.3 [28] to 18.4 [24]. However, at least two studies have found no difference in crash rates between individuals with dementia and healthy controls [29, 30]. This discrepancy may be, in part, related to differing dementia severity amongst participants or different research designs adopted.

Although the topic of dementia and crash risk has been extensively studied [22], less is known about the issue of drivers with dementia becoming lost while driving. Individuals with Alzheimer's disease (the most common form of dementia) are at risk of wandering, becoming disorientated and getting lost [31]. This may occur in both familiar and unfamiliar environments [31]. A review of 207 media reports over a 10 year period, highlighted the potential for dire consequences when drivers with dementia become lost (e.g. not found, injury or death) [32].

Current clinical guidelines

In 2009, the Australian and New Zealand Society for Geriatric Medicine (ANZSGM) published a position statement addressing the topic of driving and dementia [6]. The ANZSGM contends that a diagnosis of dementia does not always necessitate immediate cessation of driving. For those deemed safe to drive, biannual clinical review

is recommended. In 2010, the American Academy of Neurology (AAN) conducted a systematic review of the available literature and issued a practice parameter for physicians [33]. The authors found that there does not exist a test or historical feature that can accurately establish one's risk of having a crash. Specifically, a driver's self-rating of driving ability is not a reliable indicator of increased risk of unsafe driving. The AAN proposed that individuals with mild dementia should strongly consider retirement from driving [33].

In Australia, the responsibility for issuing a licence rests with the Driver Licensing Authority (DLA) [16]. Each State and Territory has a separate DLA (e.g. Roads and Maritime Services in NSW). Mandatory reporting by health professionals of all unsafe drivers applies in South Australia and the Northern Territory [16]. In March 2012, Austroads updated its national clinical guidelines for Australian healthcare professionals [16]. This publication details the medical criteria which must be met for an individual to hold a driver licence in Australia. Individuals with dementia are deemed unfit to retain an unconditional licence (private or commercial). However, they may be eligible to hold a conditional licence once a DLA has taken into account: (i) the nature of the driving task; (ii) a medical assessment of visuospatial perception, insight, judgement, attention, reaction time and memory; and, if necessary, (iii) the results of a practical driving assessment. If a commercial licence is required, the Austroads guidelines stipulate that a medical review must be conducted by an appropriate specialist. Furthermore, Austroads insists that drivers with dementia undergo an annual review of their fitness to drive.

Methods

Participants

All participants were medical doctors recruited from a 500-bed university-affiliated teaching hospital in regional NSW, Australia. A convenience sample of 40 potential participants was emailed a standardised invitation to be involved in the study. Those who expressed an interest in participating, verbally or in writing, were provided with a Participant Information Sheet and a Consent Form. Once the predetermined quota of 20 participants was reached recruitment ceased. The study was approved by the (i) local Human Research Ethics Committee, and (ii) the hospital research governance directorate.

Design

This exploratory study employed a mixed-methods approach. More specifically, a questionnaire was created de novo so as to capture both quantitative and qualitative data. Pilot testing of the questionnaire was not undertaken.

Questionnaire

The questionnaire consisted of 20 items using a series of response options, including 16 items with 'yes' or 'no' answers. Initial questions established the clinical roles and levels of experience in caring for individuals with dementia of the participants. The knowledge base of participants was explored with questions regarding: (i) current guidelines on driving; (ii) occupational therapy driving assessments; and (iii) legal obligations of doctors to report unsafe drivers. The attitudes of participants were sought regarding: (i) safety of drivers with mild dementia; (ii) most appropriate groups to assess fitness to drive; and (iii) factors which delay driving retirement by individuals with dementia. The past behaviours of participants were established regarding: (i) advising patients to cease driving; and (ii) advising patients with dementia to cease driving. The final item was an open-ended question which enabled participants to provide comments.

Procedure

Recruitment was conducted in January 2012 over a four week period. A research assistant contacted potential participants to arrange a suitable time to complete a short questionnaire. The majority of the surveys were conducted face-to-face. The remainder were completed via telephone. It took no longer than five minutes to complete the questionnaire (using either method). All responses were recorded confidentially on sequentially numbered de-identified data sheets.

Results

A total of 20 medical doctors participated: three interns; four resident medical officers; 12 registrars; and one specialist. All respondents indicated that they had, at some time, treated an individual with dementia. Further, 85% of those sampled had previously treated someone with dementia who drives. Although all participants recollected instructing a patient to stop driving, only 65% had advised a patient with dementia to cease driving. A large majority of respondents (80%) felt that some individuals with mild dementia are safe to drive.

Half of all doctors surveyed were aware of the national Austroads 'Assessing Fitness to Drive' guidelines but only 30% knew of the Austroads guidelines for drivers with dementia. Five percent of the participants had knowledge of the ANZSGM position statement on driving and dementia, while 60% incorrectly believed that, as doctors working in NSW, they were legally obliged to notify the Driver Licensing Authority (DLA) of all unsafe drivers.

Half of the participants were aware of occupational therapy driving assessments. One in four respondents were either unsure or incorrect in their assumption that occupational therapy driving assessments are funded entirely by Medicare. Furthermore, 95% of participants were either unsure or incorrect in their estimation of the true cost of such assessments.

A question relating to the optimal time to raise the issue of driving retirement with individuals with dementia allowed respondents to select more than one answer: 80% believed the topic should be raised at the time of diagnosis and 45% felt it should be raised when a driver becomes unsafe to drive. 15% believed that the subject of driving retirement should be raised after a car crash.

As noted above, the responsibility of determining fitness to drive of individuals with dementia lies with the DLA. However, input from health professionals is often required in order to facilitate a decision. Of the doctors surveyed, more than 60% felt that a wide range of individuals should be involved in such a decision (Figure 2).

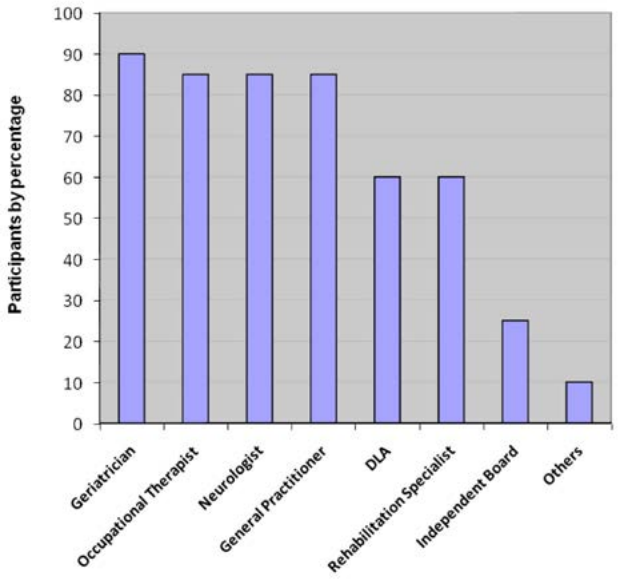

Figure 2. The individuals/groups which participants considered should be responsible for assessing fitness to drive

The participants were asked which factors they believed delayed driving retirement by individuals with dementia. Participants were directed to select one or more responses from a dozen wide-ranging options (e.g. 'denial of diagnosis by patient', 'pleasure of driving'). The majority of participants selected multiple responses (Figure 3). An open-ended item was included (termed 'others') to enable participants to document their suggestions. This item yielded only three responses: 'depression'; 'keeping appointments'; and 'lack of support'.

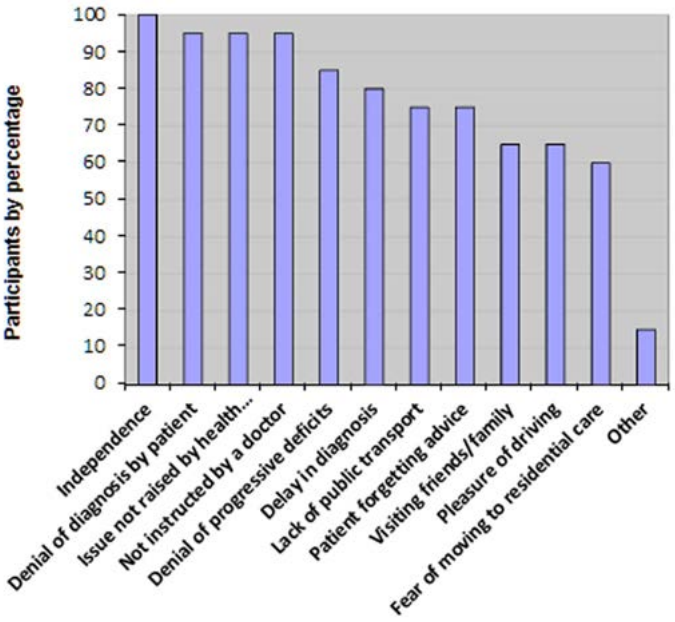

Figure 3. The factors which participants considered delayed driving retirement for individuals with dementia

The participants were also surveyed regarding their thoughts on how current practices could be improved. All participants felt that driving recommendations should be included in hospital discharge letters. Almost all (90%) participants felt it would be helpful if they were informed of the Austroads guidelines during orientation to a new hospital. Most (90%) participants felt that a client-centred booklet on 'driving and dementia' would be useful if it were made available to individuals with dementia. The final survey question enabled participants to provide comments/ feedback. The single response to this question proposed that 'family should be involved in the decision making process'.

Discussion

General practitioners (GPs) in South Australia have expressed reluctance to be responsible for the assessment of fitness to drive of individuals with dementia [34]. A survey of 485 GPs revealed that 12% were unaware of their obligation, under South Australian state law, to report all unsafe drivers. This is in contrast with the findings of the current study in which 60% of respondents incorrectly believed that they are legally obliged to report all unsafe drivers in New South Wales. Most (80%) of the South Australian GPs felt that a 'multidisciplinary driving centre' would be a useful resource which mirrors the findings of the current study where the majority of doctors surveyed felt that a wide range of groups/individuals should be responsible for the assessment of fitness to drive (Figure 2).

In a US study, physicians were more likely to raise the issue of driving with their patients if they: (i) had a strong perceived role regarding driving; (ii) were older; (iii) believed it was important to address driving; and (iv) were aware of the American Medical Association's guide on older drivers [35]. They concluded that a concerted effort should be made to provide physicians with the tools to address the issue of driving and dementia. This reflects findings from the current study in which most participants felt that a number of interventions would be worth pursuing.

Another study found that 75% of Geriatricians feel that physicians are responsible for reporting patients 'who may be a danger to others' [36]. The study, involving a national survey of 467 Geriatricians in the United States, found that more than 86% would contact state authorities despite the objections of a patient. Further, 72.9% would contact authorities despite the objections of a patient's family. However, over one in four participants claimed to be unaware as to how to report an unsafe driver to the appropriate authorities.

In 2003, a survey of 220 public hospital doctors in Adelaide to determine their clinical practice, knowledge and attitudes regarding the assessment of fitness to drive found that 70% of the participants were aware of the Austroads national guidelines but their knowledge of its contents was poor [37]. Many of the respondents were uncomfortable with the responsibility of assessing fitness to drive. The conclusion was that alternative approaches to the assessment of fitness to drive should be considered. Beran [38] subsequently argued that this paper [37] should 'sound warning bells for all doctors who assess fitness to drive'. Beran's concern stemmed from the apparent apathy of hospital doctors towards the assessment of fitness to drive.

A striking finding of the current study was the lack of awareness among participants of the Austroads 'Assessing Fitness to Drive' national guidelines. Further, the majority of participants were incorrect in their belief that reporting all unsafe drivers to the DLA is mandatory in NSW. As explained earlier, mandatory reporting of unsafe drivers to the DLA only applies to health professionals (e.g. doctors, optometrists, occupational therapists) practicing in South Australia and the Northern Territory.

A lack of knowledge was apparent when participants were asked about occupational therapy driving assessments. Although such assessments are available nationally, many doctors were unaware of their existence. In addition, most respondents were inaccurate in their estimation of the true cost of such assessments. Interestingly, most participants supported the input of an occupational therapist in the decision making process. In response to a question regarding the factors which doctors consider delay driving retirement, the majority of participants chose 10 different responses (Figure 3). This finding suggests that the decision by drivers with dementia to delay driving retirement is not based on a single factor.

Implications and recommendations for road safety

Many older drivers do not plan for driving cessation [39, 40]. Individuals with dementia often develop difficulty with planning, judgement and problem solving [4, 41]. Furthermore, it has been found that 80% of drivers with dementia continue to drive despite having a car crash [42]. This is of concern, not least because older drivers involved in a car crash are more likely to be seriously or fatally injured [43]. It would seem reasonable, therefore, that steps be taken to enhance road safety for all.

Therefore, the following measures are proposed to improve road safety:

- undergraduate curricula for medical students should include content on driving and specifically driving and dementia;
- hospital doctors should be reminded during orientation of the updated Austroads national guidelines;
- hospital doctors should be reminded during orientation of their legal obligations regarding the potential need to report unsafe drivers (mandatory in SA and NT);
- individuals with dementia who are admitted to hospital should have driving recommendations included in discharge letters;
- DLA representatives should approach hospital administrators to initiate annual sessions on DLA-led education for hospital doctors; and
- DLA representatives should approach medical schools to provide sessions to students on Australian legislative requirements for driving and specifically driving and dementia.

Strengths and limitations

To our knowledge, this is the first study to specifically examine the attitudes, knowledge and behaviour of hospital-based doctors regarding drivers with dementia. A limitation of this exploratory study is the low number of participants which precludes the use of inferential statistical analyses; thus only descriptive statistics were applied. In addition, the low sample size of this study limits the generalisability of its findings. A strength of the study is the

clear identification of a gap in knowledge of hospital-based doctors regarding the topic of driving and dementia.

Recommendations for future research

As noted earlier, 90% of doctors surveyed would find a client-centred booklet on 'driving and dementia' useful. Thus the development and evaluation of a 'decision aid' booklet designed to facilitate early retirement from driving by individuals with dementia is appropriate; this is currently being undertaken by our research group.

Conclusion

The aim of this study was to explore the subject of driving and dementia from a hospital-based doctor's perspective with the intent of facilitating improvements in road safety. The findings highlight an increasingly important road safety issue - many doctors feel trapped between the Scylla of patient autonomy and the Charybdis of reporting unsafe drivers. To navigate this strait successfully, some changes are required. It is hoped that the findings of the current study will inform clinical practice and encourage additional research focussing upon potential interventions for drivers with dementia.

Acknowledgements

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Influences on young drivers' reported driving behaviours and perceptions: a focus group study

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Abstract

Forty-four (25 females) Australian citizens aged 17-24 years, all holding a current driving licence, participated in six focus groups to discuss: personal factors – age, maturity and inexperience; and other factors (including safety campaigns) which could affect driving behaviours. Group discussions were audio taped and data analysis proceeded by grounded theory. Major themes were: intersections, parental influences, inexperience/inattention and safety campaigns. Several sub-themes associated with these major themes were extracted from information provided by participants. Prime influencing parties on early driving experiences are outlined and potential areas for material from this study to contribute to road safety are discussed.

Keywords: Inattention; Inexperience; Parental influences; Qualitative study; Road safety campaigns

Introduction

Reported attempts to identify and assess the extent to which young drivers' behaviours might be rendered less risky include: in-vehicle support systems [1]; skid pan training [2, 3]; simulator training [4]; driving school policies [5]; safety training [6-8]; parenting practices in relation to driving [9]; a cultural approach [10]; safety campaigns [11-13]; and passenger influences [14, 15]. Addressing these topics from a grounded psychological approach might help to provide a framework that could help to guide policy and training in this field. A longer-term objective is to seek information relevant to developing road safety campaign material that would be effective with drivers within this age group.

Data for this study were collected within the context of Queensland's graduated driver licensing (GDL) system. As in a number of overseas jurisdictions, some form of GDL has been introduced in all Australian states. Like all such schemes, Queensland's unique GDL system is based upon a graduated approach to novice driver education and experience. Described in detail on the Queensland Department of Transport and Main Roads web site [16], it comprises these stages:

1. Pre-licencing (up to age 16 years).

2. Learner Licence (from age 16 years to be held for a minimum 1-year period), requiring all on-road driving to be appropriately supervised, leading to the driving test.

3. Provisional Licence P1 (red P plates) for drivers under 25 years of age who have passed both components of the driving test (hazard perception test and practical component).

4. Provisional Licence P2 (green P plates) for drivers who meet the age-related criteria for this stage and who have passed the required driving test components.

5. Open Driver Licence, once all probationary criteria have been fulfilled.

For drivers up to age 25 years, Queensland's GDL has various restrictions at different stages, inter alia, relating to: high powered (performance) vehicles, night-time driving, alcohol consumption, mobile phone use, and peer passengers. Detailed information is available on the relevant pages of the Queensland Government website [16]. Further description of Queensland's GDL is beyond the scope of the current paper. However, researchers have considered the impact on learner drivers' experiences of recent changes to Queensland's GDL [17], a comparison between Queensland and New South Wales in terms of numbers of required hours for learner drivers [18], the effect of peer passengers on young drivers' speeding intentions [15], and development of a nationwide best practice GDL scheme [19].

While the evidence for the effectiveness of GDL programs, for example in terms of crash rate reductions, particularly from US research is overwhelming [20-28], the main mechanism for this effect appears to be reduced risk exposure rather than enhancing young novice drivers' driving skills [17, 27, 29, 30]. There is conflicting evidence as to whether such beneficial effects continue after the key elements of a GDL program have been completed, that is by ages 18-19 years. While some researchers have found negative transfer effects [21, 28, 31], others have identified continuing positive effects [19, 22, 32]. What seems to be indisputable is that the key to learning safe driving skills is relevant experience, particularly when this reflects the range of driving situations that the young novice driver will encounter [33, 34]. Therefore, it is incumbent on traffic researchers to determine some of the components of that experience from young drivers themselves. It is to this objective that the current study was directed.

Method

Participants were 19 male and 25 female Australian citizens aged 17-24 years recruited in SE Queensland by local advertising. All held a current driver licence. Six focus groups were run with facilitators imposing minimal direction on discussions, guiding conversation to incorporate themes of: speeding, alcohol and other drugs, fatigue, seatbelts, inexperience and inattention, and intersections. Selection of these themes was based upon recent data concerning vehicle crashes in Queensland. Group discussions, lasting between 75 and 90 minutes were audio taped, and continued until little additional information was extracted. A marginal utility criterion was adopted so that the number of focus groups represented the stage at which little new material was forthcoming.

Characteristic of this approach to data gathering [35], as a purely qualitative study, no attempt was made to quantify the number of times that a point was made. Attempts to quantify could have reduced the variety of data presented while the numbers in any given cell would have been too small for useful further analysis. This criterion also applied to age and gender variables, which are more applicable in quantitative research. Given that the representativeness of any given comment could not be determined, no record was kept of whether either a male or a female participant made a particular statement, nor the age of the person speaking. As a characteristic of the focus group method is that several participants might agree on a particular point, this could make transcribing it as a perception of any given individual problematic.

No attempt was made to ensure that comments were consistent, either within a group, or between groups. This reflects the reality that drivers can hold mutually contradictory perceptions, and that this might be considered

as an aspect of a jurisdiction's driving culture. The aim of the study was not to determine whether young novice drivers held "correct" views on driving and road safety more generally, but to gain a snapshot of what such a range of perceptions might comprise.

The methodology of focus groups is well known [36-39]. The success of using focus groups to understand young drivers' decision processes in respect of drink driving [40], lifestyle impacts on psychosocial functions of driving [41], vehicle identification and driving safety campaigns [42], rural drivers' risk perceptions [35], and risks from hazardous driving behaviours [43], as well as qualitative accounts of driving incidents [44], is well established.

Grounded theory provided the basis for data analysis [45]. Each group discussion was first analysed individually before the data were collated to summarise all discussions. Themes and sub-themes were extracted from the information provided by participants under the headings outlined above [46-48]. Additional categories emerged from the data and some verbatim quotes representing emergent themes were noted. However, in most of the illustrative comments in the current paper, a summary paraphrasing of the content of a theme, idea, perception, or experience was constructed to represent a verbalised point. As far as possible, even when not quoting verbatim, participants' own words have been used. Table 1 summarises the terminological hierarchy used to describe study findings.

Results and Discussion

This section provides a framework for describing the findings. Participants' expressed thoughts are presented as directly as possible. To facilitate appreciation of these views, material drawn directly, for example paraphrasing an idea from the discussions is presented in italic text in bullet points, while verbatim speech is italicised within quote marks. Material from the discussions was coded within major linked domains: external influencing factors, personal factors, and counter strategies. As a qualitative study, no reference is made to the number of times that a particular view was expressed or behaviour described, but merely records that the material emerged from one or more of the discussions.

As far as possible the terminology used by participants has been retained, for example the term "accident" instead of the less attributionally loaded "crash" is used to reflect as accurately as possible the ways in which participants expressed their views. An exception to this general rule is that where an originally intended meaning might have been unclear, the paraphrasing has sought to clarify this.

Where the discussion context made it obvious that comments referred to other drivers or to particular driver groups (e.g., older drivers), this has been identified in the revised text. However, in many cases, it was not clear from the discussion context whether a particular class of drivers was the reference point, and thus comments about these attributed behaviours remain ambiguous. In some cases it was clear that participants were referring either to their own behaviour or to drivers in general. Where the discussion context allowed for unambiguous interpretation, paraphrased extracts described in this section attempt to clarify which, if any, class of driver or road user was the main referent for comments.

Table 1. Terminology

Term	Description/derivation
Domains	Areas for investigation: Behavioural hazards, External influencing factors, Personal factors, Counter strategies
Themes	Selected for study: Intersections, Parental Influences, Inexperience/Inattention, Campaigns
Sub-themes	Emerged from discussion
Components	Perceptions, opinions, expressed thoughts, cognitions, topics, attitudes, emotions, comments, suggestions, reported behaviours, examples, ideas, experiences, views, values, perspectives, illustrations, notions, arguments

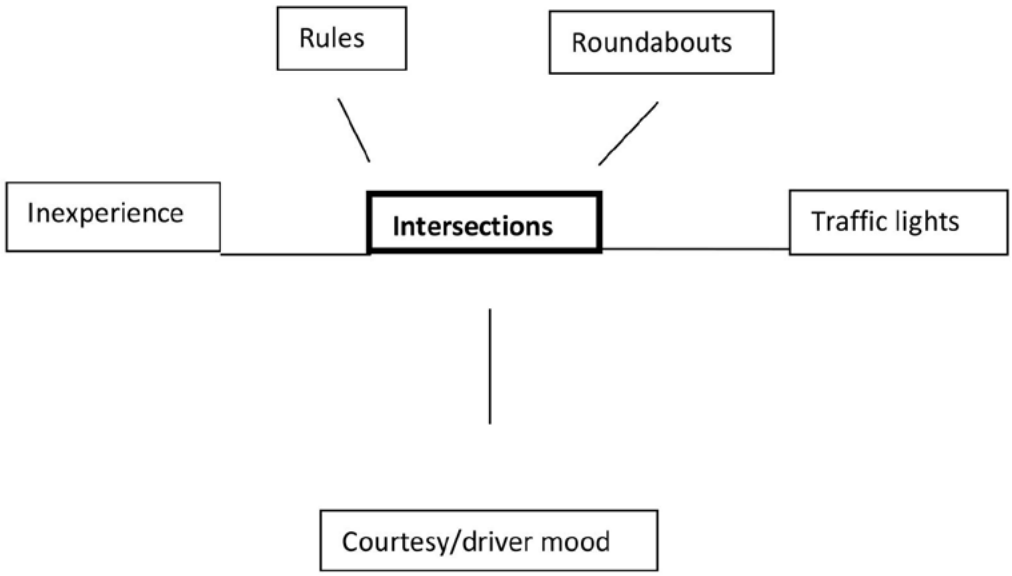

Figure 1. Sub-themes within the intersections theme

Influencing Factors

Intersections. Because of the extent to which they were represented in road crashes in Queensland, intersections were a selected theme topic for this study. Figure 1 illustrates the five sub-themes generated by this theme. The **rules** sub-theme produced these illustrative comments:

- *[other] drivers don't know how to merge;*
- *many people don't know the rules at intersections;*
- *[other people] doing stupid things at intersections, which causes accidents;*
- *[intersections are] the most likely place for "near miss accidents" to happen;*
- *[important to] have your car working properly at intersections;*
- *if your brake lights are not working, this is more likely to cause accidents;*
- *[particular frustration expressed at] drivers who don't turn when the red filter arrow at traffic lights disappears;*
- *"elderly drivers who don't know the road rules, especially at roundabouts"* (the context did not make it clear whether this quote referred to all elderly drivers).

Roundabouts generated specific comments, including:

- *unclear when and when not to indicate at roundabouts;*
- *too much confusion due to different roundabout designs and sizes;*
- *ambiguities in design and the need for standardisation, indicating which lanes to enter and exit from.*

Suggested counters to this confusion were:

- *educating people about how to use roundabouts;*
- *signage at roundabouts to help people understand what to do.*

One perception under the **traffic lights** sub-theme was that:

- *lights are red for too long [in this locality].*

Comments reflecting participants' reported strategies to overcome this perceived problem, included:

- *speeding through/running red lights to avoid waiting for so long – particularly late at night when there's no-one around;*
- *tailgating trucks through red lights to avoid getting a ticket;*
- *avoiding roads with too many lights to reduce the frustration of getting stuck all the time.*

The **courtesy/driver mood** sub-theme generated comments about:

- *[a] lack of courtesy, one comparison being with the greater level of courtesy shown by drivers on English roads;*
- *the role of a lack of courtesy in causing accidents;*
- *impatience – depending on how busy the roads were;*
- *other drivers following too closely at intersections.*

This latter comment was interesting in view of the comment above from a different participant about tailgating trucks through red lights! It was also alleged that:

- *[negative] mood was inspired by other drivers not obeying the road rules.*

Literature on driver stress, age and personality has been reviewed [49], while the role of stress and experience in traffic crash involvement has also been addressed [50].

While the **inexperience** sub-theme is explored in greater detail below, some comments related this issue specifically to intersections. Participants reported that:

- *a driver would be more likely to hesitate at intersections when inexperienced;*
- *an inexperienced driver would be less likely to check for cars entering an intersection;*
- *lots of things to pay attention to at intersections when you were inexperienced;*
- *an inexperienced driver would be concentrating so much on what they were supposed to be doing at intersections that they would not notice other cars so much.*

Parental Influences. The three sub-themes that emerged under this theme are illustrated in Figure 2. While parents are the people most likely to be involved in the early stages of a person's driving career, until relatively recently this was an under-researched and under-estimated area [9, 51, 52]. This theme is revisited later in the paper. The **relationship** that a young person has with their parents was acknowledged to be important by several participants, for example that:

- *parents' word is law when you're a kid;*
- *young people pick up their parents' values in respect of driving, although this depended upon the relationship that you have with them – if they tell you not to speed and you have a bad relationship with them, then you'll do the opposite, whereas if you look up to them it's different;*
- *[the] threat of getting a lecture from my parents is worse than the threat of getting fines or worse than worrying about other consequences – "Mum's gonna kill me!"*

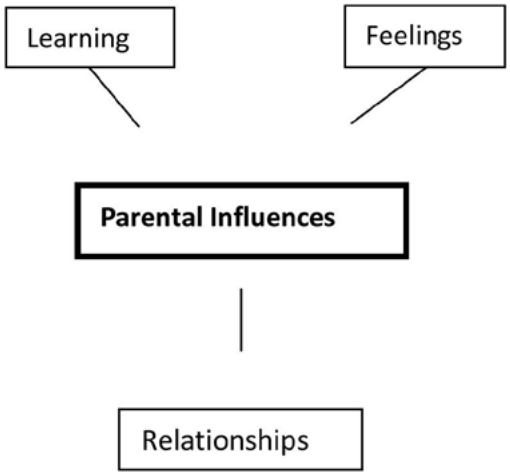

Figure 2. Sub-themes within the parental influences theme

The **feelings** sub-theme was represented by participants' comments acknowledging:

- *feelings of guilt if they went against what their parents had told them;*
- *if parents had faith or trust in you, then you didn't like to disappoint them – " ... my parents trust me on the roads; it's a whole trust thing ... ";*
- *my parents are fearful of me being in a car with inexperienced drivers.*

Perspectives on the **learning from parents** sub-theme were illustrated by several types of comment:

- *it was a lot easier to get your driving licence when your parents learnt to drive, so it is not sensible to follow what they do;*
- *parents don't know the road rules as well as younger people do;*
- *parents telling you that they did lots of bad things in traffic when they were a kid and then teaching you the same behaviour;*
- *[it's] important to learn what not to do from parents;*
- *parental influence is not important but some people recommended following parents' driving;*
- *[desirable to] selectively adopt driving skills from parents;*
- *one parent might be a good role model but not the other, so it made sense to follow the one that was respected;*
- *Mum had the "click-clack front and back" tape in the car for whenever we got in [as children] and this now serves as a permanent reminder to put on the seatbelt every time we get in a car;*
- *" ... my Dad said to me when I first started driving, 'a car is a lethal weapon, treat it like it is one'. Now I'm a lot more careful. It is a lethal weapon. It kills more people than guns."*

Driving Culture. Comments under this theme came mainly from younger participants who were still at school, for example:

- *[school is] a critical period where not everyone has their licence and a small number of people drive a large number of people around with people in the car encouraging stupid behaviour;*
- *you grow out of it once you get a job or everyone else gets a licence;*
- *this is a phase you go through where you test the limits all the time;*
- *you are more likely to do stupid or crazy things with friends in the car when you're young and inexperienced, this being just a stage you go through.*

The inexperience theme is explored further in the section below. The important peer influence aspect of driving culture for this age group was illustrated for example by:

- *backseat drivers – peer pressure telling you to do stupid things on the road;*
- *hoons and risky driving not being self-motivated but a product of peer pressure, and acting "harder" than you really are to impress friends.*

The value for risk emerged by way of the:

- *social hierarchy, such that a young driver climbs the social ladder by doing risky things and having a good car, and that taking risks makes you "harder".*

A "certain mind set" was also held responsible for:

- *knowing that on Saturday night you will go out and drive crazy and take risks.*

On gender differences one opinion was that:

- *males were more confident than females when on "Ls" and "Ps".*

It is known that changes in risky driving behaviours may occur during the early twenties [53]. It has been suggested that by 20-22 years, drivers have passed the age at which the influence of friends as passengers is strongest and are therefore less concerned about what their friends think and do [14]. Engström found that drivers could be under strong pressure from peer passengers, for example to drive faster, but that in most cases they resisted this pressure [14]. Engström interpreted this as self-confidence and responsibility with respect to driving.

Personal Factors

The themes of age, maturity and inexperience are linked. Because age and maturity per se were not introduced as discussion topics, comments within this domain are considered under the inexperience/inattention heading. Comments on age and maturity related to driving were considered above.

Inexperience/inattention. The sub-themes within this theme are illustrated in Figure 3. The **influences on learning to drive** sub-theme had a number of identifiable components. The first was the environment in which a person first learnt to drive, specifically whether this was the city or the country – each of which was perceived as representing a different type of danger level. It was pointed out that:

- *you start to drive much earlier in the country; the police are [allegedly] more lenient, there were fewer things to hit, although there were more potholes to avoid, more train tracks, kangaroos and poorly lit places;*
- *[you can] learn from mistakes when driving in the country, with less risk;*
- *where you learn to drive affects how much you speed, so that learning in a place in which "everyone" speeds will mean that you will always speed – " ... it all comes back to when you learnt to drive and what you saw at the time ... ".*

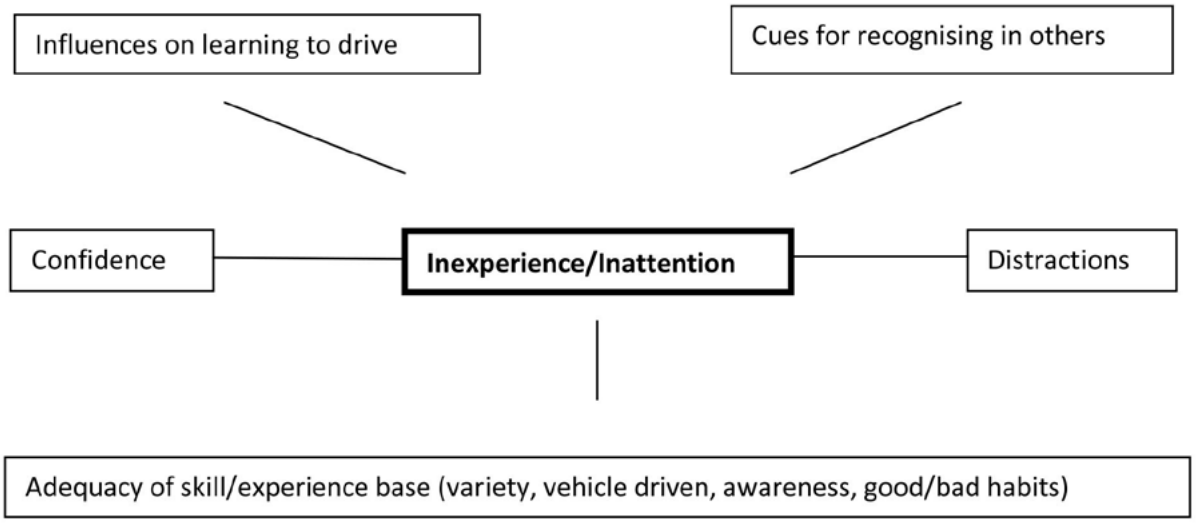

Figure 3. Sub-themes within the inexperience/inattention theme

Another influence upon the learning to drive process was the **presence and role of others** in the vehicle. Thus, if a driver's behaviour was being monitored by others in the vehicle, it was pointed out that:

- *your driving behaviour changes;*
- *[it] depends who is in the car with you as to whether you feel comfortable – [I feel] less confident with kids in the car, being more defensive, watchful of other drivers, and distracted by noises;*
- *you drive more sensibly with other people in the car and take fewer risks.*

The apparent contradiction between this latter comment and the remarks cited above concerning the role of peer pressure upon driving behaviour can be resolved by reference to in-vehicle social facilitation effects [54]. Picking up topics from earlier sections, it was pointed out that:

- *[you] learn from other people's driving – such as parents and friends, and selectively pick skills or traits from them;*
- *parents can interfere with the learning process, particularly if they are critical of your driving and don't let you learn for yourself;*
- *[you should be able to] self-monitor without other people interfering.*

Also finding expression was the notion of gaining a sufficient **quantity of driving experience** – particularly after passing the driving test, one respondent commenting that they were, told:

- *that they could drive after passing the driving test, yet lacked awareness that they were not that good, and continued to do lots of bad things in traffic – quotes included: " ... I've got my licence, but I really don't know how to drive ... "; " ... I've had my licence for a year, but I'm still not aware of everything around me ... ";*
- *a one-hour test is not indicative of how someone really drives;*
- *not enough time is spent in learning to drive before you get on the roads;*
- *it should be obligatory to spend more hours with an instructor.*

Germany was given as an example of where drivers speed more but have fewer accidents because it was claimed that Germany had "more driver education". It was suggested that:

- *["P" provisional or probationary] plates should be standard for all states;*
- *they should be mandatory from the point of view of visibility and giving other drivers the option of "giving you room".*

However, it was also alleged that:

- *you get more hassled by the police when "on Ps".*

A complementary component was the quality of driving instruction available, and some discussion focused upon defensive driving courses, which for those participants who reported having taken one, had:

- *improved my driving and had been "fun";*
- *[defensive driving courses] should be mandatory;*
- *[but] courses had to be paid for;*
- *insurance companies offered courses free to drivers under 25 years of age;*
- *[defensive driving courses] had been offered at school, but not at a convenient time.*

Perceived benefits of defensive driving courses cited included:

- *increases confidence;*
- *learning vehicle control;*
- *gives you skills that you wouldn't have got from ten years of driving;*
- *can minimise damage to other people.*

One view was that after taking such a course the:

- *confidence gained would make a driver speed more.*

An alternative view was that defensive driving courses had a:

- *focus on reducing speeding.*

It was also suggested that while a defensive driving course might:

- *not result in changes to someone's driving style, it prepared them better for emergencies.*

The **adequacy of skill or experience** sub-theme was expressed through a number of components. One of these was the desirability of a variety of driving experiences:

- *experience in all conditions, for example city, country, wet, etc, made for a "good driver";*
- *[desirable to experience] handling a car when out of control in order to find out how much control you have;*
- *desirable to have somewhere to learn your own driving capabilities in a safe environment;*
- *experience of driving different cars;*
- *good to know the differences between driving large and small cars, and where basic features such as wipers and indicators, were located;*
- *[you drive] differently according to the capabilities of the car, pulling in and out of traffic quicker or braking later;*
- *learning to drive and what a car can do in the "back streets" is effective;*

- *important to be familiar with where you are driving;*
- *use the experience to focus upon everything, even in a novel environment.*

As far as type of vehicle driven was concerned, two contrasting views were:

- *learning to drive in an automatic car had the advantage of getting to know the road rules without having to pay attention to changing gears;*
- *everyone should learn to drive a manual car.*

Other suggestions were that an inexperienced driver should:

- *not have a car that was too powerful;*
- *you should have a "bomb" when first driving because you know you're going to crash it!*

The awareness component of this sub-theme took various forms. It was acknowledged that:

- *inexperience was associated with a lesser ability to concentrate on what's going on around you;*
- *you couldn't ever be aware of everything that's happening around you;*
- *[an inexperienced driver] was not as careful a driver;*
- *reaction times are slower;*
- *you are less able to anticipate what other drivers would do;*
- *[while you] may be able to handle the car adequately, inexperience meant that your perception of distance and what is and is not safe, is not good;*
- *an inexperienced driver was conscious of the learning process when they first start, but this type of awareness diminishes over time.*

These comments, particularly the last one, might be interpreted as acknowledging that knowledge-based behaviour transforms through rules-based actions to skill-based performance as driving experience accumulates. More specific representations of the awareness perspective were that:

- *initial learning focused on the immediate environment, and this moves to concentrating on the self and what's going on around you;*
- *not being aware that losing concentration for two seconds is enough to have an accident;*
- *accidents can help you to become more aware;*
- *[I am] more aware in [urban] traffic than when driving on a freeway.*

This latter comment might be interpreted as reflecting the respective levels of attentional capacity required for driving in these different types of environment. A related comment was:

- *being aware of other drivers so that one could steer clear of such categories as elderly drivers, those who were drunk or on drugs, fatigued or driving erratically.*

Perceptions of what constituted a "good" or "skilful" driver included:

- *[there are] "skilful" and "good" drivers, the latter followed the rules, were aware and had experience of different driving conditions;*
- *good driving habits deteriorate three months [after passing the driving test];*
- *[they – possibly young drivers] should be concentrating on driving but instead were changing CDs.*

The value for risk – in this case in the form of risk compensation (behavioural adaptation), was that while:

- *more experience made you a better driver, this was translated into speeding and drink-driving with greater safety.*

Driving **confidence** was variously expressed and was generally considered to be important to good driving, for example that a driver with:

- *less confidence was more likely to hesitate.*

Various individual differences were considered to be important. For example, in respect of age, reports included:

- *[I was] not confident enough to get my learner's licence when I was first old enough – [I] preferred to wait until I was older and had the confidence to drive;*
- *some people are just more confident personality types and will take risks as a result and do stupid things;*
- *[drivers of a] certain age, perhaps in their early 20s, when you didn't care what you did on the roads, nothing affects them and they think they are "bullet-proof".*

A number of older respondents reflected on their approach to driving:

- *"I thought I was confident when I started but then I realised I wasn't as good a driver as I thought I was when I had my first accident – that was the only thing that stopped me driving like an idiot";*
- *inexperienced drivers are over-confident;*
- *"if I was me three years ago, I would have slapped myself across the face";*
- *[after a personal accident experience] " … I was much more conscious of driving safely … it's so dangerous; there's so much risk around when you're driving … [describes a personal experience] … makes you realise just how bad it is".*

Comments on elderly drivers included:

- *older drivers tend to be over-confident;*
- *keep away from them and give them more room.*

Experiences that were considered to enhance confidence included:

- *driving for a longer period;*
- *driving by yourself – this being the only time that you're completely in control;*
- *personal maturity and confidence make one a better driver;*
- *it takes three months [after passing the driving test] until one was experienced and six months to become confident as a driver;*
- *you can switch your emotions when [you are] more experienced.*

Awareness of the dangers of driving were variously represented, including impersonal attributions, through others' experiences, via emotionally charged reflection, as attempts to impose personal control over driving, or as a component of personal development and maturity, as illustrated by these verbatim quotes:

- *"a car is a metal coffin";*
- *"she lost her licence three times – she'll never learn";*
- *"the scary thing about driving is that anyone can drive – it's a matter of life and death";*
- *"you tend to push the boundaries a bit in controlling your car so you know what you can do – it helps you to avoid accidents";*
- *"it's the way you reflect on your driving – your responsibilities and self-worth".*

Distractions that could affect attention level that were mentioned included:

- *having kids in the car;*
- *changing CDs;*
- *playing music at a high volume;*
- *not knowing where you are going;*
- *checking out guys/girls at the roadside;*
- *other people looking at you while [you are] driving;*
- *mood [could be either highly positive or very negative];*
- *talking on a mobile phone.*

One respondent reported that:

- *because of recently introduced mobile phone laws, I will use the text messaging function instead of calling, which takes greater concentration.*

Cues used to recognise drivers who were not paying attention included:

- *talking on a mobile phone;*
- *speeding or weaving in and out of traffic;*
- *speeding up and slowing down;*
- *the "look on their face".*

Particular categories of inattentive drivers mentioned were:

- *hoons;*
- *hesitant drivers;*
- *elderly drivers;*
- *abusive ["road rage"] drivers.*

Differences of opinion existed as to which states had the worst drivers, for example it was alleged that:

- *Victorians think that Queensland has the worst drivers.*

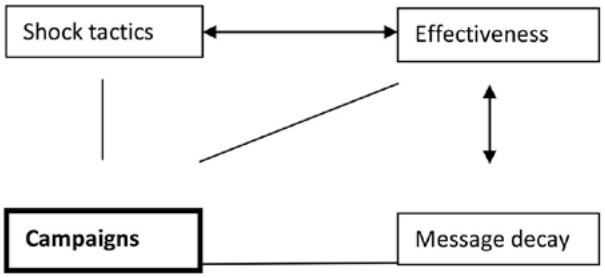

Figure 4. Sub-themes within the campaigns theme

Campaigns

Sub-themes within the Campaigns theme are illustrated in Figure 4. Views on the use of **shock tactics** as a campaign strategy included:

- *shock is good;*
- *ads of pictures of real people that are dead would work;*
- *[some] ads were too shocking, so that people switch off, reject the message and don't want to see really gruesome stuff;*
- *[some ads could be] painful for people who have had something similar happen to someone close to them;*
- *[there is a] limit to shock tactics;*
- *TV ad showing children hitting the roof of a bus was too shocking – it shouldn't be shown;*
- *shock works for the first couple of times but then loses its validity;*
- *same principles might apply, new ads are required.*

A majority of comments on this theme related to campaign **effectiveness**. The four components of any communication are: sender, message content, medium, and target audience. A few comments referred to message senders:

- *who delivers the message is important;*
- *[messages from] accident victims or their family members would hit home more, especially for high school kids;*
- *police don't have the respect, authority or credibility of accident victims;*
- *if people who are recognised from the community are involved, this would have more impact;*

- *Homer Simpson, who was "always driving drunk" and doing bad things on the road – should be countered by messages, perhaps from, parents or from the show, that his actions were bad.*

Message content was referred to in various ways, for example:

- *some ads that aren't that explicit have more impact;*
- *serious ads that you can't make fun of were more effective;*
- *invoking a sense of loss through ads seemed to be more effective, for example, loss of [licence] points, loss of family members – e.g., ads showing a family left behind, or of something really important to you, for example, the model who was burnt in a car accident and lost her beauty forever;*
- *"ads can make you aware, but it's not until it happens to someone close to you ... ";*
- *need for more information about what can happen at different speeds, such as hitting a pothole can send you into the trees;*
- *it is not necessary for other people to be involved in accidents;*
- *emphasise that things such as poor car maintenance, incorrect tyre pressure and faulty brakes can cause accidents;*
- *people should know about their cars and their capabilities.*

Campaigns, such as those concerned with drink-driving, were remembered from a time when participants were younger. It was claimed that these were effective in respect of stopping their parents from drink-driving, but not from speeding.

Some comments incorporated both medium and message:

- *a billboard with a smashed car on it;*
- *radio ads with real statistics of accidents and deaths in your area on that day would be a great deterrent;*
- *not too long;*
- *the "reality factor" is important;*
- *"graphic ads" make you think more and send shivers down your spine;*
- *in-school campaigns were very effective, particularly when they were very graphic and smashed cars were involved.*

Suggestions for targets included:

- *school kids should be targeted, one specifying 14-15 year-olds just before they learn to drive so that they have time for the awareness of the dangers of driving to set in;*
- *campaigns are more effective when you're younger because you believe the ad, but once you start to drive, you realise that ads are computer generated or that the people in the cars portrayed are dummies, so that it is less horrific and less real.*

Suggestions for the forms that campaigns could take included:

- *"if the target is safe driving, they should be targeting for safety reasons instead of fines";*
- *"stop wasting money on ads and put more police on the streets".*

The topic of driver safety campaigns is further comprehensively explored by Redshaw [42].

The problem of **message decay** was also revealed by some comments:

- *[a] campaign had impact for a while but not for long enough to carry over when driving;*
- *you just don't remember ads when you're in the car;*
- *"I can recall ads in detail but it doesn't affect my driving – I never think about them in the car";*
- *ads were not on often enough – they used to be seen "all the time".*

Conclusions

In addition to participants' comments under the thematic headings, the study revealed a number of sub-texts, which are considered in this final section. While a number of the comments revealed a level of naivety, possibly reflecting poor driving habits or perceptions (e.g., "running" close to red lights), others could be considered as reasonably representative of research findings, for example, the perceived importance of both quantity and variety of driving experience in the early stages of solo driving, and the desirability of driving practice in relatively forgiving environments throughout the learning to drive stages. Also recognised by participants were the potential for distractions to serve as antecedents to crashes or incidents, and possible adverse impacts arising from peer passenger pressure. Other evidence for the developmental aspect of the study was the awareness shown by at least some participants of the possible effects of inexperience, for example at intersections. Thus, part of the overall picture from this study is one of a work in progress, that is, of young drivers in a transition phase, and showing a reasonable degree of awareness of the transitory nature of this phase of their driving career. Further evidence for the developmental aspect of the study are the occasional contradictory or conflicting comments, which were presented as data arising from the group discussions. Further work is required to unravel these contradictory comments.

Further research and applications

To extend the utility of its main findings, topics and issues identified through this study could be converted into statements for a psychometric instrument to derive quantitative data from a large sample of young novice drivers. Worthwhile comparisons might be with parents' views on the same issues. In the meantime policy makers might use findings from this study to inform decision making on road safety campaigns, particularly those targeted at young novice drivers at different stages of their driving careers. A possible framework for planning such campaigns is shown in Table 2. Illustrative issues arising from this study that have the potential to be developed into road safety campaigns include those outlined in the paragraphs below.

Evident from some of the comments from this study was that participants correctly perceived that learning to drive was a developmental process, for example progressing from a relatively high to successively lower levels of risk. As has been pointed out, task components of the learning to drive process do not advance at the same rate [33, 55, 56], suggesting that different approaches are required to target each phase of the learning to drive process (see Table 2). These approaches would need to be consistent with a jurisdiction's GDL program, for example pre-driving teens, learner driver under instruction, the critical immediate 6-month post-test period, and the maturing novice driver.

In particular there is considerable scope for enhancing the messages that are part of the continuing education of young novice drivers after they have passed the driving test as they enter their life-long solo driving career. For example, such campaigns might incorporate a "think risk" approach that encourages (particularly young novice) drivers to carry out risk assessments as part of their cognitive driving skills repertoire. To some extent findings from this study have challenged the traditional view that fear/threat/shock-oriented messages as media campaign components should always be accompanied by an explanation of how the negative outcome could be avoided. It seems that young drivers might find their own ways of coping with such messages. However, further research is required to determine how such messages are processed, how explicit such messages should be for maximum effectiveness, and the role of problem solving by drivers confronted with such messages. As part of a campaign to educate young drivers to perceive their driving as one component of their developing maturity and increasing control over their environment, free "calming" music CDs might be made available to young drivers. Research has identified a possible approach for such an intervention [57], which should be evaluated.

Several recent studies have highlighted the importance of parental driving in shaping young drivers' behaviours [58-62]. Parents of young novice drivers and pre-drivers could be targeted to emphasise the strong influence of parental driving behaviours, particularly those that are illegal (e.g., speeding, drink-driving) upon their sons'/daughters' driving performance. The undesirability of transmitting bad driving habits to their children might be emphasised in such campaigns. Other studies have found that feedback from parents via in-vehicle technology can lead to improved teens' driving behaviour [63, 64]. Interestingly, the legality or illegality of various driving behaviours was not referred to in the group discussions, perhaps indicating that while the GDL system provided the jurisdictional framework for the young novice drivers' perceptions, it might not have figured prominently in their everyday driving experiences and influencing factors, which seemed to reside much more in personal traits, social orientation and the general driving environment.

Table 2. Early driving developmental stages and associated prime influences

Developmental stage	Prime influences on driving
Pre-driving experiences	Parents, School, Peers, Media
Early driving experiences (pre-test)	Parents, Driving instructor
Driving test (involves psychological change)	Driving instructor, Examiner
Immediate post-test driving experiences	Self, Peers, Parents
Driving maturity	Self, Parents, Other role models

A finding from the study was the potential for mutual learning between young novice drivers and their parents. For example, the comment that young drivers are better acquainted than their parents with the current road rules may not be an idle boast given the rapidity with which road rules can change. More critically, it could provide the basis for a more equal learning status between parents and their novice driver children, whereby the novice driver helps the parents to gain greater familiarity with the current road rules, while the parents help the novice driver to acquire greater driving experience. Analogous with other health campaigns (e.g., relating to smoking or diet), young people could usefully be encouraged to take responsibility for educating their parents about the current road rules in exchange for acquiring quality driving experience, while both parties could be engaged in adopting improved driving habits.

Another issue from the discussions concerned relationships with other drivers, particularly of the negative variety. These varied from the highly prejudicial categorising of older drivers along with drink/drug drivers and fatigued drivers, through over-reacting to other drivers' perceived shortcomings, to impatience at other drivers' behaviours, for example older drivers at traffic lights. Extrapolating from these findings, this might suggest that many young drivers remain relatively unaware of the range and extent of risks encountered on the road as well as lacking the knowledge or insight that, as a group, they pose the greatest risk to the safety of other road users, rather than the older drivers who they seem to think they should avoid.

A more generic issue from these findings is that of driving courtesy on Australian roads, which was compared unfavourably with that existing in at least one other jurisdiction. These findings could serve as a potential indicator for implementing either national or local courtesy campaigns, for example encouraging drivers to acknowledge courtesies by others, and to accept that it is desirable to gesture an apology to another road user when appropriate. Such campaigns would need to involve all drivers and not just young novice drivers, and could be part of a more inclusive attempt to change this aspect of Australian driving culture. Examples include a "celebrity" backed local media campaign that was attempted in Sydney (*Bring back 'The Wave'*) a few years ago [65] and a high-profile road safety organisation that has produced a brief driving courtesy guide [66]. However, these ad hoc approaches are unlikely to have much impact and their effectiveness has almost certainly not been evaluated.

To address the acknowledged attributional biases that have been documented as generic to many drivers self-perceptions, de-biasing techniques could be used selectively where they have been shown to be effective, for example to moderate driving over-confidence and the driver's illusion of control [67, 68]. Further research is also required in finding optimum ways of using peer pressure positively, for example emphasising peer responsibility in helping a mate who is a novice driver to improve their driving skill and awareness [8, 69, 70].

It would be useful for further research to assess the extent to which young novice drivers are exposed to courses that are represented as "defensive driving courses", and more critically to evaluate their effects upon driving performance, ideally over an extended period. As a general principle an essential aspect of all driving interventions is that they should be evaluated, as recommended by a number of authorities [71-73].

Study limitations

While the data were relatively rich in terms of content and the insights that they provided, the small number of participants was a limitation of this study. This could be balanced by a more extensive quantitative study based on the findings, as described above. In addition, because participants self-selected for this study their representativeness in comparison with the driving population of this age group is unknown. For example, it is possible that these volunteering participants had a particular motivation to engage in group discussions on driving. One factor suggesting that this might have been the case was that in most of the groups at least one person knew a friend who had been killed in a traffic incident. How this might have affected the findings cannot be known.

Acknowledgements

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Do older rural drivers self-regulate their driving? The effects of increased driving importance and limited alternative transportation

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Abstract

This study examined whether older rural drivers are restricted in the ability to self-regulate their driving by the importance they attribute to driving and reduced access to alternative transportation. A sample of 170 drivers (aged ≥ 75) from rural and urban areas of South Australia completed a questionnaire on driving importance, alternative means of transportation and driving self-regulation. Rural participants viewed their driving as more important than urban participants did and believed that they had less public transport available to them, used public transport less and had fewer other alternative means of transportation (e.g., taxi) available. However, they did not differ on indices of self-regulation (avoidance of difficult driving situations, reductions in amount of driving and willingness to stop driving). Thus, older rural drivers' self-regulation is not restricted by increased driving importance or limited alternative transportation. However, limited alternative transportation is still viewed as a disadvantage to mobility.

Keywords

Driving behaviour, Older drivers, Rural, Self-regulation, Transportation services, Urban

Introduction

Older drivers (generally defined as 65 years and older) have an elevated crash rate per kilometre driven (1, 2) and have an increased risk of being seriously or fatally injured if they are involved in a crash (2-6). However, it is important that older drivers do not cease driving prematurely because the mobility that driving provides is important to maintaining their independence and an active lifestyle (7-9). Moreover, a loss of mobility can lead to depression (4, 10, 11), a reduced network of friends (12) and an increased risk of mortality in the ensuing 3-year period (13). Recent research has therefore emphasised the importance of older adults maintaining their driving mobility for as long as possible, provided it is safe for them to do so (14-16).

One way in which older adults can both prolong their driving mobility and potentially reduce their crash risk is by self-regulating their driving behaviour (17, 18). Self-regulation involves individuals assessing any deterioration in their driving, cognitive and functional abilities, as well as their health, and then adjusting their driving behaviour either through an overall reduction in the amount of driving they do or by avoiding specific driving situations that an individual finds difficult (e.g. driving at night). This then reduces a driver's exposure to difficult conditions and, consequently, their crash and injury risk, while maintaining some degree of mobility. Self-regulation may also include the decision to stop driving when an individual believes that they are no longer safe on the road.

Ideally, greater self-regulation should be practised by those older drivers who are most at risk of being involved in a crash and of sustaining a serious or fatal injury in the event of a crash, with those drivers who are at a lower risk of these outcomes adopting fewer restrictions on their driving. Research by Thompson et al. (6) has revealed that drivers who are aged over 75 years and who live in rural areas of South Australia are more than twice as likely as their urban counterparts to be seriously or fatally injured when involved in a crash, suggesting that this is one group for whom self-regulation may be a useful strategy to avoid crash involvement and resulting injury. However, there are a number of reasons why older rural residents may find it more difficult to practice self-regulation than their urban counterparts. Firstly, rural residents are more likely to need to drive in order to access important community services (e.g., doctor, supermarket) and to maintain their community involvement. Consequently, they may be less willing to reduce or stop driving, as it would have a greater effect on their independence and lifestyle than would be the case for urban residents who have shorter distances to travel in order to access community services.

Secondly, self-regulation may be problematic in rural areas because access to public transport (19) and the availability of friends and family to provide transportation (20) is often more limited. Other transport options, such as community buses and taxis are also less likely to be available, further increasing the importance of driving for older rural adults.

The intention of the present study was to determine whether older rural drivers are restricted in their ability to self-regulate their driving by the importance they attribute to driving and the availability of alternative transportation in rural areas. To date, there has not been any research which has examined this issue but it is important to understand because if they are restricted in their ability to self-regulate then this reduces the level of control that they have over their safety on the road. Furthermore, it is important to understand the possible causes so that they can potentially be addressed.

Method

Participants

Participants were recruited through an appeal to people who attended the South Australian Royal Automobile Association's (RAA) "Years Ahead" community presentations. The RAA is an independent automobile club in SA, which has approximately 560,000 members and provides a range of services, including road safety information. The "Years Ahead" presentations are given at churches and senior citizens' clubs in both rural and urban areas of South Australia, and provide information on road safety that is specifically relevant to older adults. One of the researchers (JPT) attended these presentations, spoke about the research, and invited individuals to participate.

To be eligible, participants had to be aged 75 years or older. This age range was chosen to define an "older driver" based on a parallel study (6), which found that drivers 75 years and older were significantly more likely to be seriously or fatally injured when involved in a crash than drivers below this age. In addition, participants were required to hold a valid driver's licence for a car, drive regularly (i.e. more than once in the previous month), and be fluent in English (in order to complete the questionnaires).

A total of 170 eligible participants (71 females, 99 males) completed the study questionnaire. Of these, 64 (38%; 27 females, 37 males) resided in rural areas and 106 (62%; 44 females, 62 males) lived in urban areas of South Australia. Urban areas of South Australia were defined as the capital city, Adelaide, and a surrounding 5-20 kilometre region, while rural areas were defined as those outside of the Adelaide area but within a two hour drive from the centre of Adelaide (a radius of approximately 100 kilometres). The age of the participants ranged from 75 to 94, with a mean of 79.9 years (SD = 4.0). The mean age of the rural participants was 79.1 years (SD = 3.8), while for the urban participants it was 80.5 years (SD = 4.0).

The sample was compared to data on licensed drivers aged 75 and over in South Australia for the year 2009 to determine whether it was representative of the older driver population. The data were obtained from the South Australian Department of Planning, Transport and Infrastructure for the year 2009 and for individuals with a class C driver's licence (able to drive non-commercial motor vehicles not exceeding 4,500kg). There were 60,602 licensed drivers aged 75 and over in South Australia in 2009, 28% from rural areas and 72% from urban areas. There were 83% of the population in the 75-84 age group and 17% in the 85 and over group, compared to 86% and 14% for the sample. Therefore, the age composition of the sample appears to approximate that of the population.

Measure

Participants completed a 'Driving Patterns Questionnaire' (DPQ). The DPQ was developed and trialled specifically for use in the present research as no other appropriate measures existed. It was divided into four parts (background information, driving importance, alternative means of transportation and driving self-regulation). The first part sought background information on the participants, including the postcode for their home residence (four digit code, used to determine whether they lived in a rural or urban area); age (in years) and gender; highest level of education that they had completed (six options: some secondary or high school, completed high school, trade/technical college, certificate or diploma, university degree, postgraduate degree); and whether they held a valid driver's licence for a car (yes or no) and had driven in the last month.

The *Driving Importance* section included six items asking participants to report how strongly they agreed with statements indicating that driving is important for various reasons, such as for independence (for a full list see Table 1 in the Results section). Each item was rated on a four-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). Responses to these items were aggregated to provide an overall measure of driving importance, with scores potentially ranging from 6 (not important) to 24 (extremely important).

The *Alternative Means of Transportation* section asked participants whether convenient public transportation was available (yes or no) to get them to four common destinations (doctor, supermarket, friends and family, and social activities). The "yes" responses were summed for each participant to provide an overall 'availability of public transportation' score, ranging from 0 to 4. Next, participants indicated how often they used public transportation (never, rarely, sometimes, often). A four-point scale was applied to these responses (0 = never, 3 = often). They also had to indicate which of seven other alternative means of transportation, such as taxis (for a full list see Table 3 in the Results section) they believed would be available to them

if they had to stop driving. A total 'available alternative means of transportation' score was then calculated for each participant by tallying the options that were marked, ranging from 0 (no alternative means) to an unlimited number because "other" (i.e., any number of alternative means that they believed would be available to them) was included.

The final section, *Driving Self-Regulation*, asked the participants to rate their level of avoidance during the past year of nine difficult driving situations, such as driving at night (for a full list see Table 4 in the Results section), using a five-point scale (1 = never avoid, 2 = rarely avoid, 3 = sometimes avoid, 4 = often avoid, 5 = always avoid). The sum of the ratings for these items provided an overall driving avoidance score, ranging from 9 (never avoid any driving situations) to 45 (always avoid all difficult driving situations). These questions, as well as the scale and overall score, have been widely used in previous research on older drivers to measure self-regulation (18, 21-23). Indeed, this was the only part of the DPQ that was not developed specifically for the present research. It was chosen so that the results could be compared to other research. Next, participants had to specify how much they had reduced the amount that they drove in the past year, choosing from four options (not at all, somewhat, reasonably, greatly). A four-point scale was applied to these options (0 = not at all to 3 = greatly). Finally, they had to specify the degree to which they agreed with statements indicating that they would stop driving given certain situations, such as their doctor recommended it (for a full list see Table 5 in the Results section), using a four-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). The aggregate of the responses to these five items provided an overall measure of participants' willingness to stop driving, with scores potentially ranging from 5 (not willing) to 20 (completely willing).

Procedure and statistical analyses

The attendees at the "Years Ahead" presentations who agreed to participate were provided with a copy of the questionnaire, an information sheet about the research, two copies of a consent form and a reply paid envelope. The questionnaire was completed by the participant at home and mailed back to the investigator, along with one of the signed consent forms (the other was kept by the participant). Ethics approval for the research was granted by the Human Research Ethics Subcommittee in the School of Psychology at the University of Adelaide. Prior to completing the questionnaire, the participants were reminded that they could withdraw from the study at any stage and assured that their responses would remain confidential.

The data obtained from the questionnaires were used to compare the rural and urban participants to determine whether there were any differences between them in terms of (a) the importance of driving, (b) the public transportation available to them, (c) their usage of public transportation, (d) the other alternative means of transportation available to them, and (e) their driving self-regulation (in terms of avoidance of difficult driving situations, reductions in amount of driving in the past year and willingness to stop driving given reasons to do so). Independent samples *t*-tests were used for these between-participants comparisons, except for the comparisons of their usage of public transportation and the amount that they had reduced their driving in the past year as these were measured on ordinal scales and, therefore, chi-square tests were used. Cohen's *d* effect sizes were calculated for the t-tests to evaluate the magnitude of any group differences, with $d = .2, .5$ and $.8$ equating to small, medium and large effect sizes, respectively (24).

They were also compared to determine whether they differed in terms of (f) the effect that driving importance, availability of public transportation, usage of public transportation and availability of other alternative means of transportation had on the degree to which they self-regulate their driving. For this comparison, the measures of driving importance, availability of convenient public transportation, usage of public transportation, and availability of other alternative means of transportation were used as independent variables in three regression models. Linear regression was used in models 1 and 2, with the overall measure of avoidance of difficult driving situations as the dependent variable in model 1 and the overall measure of willingness to stop driving in model 2. In model 3 the dependent variable was the measure of driving reduction in the past year. However, this measure used an ordinal four-point scale, which limited the variance. Therefore, logistic regression was used with the data analysed in binary terms, namely whether the participants did (i.e., a response of "somewhat", "reasonably" or "greatly") or did not reduce their driving (i.e., response "not at all"). The three models were examined separately for rural and urban participants (total of six analyses) so that the effects of the independent variables on the three dependent variables could be determined for each group independently and then compared. The age of the participants was also entered as an independent variable in the models because older age has been shown to be associated with increased self-regulation (25-29) and could therefore mediate the effects of the other independent variables on the three dependent variables.

For all analyses, an alpha level of .05 was used to determine statistical significance. Also, in order to identify significant differences of either direction between the rural and urban groups, all of the analyses were two-tailed.

Results

Demographic comparison of rural and urban drivers

The age, education and gender composition of the rural and urban groups were initially compared to assess whether there were any demographic differences between the two groups. These analyses revealed that there were no significant differences between the two groups in terms of their level of education, $t(163) = .58$, $p = .561$, or gender, $\chi^2(1, N = 170) = .01$, $p = .931$. While the urban participants had a significantly higher mean age (80.5, $SD = 4.0$) than the rural participants (79.1, $SD = 3.8$), $t(168) = 2.26$; $p = .025$, the difference of only one year equates to a small effect size (Cohen's $d = .36$) and is unlikely to be of practical significance in terms of driving behaviour.

Driving importance

The mean overall driving importance scores for the rural (20.4, $SD = 3.0$) and urban participants (19.5, $SD = 2.8$) were both high, given that scores could range from 6 to 24. The difference between these means was small ($d = .34$) but significant, $t(153) = 2.07$; $p = .040$, suggesting that driving is more important to meeting the day-to-day needs of older rural drivers. Responses to the individual items are summarised in Table 1, where it can be seen that the greatest differences between rural and urban participants were for the three items relating to the availability of other sources of transportation (public transport, friends, family), with more rural participants strongly agreeing with statements that these sources were not available to them and more urban participants disagreeing with these statements.

Table 1. Perceived importance of driving for six reasons: rural and urban responses

Reason		Level of Agreement (%)			
		Strongly disagree	Disagree	Agree	Strongly agree
For accessing necessary services (e.g., doctor)	Rural	1.7	5.2	37.9	55.2
	Urban	1.0	2.1	39.2	57.7
Because public transportation is unavailable	Rural	3.4	3.4	34.5	58.6
	Urban	6.2	30.9	40.2	22.7
Because friends are unavailable to provide transportation	Rural	3.4	8.6	43.1	44.8
	Urban	7.2	21.6	42.3	28.9
Because family are unavailable to provide transportation	Rural	5.2	12.1	44.8	37.9
	Urban	6.2	22.7	46.4	24.7
For independence	Rural	0.0	0.0	43.1	56.9
	Urban	0.0	0.0	25.8	74.2
For community involvement/ active lifestyle	Rural	0.0	5.2	43.1	51.7
	Urban	1.0	1.0	39.2	58.8

Note: six rural and nine urban participants did not give valid responses to these items. Therefore, $n = 155$ for these analyses, 58 rural and 97 urban.

Alternative means of transportation

In terms of the overall availability of public transportation, rural participants had a mean score (0.7, *SD* = 1.3), which indicates low levels of availability (possible range: 0 - 4), compared to that of urban participants (1.2, *SD* = 1.3). The difference between these means was low-medium in size ($d = .44$) and significant, $t(161) = 2.74$; $p = .007$, indicating that older adults from rural areas have moderately less public transportation available to them than those from urban areas. This was also reflected in the responses to the individual items in the measure (see Table 2), with particularly large differences in access to transport that would enable residents to get to supermarkets.

In terms of the amount that the rural participants used public transportation, 46.0% reported "never" using it, 36.5% reported "rarely", 14.3% reported "sometimes", and 3.2% reported "often". For the urban participants, 2.9% reported "never" using it, 33.3% reported "rarely", 56.2% reported "sometimes", and 7.6% reported "often". Therefore, more rural than urban participants responded with "never" and "rarely", while more urban participants responded with "sometimes" and "often". Moreover, there was a significant association between rural/urban residence and use of public transportation, $\chi^2(3, n = 168) = 57.04$, $p < .001$, with the Cramer's V statistic of .58 indicating that 34% of the variation in usage by older adults was explained by whether they lived in a rural or urban area. Thus, older rural drivers appear to use public transportation less than their urban counterparts.

Rural participants reported that they had an average of 2.4 (*SD* = 1.0) alternative means of transportation available to them if they needed to stop driving, which was significantly fewer than the average number available to urban participants (mean = 3.2, *SD* = 1.3), $t(167) = 4.10$; $p < .001$, $d = .67$. Older rural drivers therefore have fewer alternative means of transportation available to them. This was reflected in the responses regarding the availability of each individual alternative means of transportation (see Table 3), where, for most of the options, fewer rural participants reported that they were available than urban participants. The biggest difference was for public transportation, which supports the finding in the previous section that rural participants had less public transportation available to them. Unexpectedly, however, more rural participants indicated that their friends and their partner were available.

Table 2. Percentages of rural and urban participants who indicated that convenient public transportation was available to get them to four common destinations

Destination		%
Doctor	Rural	14.5
	Urban	29.7
Supermarket	Rural	17.7
	Urban	51.5
Friends and family	Rural	16.1
	Urban	15.8
Social activities	Rural	16.1
	Urban	24.8

Note: two rural and five urban participants did not give valid responses to these items. Therefore, $n = 163$ for these analyses, 62 rural and 101 urban.

Table 3. Alternative means of transportation: percentages of participants (rural and urban) who indicated that the relevant option was available to them

Alternative means of transportation		%
Community transportation	Rural	31.3
	Urban	46.7
Public transportation	Rural	34.4
	Urban	88.6
Friends could drive me	Rural	37.5
	Urban	35.2
Family could drive me	Rural	35.9
	Urban	50.5
Husband/wife/partner could drive me	Rural	54.7
	Urban	37.1
Taxi	Rural	34.4
	Urban	48.6
Other[a]	Rural	9.4
	Urban	9.5

Note: one urban participant did not give a valid response to this item. Therefore, $n = 169$ for these analyses, 64 rural and 105 urban.
[a] "other" responses included using a gopher, walking, and riding a bicycle.

Driving self-regulation

When the extent to which rural and urban drivers were using self-regulation to limit their exposure to risky driving situations was compared, it was found that rural participants had an overall mean of 17.6 ($SD = 7.4$) on the measure of avoidance of difficult situations, while the urban participants had a mean of 15.8 ($SD = 6.7$). Both rural and urban scores were low (possible range: 9 - 45) and the difference between the means was small ($d = .25$) and not significant, $t(161) = 1.55$; $p = .123$; indicating that neither group actively self-regulates their driving. Indeed, the levels of avoidance reported for each of the difficult situations individually (see Table 4) were similar for rural and urban participants.

Table 4. Avoidance of individual difficult driving situations: rural and urban responses

Driving situation		Level of Avoidance (%)				
		Never	Rarely	Sometimes	Often	Always
In the rain	Rural	57.1	20.6	19.0	3.2	0.0
	Urban	65.0	20.0	13.0	2.0	0.0
When alone	Rural	82.5	7.9	7.9	1.6	0.0
	Urban	91.0	6.0	3.0	0.0	0.0
Parallel parking	Rural	34.9	20.6	19.0	15.9	9.5
	Urban	47.0	21.0	19.0	6.0	7.0
Right turns	Rural	54.0	28.6	14.3	0.0	3.2
	Urban	60.0	23.0	13.0	3.0	1.0
Freeways	Rural	68.3	17.5	4.8	7.9	1.6
	Urban	73.0	12.0	8.0	6.0	1.0
High traffic roads	Rural	55.6	15.9	15.9	11.1	1.6
	Urban	61.0	19.0	16.0	4.0	0.0
Peak hour	Rural	42.9	12.7	20.6	11.1	12.7
	Urban	45.0	27.0	21.0	7.0	0.0
At night	Rural	38.1	22.2	23.8	6.3	9.5
	Urban	53.0	15.0	9.0	9.0	14.0
At night in the rain	Rural	46.0	12.7	23.8	3.2	14.3
	Urban	49.0	16.0	10.0	5.0	20.0

Note: one rural and six urban participants did not give valid responses to these items. Therefore, n = 163 for these analyses, 63 rural and 100 urban.

In terms of the amount that the rural participants had reduced their driving in the past year, 57.1% reported "not at all", 20.6% reported "somewhat", 14.3% reported "reasonably", and 7.9% reported "greatly". For the urban participants, 50.9% reported "not at all", 34.0% reported "somewhat", 10.4% reported "reasonably", and 4.7% reported "greatly". Thus, the responses to this question were similar for rural and urban participants. Indeed, a 2 x 4 χ^2 showed no significant association between rural/urban residence and any reduction in driving, $\chi^2(3, n = 169) = 3.91$, $p = .272$, with a small Cramer's V statistic of .27.

In terms of overall willingness to stop driving, the mean scores for both rural (16.8, *SD* = 1.8) and urban participants (16.4, *SD* = 2.4) were high (possible range: 5 - 20). The difference between the means was small (*d* = .21) and not significant, $t(151) = 1.23$; $p = .222$, suggesting that older rural and urban drivers do not differ in their willingness to stop driving. Indeed, the responses to the specific reasons to stop driving were similar for rural and urban participants (see Table 5).

Prediction of levels of self-regulation of driving

The first regression model, which examined the effects of the independent variables (driving importance, availability of convenient public transportation, usage of public transportation, and availability of other alternative means of transportation) on avoidance of difficult driving situations, was not statistically significant for the rural, $F(5, 51) = .73$; $p = .603$, or urban participants, $F(5, 83) = 1.52$; $p = .194$, with the independent variables only accounting for -.03% and .03% of the variance in avoidance of difficult driving situations, respectively (adjusted R^2). It can be seen from Table 6 that age had a significant effect on the self-regulation of urban but not for rural drivers, while none of the other independent variables had any significant effects.

The second regression model, which examined the effects of the independent variables on willingness to stop driving, was also not significant for the rural, $F(5, 48) = .60$; $p = .704$, or urban participants, $F(5, 81) = 1.81$; $p = .121$, with the independent variables only accounting for -.04% and .05% of the variance in willingness to stop driving

Table 5. Willingness to stop driving for five reasons: rural and urban responses

Reason to stop driving		Level of Agreement (%)			
		Strongly disagree	Disagree	Agree	Strongly agree
Doctor recommendation	Rural	0.0	3.4	56.9	39.7
	Urban	1.1	3.2	55.8	40.0
Friends and family	Rural	3.4	15.5	56.9	24.1
recommendation	Urban	5.3	20.0	56.8	17.9
Not confident enough	Rural	0.0	1.7	56.9	41.4
	Urban	1.1	4.2	50.5	44.2
Health and driving	Rural	0.0	0.0	39.7	60.3
abilities not at safe level	Urban	0.0	0.0	45.3	54.7
Caused a serious	Rural	0.0	10.3	36.2	53.4
accident	Urban	1.1	14.7	46.3	37.9

Note: six rural and eleven urban participants did not give valid responses to these items. Therefore, *n* = 153 for these analyses, 58 rural and 95 urban.

(adjusted R^2). However, in Table 6 it can be seen that the effect of the variable 'availability of other alternative means of transportation', while not significant for rural drivers, was significant for urban drivers (p = .016). For every additional means of transportation available to an older urban driver, their willingness to stop driving increased by 0.49 of a unit on the scale of 5 to 20. This suggests that availability of other alternative means of transportation has an effect on willingness to stop driving for older urban drivers but not for older rural drivers.

Finally, the third regression model, which examined the effects of the independent variables on whether an older driver would reduce their driving or not, was also not statistically significant for the rural, $\chi^2(5, n = 57) = 1.93$; p = .859, or urban participants, $\chi^2(5, n = 90) = 6.02$; p = .304. The independent variables only accounted for .03% and .07% of the variance in driving reduction (Cox & Snell R^2). None of the independent variables significantly predicted whether an older driver would or would not reduce their driving (see Table 6).

Table 6. Results of linear regression to predict avoidance of difficult driving situations (model 1) and willingness to stop driving (model 2), and logistic regression to predict driving reduction in the past year (model 3), for rural and urban participants separately

		Independent Variable	B[a]	Beta[b]	*t*	*p*-Value
Model 1	**Rural**	Driving importance	0.39	0.16	1.12	0.268
		Avail. of public transportation	0.81	0.14	1.00	0.323
		Usage of public transportation	0.43	0.05	0.35	0.727
		Avail. of alternative transportation	0.85	0.12	0.84	0.403
		Age	0.01	<0.01	0.02	0.986
	Urban	Driving importance	-0.04	-0.02	-0.14	0.890
		Avail. of public transportation	-0.26	-0.05	-0.40	0.693
		Usage of public transportation	1.00	0.10	0.89	0.374
		Avail. of alternative transportation	0.58	0.11	1.01	0.315
		Age	0.48	0.27	2.48	0.015*
Model 2	**Rural**	Driving importance	0.11	0.18	1.19	0.242
		Avail. of public transportation	-0.09	-0.06	-0.40	0.689
		Usage of public transportation	0.04	0.02	0.13	0.898
		Avail. of alternative transportation	0.20	0.12	0.78	0.439
		Age	0.03	0.06	0.42	0.679
	Urban	Driving importance	-0.07	-0.08	-0.70	0.488
		Avail. of public transportation	0.07	0.03	0.29	0.771
		Usage of public transportation	0.30	0.09	0.78	0.440
		Avail. of alternative transportation	0.49	0.27	2.47	0.016*
		Age	0.07	0.12	1.09	0.280
			B[a]	**Odds**	**Wald**	***p*-Value**

				Ratio		
Model 3	**Rural**	Driving importance	<0.01	1.00	<0.01	0.973
		Avail. of public transportation	-0.30	0.74	1.32	0.252
		Usage of public transportation	-0.19	0.83	0.28	0.598
		Avail. of alternative transportation	-0.01	0.99	<0.01	0.984
		Age	-0.01	0.99	0.02	0.886
	Urban	Driving importance	-0.04	0.97	0.15	0.696
		Avail. of public transportation	-0.11	0.90	0.33	0.568
		Usage of public transportation	0.50	1.65	2.08	0.149
		Avail. of alternative transportation	0.10	1.11	0.36	0.547
		Age	0.11	1.12	3.42	0.065

[a] the results for B are unstandardised coefficients.

[b] the results for Beta are standardised coefficients.

* $p < .05$.

Discussion

This study demonstrated that driving is perceived to be more important to meeting the day-to-day needs of older rural drivers than it is to older urban drivers. It also found that older rural drivers report that public transportation and other alternative means of transportation are not as readily available to them. Indeed, the main reasons for driving being more important to older rural drivers were the limited availability of public transportation, and friends and family who could assist with their transport needs.

A comparison of the importance that is placed on driving by older drivers from rural and urban areas has not previously been undertaken and, therefore, this is the first time that the greater importance of driving to older rural drivers has been demonstrated. Similar findings have been found previously regarding the availability of alternative means of transportation. Corcoran et al. (19) found that public transportation was limited for people aged over 65 years living in a rural region of Victoria, Australia. In addition, a survey of older adults from rural areas in the USA by Johnson (20) indicated that their friends and family often lived a long distance away, making assistance with transportation difficult. Interestingly, in the current study more rural participants suggested that their friends, as well as their partner, were available to provide transportation. The availability of community transport and taxis for rural and urban older persons has not been compared previously. More rural participants indicated that neither were readily available.

The limited availability of public transportation is likely to be responsible for the finding that rural participants were using it less frequently. For the urban participants, public transportation options were greater, as was their usage of it, suggesting that older adults increase their usage of public transportation when it is available.

Based on the importance of driving for older rural drivers and the limited availability of alternative transportation, it might be expected that they would be less able to avoid, reduce or stop driving. However, older rural drivers did not differ from older urban drivers in their avoidance of difficult driving situations, the amount that they had reduced their driving in the past year, or their willingness to stop driving. This suggests that they are able to self-regulate their driving to a similar degree as older urban drivers and that they are not restricted in doing so by the greater importance they place on driving or the limited alternative transportation available to them. Indeed, based on the multivariate regression analyses, it appears that driving importance, the availability of public transportation, usage of public transportation and the availability of other alternative means of transportation do not affect the degree to which older drivers from rural and urban areas self-regulate. However, the availability of other alternative means of transportation did affect the willingness of urban drivers to stop driving. This is consistent with Choi, Adams and Kahana's (30) finding that older adults are more likely to stop driving if they have transport support from friends and neighbours, as well as other organisations, such as churches.

Study limitations and future directions

There were several limitations to this study. Firstly, self-report measures can be unreliable as the participants may accidently report inaccurate information. They may also attempt to portray a socially desirable account of themselves through the information they provide. For example, they may report that they are more willing to stop driving than would perhaps actually be the case. This may have affected the results.

The samples of rural and urban participants were small for the purposes of the regression analysis, which had multiple independent variables, thereby limiting statistical power. Also, there are other factors which were not assessed in this study that may affect the degree to which older drivers are able to avoid, reduce or stop driving. These include the distance from the participants' residences to necessary services, as well as to their friends and family, and whether recommendations to avoid, reduce or stop driving had been made to the participants by their friends, family or doctor. These variables and their effect on self-regulation could be examined in future research.

The rural participants were recruited from rural areas in South Australia that were relatively close to the capital city (i.e., within approximately two hours driving distance). For practical reasons, it was not possible to recruit older drivers from more remote areas of the state. Driving is likely to be even more important to persons from such areas and alternative transportation is likely to be less available, making it even harder for persons living in more remote rural areas to avoid, reduce or stop driving. If individuals from remote areas had participated, it may have affected the findings relating to self-regulation. Those living in remote areas should be recruited in future research.

The majority of both rural and urban participants indicated that they "never" or "rarely" avoided each of the difficult driving situations, reducing the variability in the scores for this measure. Other studies have also found low levels of avoidance using the same measure (18, 21, 22, 31). While the low scores may truly suggest that older drivers do not generally avoid these situations, they may also result from limitations in the measure.

On the basis of low scores on the measure of avoidance of difficult driving situations, a study by Sullivan et al. (31), which was published after the design and data collection stages of the present study, recommended that the items in the measure should be reconsidered as they may not be the only situations which older drivers avoid. The participants in the Sullivan et al. study were required to report which situations they view as safe and unsafe. Although this process did identify the situations that are currently in the measure as unsafe, thereby validating their inclusion, a range of other situations were also identified as unsafe. Sullivan et al. suggested that these additional unsafe situations could be included in a modified scale. It is likely that the present research would have benefited from a modified scale, particularly as some of the situations in the current scale (e.g., driving in peak hour) may not apply to older rural drivers. Furthermore, some of the current situations (e.g. parallel parking) can be avoided in everyday driving without having to use alternative transportation instead of driving and are unlikely to be affected by perceptions of driving importance, so these items may need to be reconsidered for future studies looking at driving importance and alternative transportation. Of the items suggested by Sullivan et al., those that would have been valuable for inclusion in the present study include 'long distance driving', 'driving in foggy conditions', 'driving when other drivers might endanger me' and 'driving when I think other drivers will put me at risk'.

The low rates of self regulation may also reflect that the sample was recruited through senior citizens' clubs and churches. Such people, and particularly those willing to volunteer for the study, may be more active, healthy and community-minded than typical adults in the same age group. In addition, they had to travel from their homes to the meeting location, suggesting that they are amongst the more mobile older residents. Past research has shown that the degree to which older drivers self-regulate is associated with their health, medical conditions and certain functional and cognitive abilities (22, 25, 32, 33). The participants in the present study may not have needed to self-regulate as much because they were healthy and highly functioning; variables that were not measured in the current study. Future research would benefit from assessment of the functional and cognitive abilities of the sample, as well as by recruiting participants with a broad range of health and cognitive and functional abilities, including those with impairments in these abilities. It would also benefit from recruiting people who have reduced mobility (i.e., not just those who are mobile enough to attend community meetings). This may provide a better indication of whether rural older drivers are able to self-regulate appropriately. Despite this, however, the sample was found to be representative of the older driver population in South Australia in terms of age composition.

Finally, the scores for the measure of changes to the amount of driving in the past year were also low, with around half of the participants reporting that they had not reduced their driving during this period. This may also have been due to a healthy and highly functioning sample who did not need to reduce their driving. It may also reflect limitations with the measure. Specifically, people were required to provide ratings using a scale that only included four nominal responses (i.e., not at all, somewhat, reasonably, greatly), which provided limited detail regarding the exact amount of

change. In addition, retrospective estimation over the past year is prone to error. Future research would benefit from a more detailed measure.

Conclusion

Overall, rural and urban older drivers were not found to differ in the degree to which they self-regulate their driving. Given that older rural drivers are more than twice as likely as their urban counterparts to be seriously or fatally injured in a crash (6), there may be a greater need for these drivers to adjust their driving behaviour in order to maintain their safety. It may be beneficial, therefore, to encourage older rural drivers to increase their self-regulation. Particular emphasis could be given to assisting them to adjust their driving in such a way that it has the least detrimental effect on their mobility, while providing the best safety outcomes.

Despite finding that the availability of public transport and other alternative means of transportation did not affect the degree to which older drivers self-regulate, it is important to provide a transportation system that adequately meets the needs of older adults and supports drivers in their decision to adjust, reduce or stop driving. This study suggests that older rural adults are disadvantaged in terms of public transportation and other alternatives. A solution would be to increase public transportation services (e.g. buses, trains) or subsidise private services (e.g. taxis) in rural areas. While it may be possible to increase public transport options in large rural communities, the cost may be prohibitive in smaller communities. Alternatively, local councils, as well as independent groups, such as churches and senior citizens clubs, could be encouraged to increase their provision of community-run transportation services (e.g., community buses that transport people to organised destinations or volunteer driver systems). These services not only reduce the reliance on the personal automobile but are also convenient and encourage community participation.

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Validation of an in-vehicle monitoring device for measuring driving exposure and deceleration events

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Abstract

Background: In-vehicle monitoring is being used increasingly in research into driver behaviour. Advances in Global Positioning Systems (GPS), data management and telecommunications have made this a viable tool to objectively measure driving exposure and also speed patterns.

Aim: The purpose of this study was to validate an in-vehicle monitoring device in the laboratory where speed and deceleration can be controlled and in field experiments.

Methods: The device consists of a C4D Data Recorder with External GPS Receiver. The hardware includes an internal 3D accelerometer, tachograph, real-time clock, internal battery (1300mA) and 128MB of flash memory. The in-vehicle data logger transmits GPS location via the mobile telecommunications network. The device was evaluated in a laboratory and field tested to investigate the context for deceleration events. We developed algorithms to process summary data for driving routes and deceleration incidents.

Results and Discussion: Protocols were established for use of the device in the field and programs developed to extract events. The application of this technology is an innovative approach in driver behaviour and vehicle safety research.

Keywords

In-Vehicle Monitoring, Impact Crash Sled, Near-Miss

Introduction

Shortcomings in the quality and type of data available from traditional epidemiological crash databases have led to a variety of alternative methods for assessing driver safety. Naturalistic driving, or in-vehicle monitoring, is being used increasingly in research into driver behaviour and safety. This type of driving assessment has been proven to increase the validity of results due to data capture in real-time and the actual driving context [Dingus, Neale et al. 2006].

In vehicle monitoring will be used to measure the primary outcomes of driving exposure and safety in a randomised, controlled study evaluating a safe driving program for older drivers being conducted in North West Sydney. By linking an in-vehicle monitoring system with global position satellite (GPS) capabilities, driving exposure can be measured. Safety may also be evaluated using the monitoring system by measuring the number of incidents a person may be involved in, by monitoring instances of rapid vehicle deceleration. Greaves et al. recently demonstrated the successful use of in vehicle monitoring to capture driver behaviour and exposure data [Greaves, Fifer et al. 2010].

A crash is defined as any contact with an object, either moving or fixed, at any speed, in which kinetic energy is measurably transferred or dissipated. This can include contact with other vehicles, roadside barriers, objects on or off the roadway, pedestrians, cyclists, or animals. A near-miss has been defined as any circumstance which requires a rapid, evasive manoeuvre by the subject vehicle to avoid a crash. A rapid, evasive manoeuvre is defined as steering, braking, accelerating, or any combination of control inputs that approaches the limits of the vehicle's capabilities. Such manoeuvres will generally be associated with a rapid change in deceleration and have been used as outcomes of interest in driving research [Hanowski 2000; Smith, Najm et al. 2002; Dingus, Klauer et al. 2006; Dingus, Neale et al. 2006; Keay, Munoz et al. 2012]. However, using rapid decelerations as a metric for near-miss events can be problematic especially when the threshold for identifying near-misses is unknown.

This study used laboratory and field experiments to validate the in-vehicle monitoring system's accuracy over time as well as verifying algorithms used to define crash and rapid deceleration events. This paper reports the findings of these experiments in the context of their future application in a large-scale, naturalistic driving study.

Methods

In-Vehicle Monitoring Device

The equipment consists of a C4D Data Recorder with connected External GPS Receiver. The GPS is incorporated into the monitoring system and is used to determine the location of the vehicle at any position on the earth through navigational satellites [Porter and Whitton 2002]. The hardware includes an internal 3D accelerometer (capacity 2000 milli-g; resolution18milli-g), tachograph, real-time clock, internal battery (1300mA) and 128MB of flash memory. The device, otherwise known of as the 'black box', is small and portable and easy to install into the participants vehicles. The black box is shown in Figure 1.

Figure 1: In-vehicle monitoring device (11cm x 8.5cm x 3cm)

The devices were hardwired to the vehicle in a concealed and unobtrusive location (under the driver or passenger seat or on another suitable location) to ensure fixed orientation to align the axis of the accelerometer with the direction of travel. Positive values recorded by the accelerometer therefore indicated deceleration of the vehicle. The in-vehicle data logger transmitted the deceleration 32 times per second and GPS location second-by-second to a central server via the mobile telecommunications network as shown in Figure 2. The second-by-second GPS location was then pre-processed by integration with a custom database of the road network to map driving routes in relation to speed zones (SmartCar Technology Pty Ltd).

Experiments

Two laboratory (Lab 1 and Lab 2) experiments and one field experiment were conducted.

Lab 1: The first laboratory experiment aimed to validate the device calibration and determine whether the accelerometer experiences any substantial drift with time. This was achieved by investigating the behaviour of the

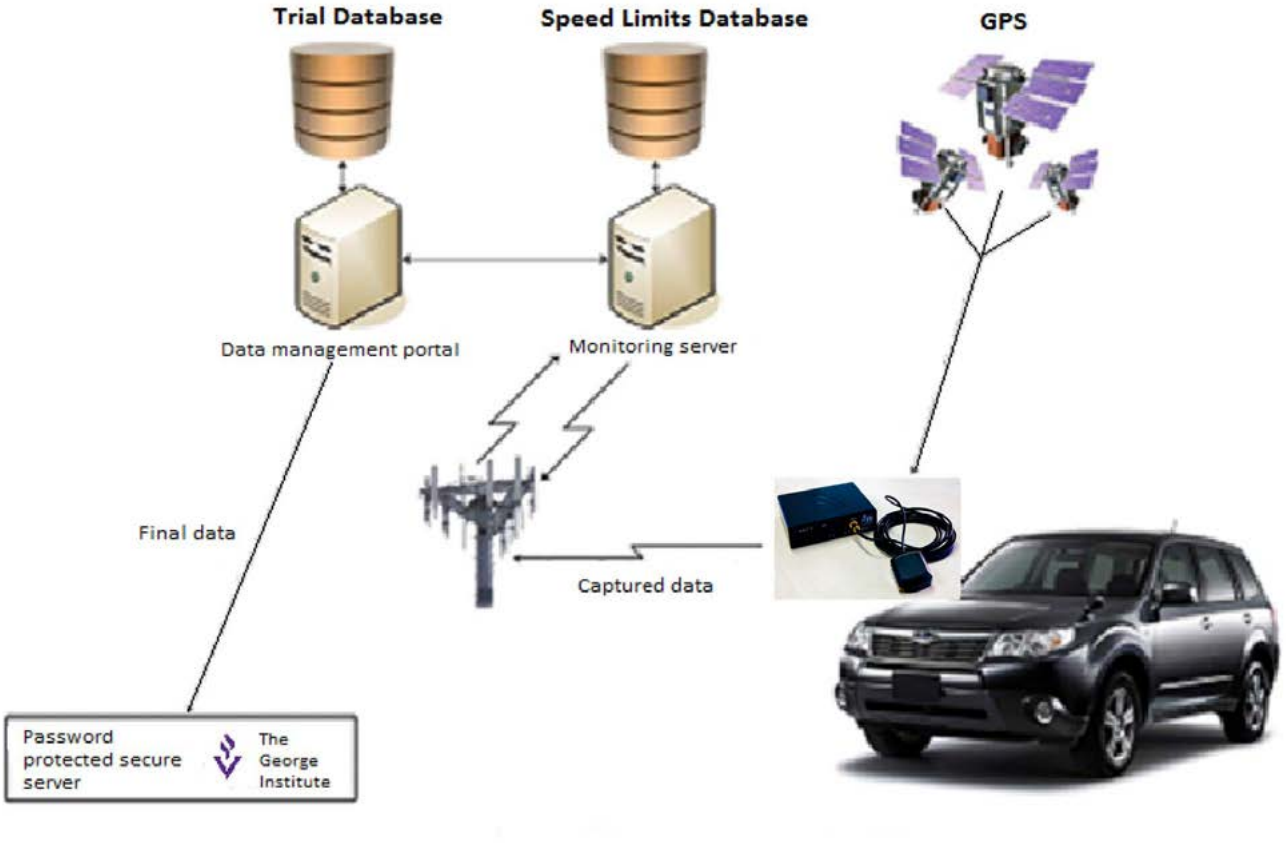

Figure 2: Data transmission via the telecommunications network
(adapted from [Greaves, Fifer et al. 2010])

accelerometer when the device remained stationary. In this experiment, one black box was powered, placed on a bench and left to run for two days while data were being transmitted. A second black box was placed inside a car and left to run for approximately ten minutes so that the difference between the two locations could be examined.

The data were examined by plotting deceleration data against time. From this, drift, signal noise and device calibration could be estimated.

Lab 2: The second laboratory experiment was a low-speed impact crash test. This study was undertaken at Neuroscience Research Australia (NeuRA) using a low-speed impact crash test sled with the capability of reaching speeds of up to 30km/h. The principal objectives of this study were to investigate the device's accuracy and sensitivity to deceleration events. The specific aims were to:

1. Model different types of acute deceleration events which may be experienced by the participants and investigate drift and change in calibration after a series of impacts.
2. Review the data output in terms of magnitude of deceleration measured and duration of events from the black box device in relation to the testing matrix and measured deceleration.

Two accelerometers and a black box with power supply were directly mounted onto the impact crash sled (Figure 3). The impact sled was then subjected to a number of different deceleration events covering a range of impact velocities and decelerations by manipulating the distance, weight and pressure in the air spring. A test matrix depicting the impact velocities and decelerations used is shown in Table 1.

Data from the accelerometers were captured using an Applied Measurement data acquisition system at 10kHz, and processed using MATLAB 7.9.0 (The Mathworks, Natick, MA, USA), using custom software routines conforming to the Society of Automotive Engineers (SAE) requirements specified in SAE J211 [SAE 2007]. Data were processed to obtain and plot peak deceleration and change in velocity (Table 1).

Table 1: Test matrix for laboratory experiment 2

Test	A1 peak deceleration (g)	A2 peak deceleration (g)	Change v (m/s)
1	9.79	9.63	6.08
2	9.71	9.63	6.07
3	7.77	7.90	4.60
4	7.867	7.87	4.96
5	14.72	14.61	8.14
6	14.89	14.86	8.16
7	10.08	10.02	6.04
8	10.00	9.98	6.07
9	8.29	8.41	4.92
10	8.39	8.08	4.91
11	17.85	17.73	8.85
12	17.98	17.78	8.85
13	19.01	18.84	8.84
14	18.99	19.13	8.84

A1=accelerometer 1 fixed to the sled, A2=the second fixed accelerometer, change v=sled change in velocity during the impact

Data from the black box were captured using the internal C4D Data Recorder and External receiver, and processed using custom MATLAB algorithms.

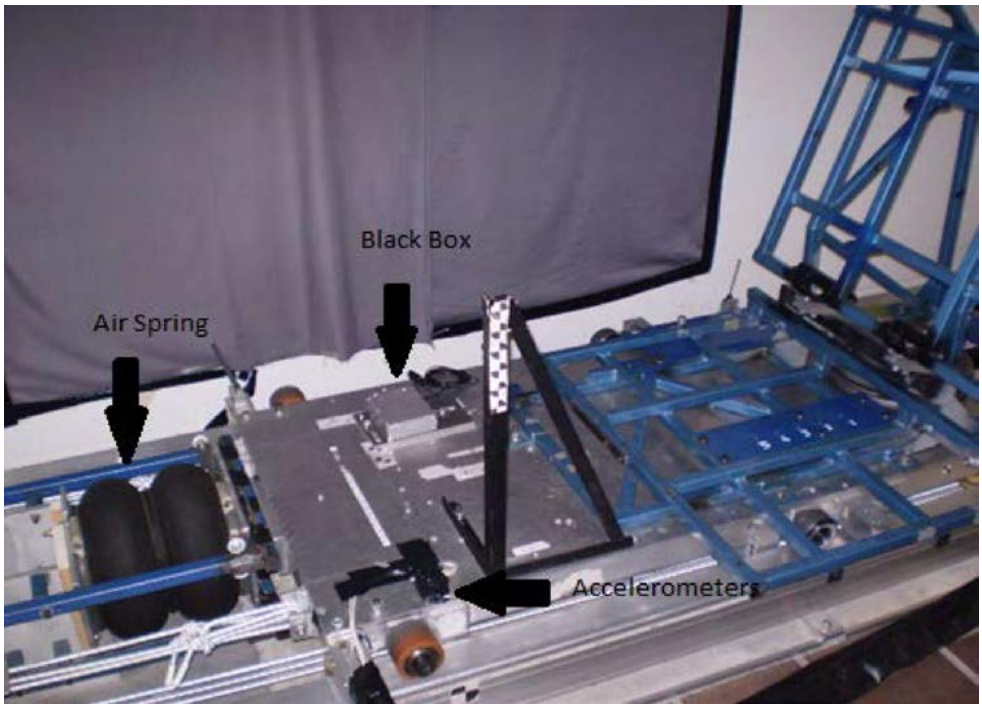

Figure 3: Low-speed impact crash test sled

Field study: In the field study data were collected in routine driving during the pilot phase of the larger study. The aim of this field study was to test the custom Matlab program during regular driving to field test the threshold for identification of rapid deceleration events. A black box was installed in the vehicles of three older driver participants and data were continuously captured (whenever the engine was running) via the internal C4D Data Recorder and External GPS Receiver over a one week period of driving. The study participants had signed a record of informed consent and the study protocol was approved by the University of Sydney Human Research Ethics Committee.

Deceleration data were processed using three versions of the custom designed Matlab program. This program included a 3Hz Butterworth filter to filter out the signal noise which was discovered during Lab study 1 (Lab 1). Additionally, any events which occurred within three seconds of each other were not included. This criterion of three seconds was chosen as the recommended trailing distance is three seconds and multiple decelerations detected within this gap could be considered as part of the same event. Each version of the program contained modified algorithms with adjusted rapid deceleration event thresholds set at 500milli-g, 550milli-g and 600milli-g. These thresholds were chosen based on thresholds used in literature [Dingus, Klauer et al. 2006, Keay, Munoz et al. 2012]. The number of events identified for each threshold was then computed. These events were plotted on the maps of the driving routes for each participant's weekly driving. Lateral deceleration data were not investigated.

Results

Lab 1: The results from the stationary black box demonstrated no drift in the data captured over the two-day continuous period. However, an offset and fluctuation, or noise, was observed in the signal. The offset indicated that the data were not at zero when the device was resting and should have been at zero. Figure 4 illustrates a sample of the data obtained over the two day testing period and shows that the offset was approximately 54milli-gfrom zero with fluctuations of ±40milli-g.

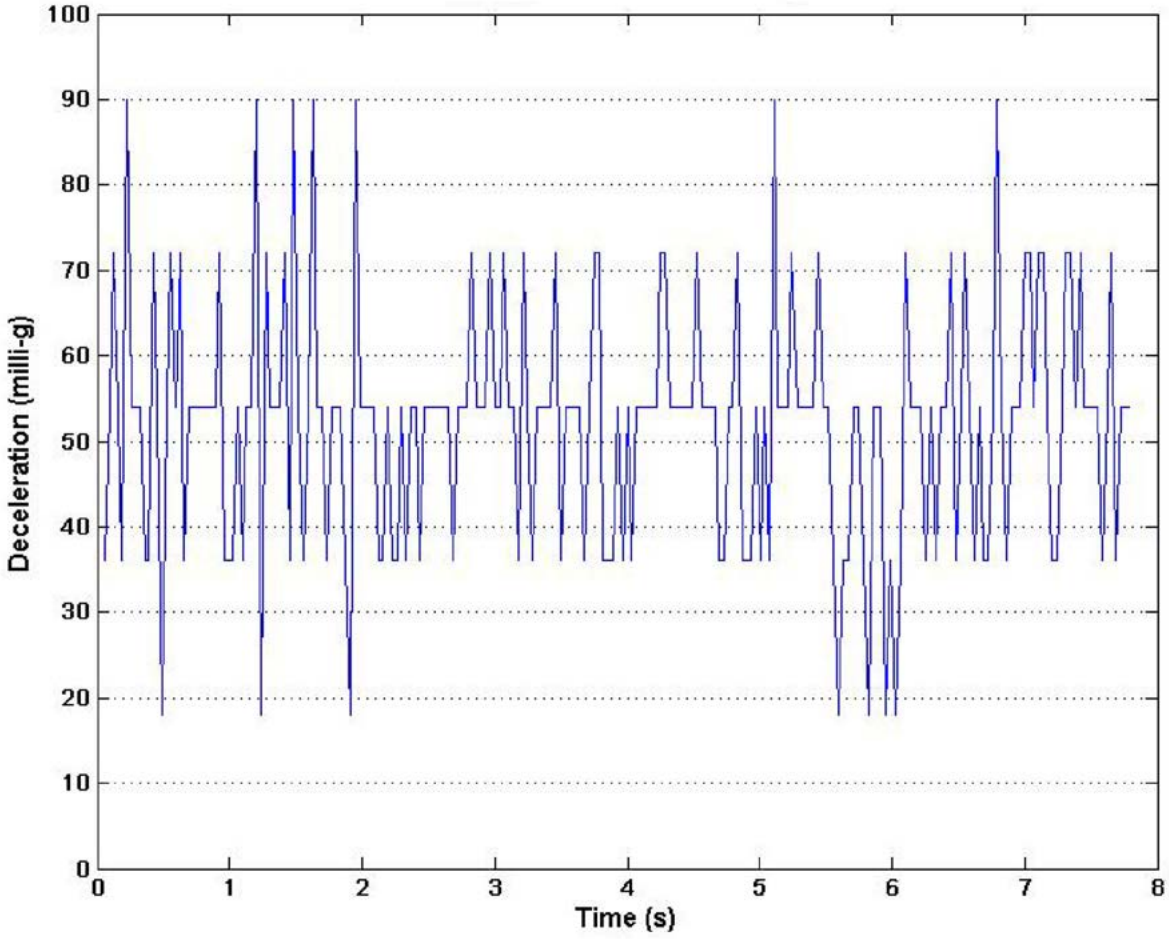

Figure 4: Sample of the data recorded by a stationary device over 2 days

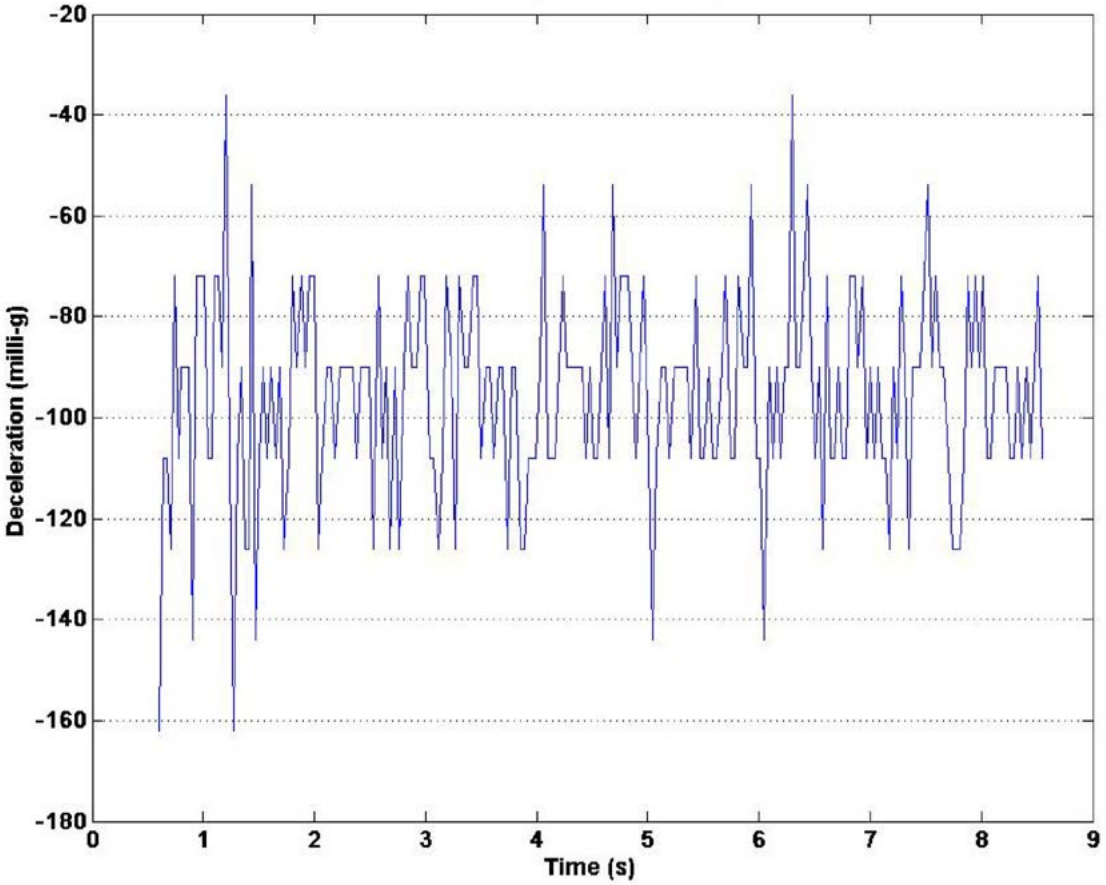

Figure 5: Sample of the data recorded by a device in a stationary car for 10 minutes

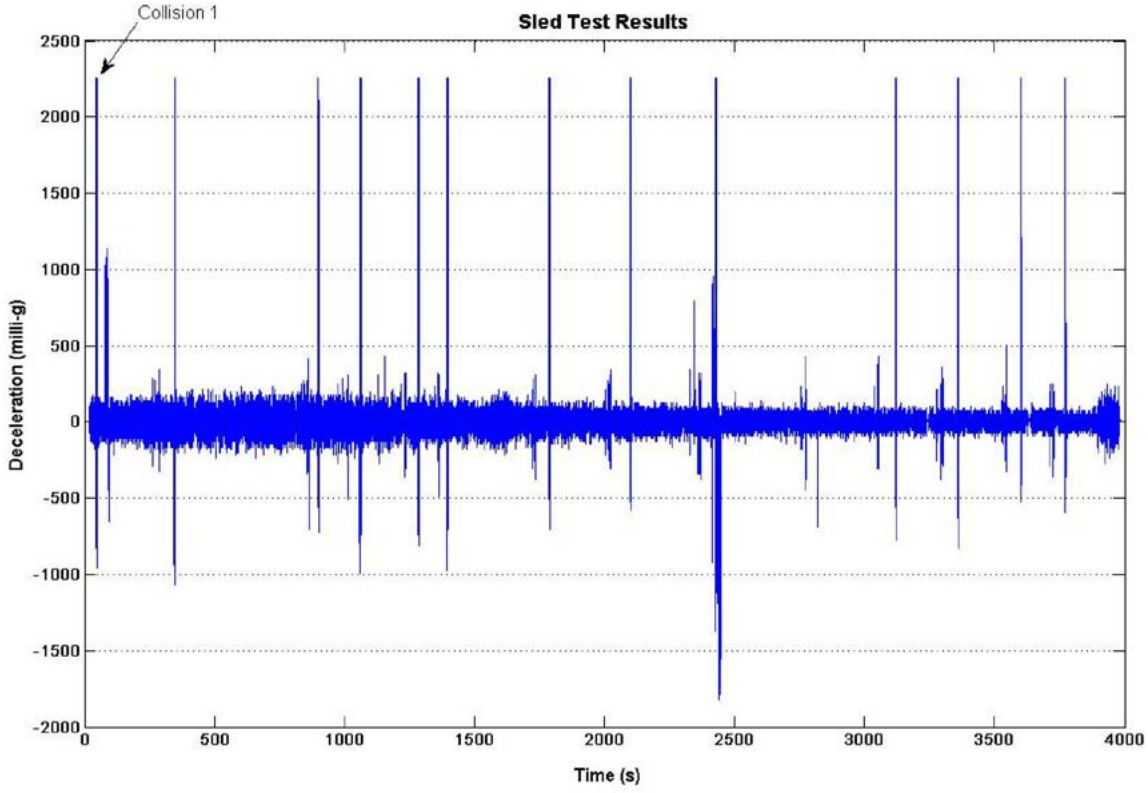

Figure 6: X-deceleration against time for the entire testing period of the sled test

The data from the stationary black box were also compared to a second device fitted in a stationary car with the engine running for 10 minutes. Figure 5 shows a sample of the accelerometer data which were captured during the 10 minute running time of the device fitted in the stationary vehicle. In this device the offset was approximately -90 milli-g. The fluctuations generally remained within the ±40 milli-g range; however, there were some greater fluctuations observed +60milli-g and -72 milli-g.

Lab 2: The data collected from the black box during the entire sled testing period is shown in Figure 6. No drift was experienced during the testing. The black box accurately recorded each impact event, however the device did not measure values above 2250milli-g. Investigation with the device's manufacturer revealed the range of the internal accelerometer had been set to a maximum of 2000milli-g, with a small buffer. As the deceleration of the impact events were 8000milli-g (Table 1) and above, the peak deceleration could not be measured. The lower peaks seen in Figure 6 are due to the movement of the sled prior to the impact.

Field Study: Data were obtained from black boxes installed in the vehicles of three participants over a week long period. A summary of these data and the number of rapid deceleration events identified with each variation of Matlab algorithm is shown in Table 2. The weekly extent of driving varied between participants from 22 to 103 kilometres and the maximum distance travelled from home varied between 4-16 kilometres. Only participant 2 travelled extensively during night hours with 48% of kilometres driven at night and while they did not travel far from home (6 kilometres) they drove over 100 km.

It is possible to investigate the context of rapid deceleration events by their location, time of day, speeds before and after the event and the duration of deceleration. Two events are shown as examples in Figure 7, panel A on a straight four-lane road and panel B at the approach to an intersection controlled by traffic lights.

Discussion

Care is required in constructing algorithms to measure deceleration using the black boxes due to data offsets and fluctuations. Accuracy of the deceleration data collected from the black boxes is critical to using this in-vehicle monitoring system to identify rapid deceleration events. Offsets, such as those observed here, would invalidate results and lead to the identification of many false events and/or allow some important events to be missed. In the first laboratory experiment, an offset was found. This offset varied depending on the particular device. To address this, modifications to the protocol for the use of the in-vehicle monitoring devices in the older drivers study have been made. Each device will be tested prior to instalment into the participants' cars by leaving the device powered in a stationary location for five minutes. From these data, a correction factor for the offset for each device can be determined and subtracted so that the data will be balanced to zero offset. Furthermore, fluctuations were accounted for by using a 3Hz Butterworth filter in the following Lab studies.

Table 2: Summary of results obtained from the field study

	Participant 1	Participant 2	Participant 3
Age (years)	81	84	83
Gender	Male	Male	Female
Total trips	21	31	9
Longest trip distance (km)	18.19	10.27	6.53
Longest trip duration (min)	25.16	33.10	13.02
Furthest radius from home (km)	15.5	5.97	3.76
Total distance driven day (km)	62.04	53.49	21.7
Total distance driven night (km)	0.04	49.82	0
Number of events ≥500milli-g	67	28	26
Number of events ≥550milli-g	50	22	15
Number of events ≥600milli-g	40	15	8

km= kilometres, min=minutes

Figure 7: Events mapped using Google maps. Panel A: Event on a straight line road. Panel B: Event at an approach to an intersection controlled by traffic lights.

The threshold chosen is important for the naturalistic driving study in order to minimise the number of false positive events. Our pilot data suggests that using thresholds of 500 milli-g in the forward direction, up to 70 rapid deceleration events per participant might be identified over a one-week period. This value is close to that used in the 100 car study [Dingus, Klauer et al. 2006] which used a cut off of 450 milli-g. Another naturalistic driving study evaluated deceleration events over 350 milli-g [Keay, Munoz et al. 2012].Our approach has detected a large number of rapid deceleration events within the one-week period. Investigation into the duration of deceleration, the speed before and after the event and the location of the event will further characterise these events. The subset of events which are over 1000 milli-g may represent more significant events such as coming to a rapid stop or low speed collisions, as found in our laboratory experiments. By comparing the timing of the event with location data and information obtained through survey of the participants more detail about exactly what occurred during each event will be gathered. Based on the results here we can expect to detect multiple events each week from the participants.

A lateral threshold was not included in this investigation as it was deemed to involve complex mechanisms and events that may not easily be determined from a simple threshold level. Further investigations are needed to determine whether a suitable threshold for lateral decelerations can be used or whether multiple criteria need to be set to determine whether a rapid deceleration event occurs in the lateral direction, such as swerving to avoid a collision.

Data from the crash testing also confirmed that low speed crashes could be successfully measured by this device as sharp peaks with short duration. It is a limitation that crash tests could not be conducted at a deceleration less than 8000 milli-g; however that was not possible with the sled test used. Therefore our laboratory tests could not confirm the accuracy of peak deceleration readings. However, the primary aim of the device, in the context in which it is to be used, is to measure the 'presence of an event' rather than to measure the severity of an event. The results from these studies provide confidence that with further confirmation from the field data, the devices will provide useful outcome data.

From the limited data collected from the three participants of the pilot study, it is clear that the devices will also provide a valid measure of any change in driving characteristics such as kilometres driven, distance driven, routes used and night driving. This is an important outcome in the evaluation of the safe driving intervention being trialled in the larger naturalistic driving study. These data will greatly inform the debate about older driver safety and has clear advantages over relying on self-report. [McGwin, Owsley et al. 1998]

With careful attention to algorithms used, the black boxes will provide invaluable exposure data for this unique sub-population of drivers, and this driving data will also provide a valid outcome measure in the planned randomised, controlled study evaluating a safe driving program for older drivers.

Conclusion

In-vehicle monitoring is becoming a widely-used tool for measuring naturalistic driving behaviour. This paper has demonstrated the validity of using an in-vehicle monitoring system for measuring outcomes, including crash or rapid deceleration events and driving exposure. This preliminary work has demonstrated the validity of the system as a tool to measure changes in driving exposure and speed patterns. It has also demonstrated that care is needed in using this technology to measure outcomes based on deceleration

events. In particular this work has demonstrated that several factors need to be accounted for when using these devices, such as the accuracy of calibration, the signal noise, and the validity of the events being recorded. Future studies using in-vehicle monitoring devices should ensure that these factors have been tested prior to use for accurate and valid results. With all these factors considered, in-vehicle monitoring using this system should prove to be a useful tool for measuring driver safety and exposure.

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Contributed articles

Towards survival on the road: a whole-of-life road safety program of learning for all road users

By Graeme S. Horsnell, member of ACRS

Learning how to improve one's chances of surviving each road trip is no easy task. It cannot be achieved in a short space of time, nor is the retention of knowledge and skills a simple matter. This program of learning aims to present road safety education as a step-by-step process that takes a lifetime. It is intended that it fit both the left and right-hand drive environments, making it accessible across the globe.

About the author:

After graduating with a BA and DipEd from Sydney University, Graeme Horsnell taught in NSW Government Schools from 1971 to 1992 and then in the Independent School System of NSW until 2006. In those years Graeme was responsible for the implementation of Road Safety and Driver Education Programs. He wrote a Senior High School Road Safety Syllabus and assisted in the framing of the Safety Strand of the Health Education Syllabus. He has also written programs for specific purposes in the field of road safety education.

In 1988, Graeme received a special award from the Royal Australasian College of Surgeons for his work in road safety. He has constantly aimed to add to his education and experience having gained his Graduate Certificate in Road Safety at the UNE and has travelled widely.

Introduction

This program lends itself to publication in hard copy format or would be equally accessible electronically, and in that

format it would be a virtually no-cost item. The program is designed to be used as a diagnostic tool for individuals and private or government systems alike; identifying what is currently being done to improve road safety and what needs to be undertaken. The program is built on the scaffolding concept in educational terms.

Road users' needs change with time

The purpose of this program of learning is to understand how road safety needs change through childhood into adulthood and later life. One step prepares for another. One major presumption is that there is a transfer of road safety skills from being a passenger, to being a pedestrian, cyclist and driver.

Towards making your own decisions

At each stage of learning it is assumed that the learner will progress from total dependence on mentors through to the possibility of total independence. The progression along this continuum is for the mentors to assess, remembering that each person's needs are different.

It is not presumed that all learners will progress from being a passenger, to being a pedestrian, then cyclist and then driver – it depends on the individual's own personal circumstances.

The whole-of-life program

Personal research on road safety education shows that there are many programs in a large number of jurisdictions, but little evidence to show how those programs link up to form a continuum for the first 1000 weeks of life and beyond. The Department for Transport in the UK does go down this path and it is useful to follow this link: dfT.gov.uk, specifically "Good Practice Guidelines for RSE in Schools", but the vital preschool years are not part of this, nor are the road users' adult years.

As a result, what is lacking is the holistic approach covering the first 19 years of life and beyond. Schools cannot make presumptions about what road safety education experiences a child has had in the preschool years nor can they predict one's road safety education needs in adult life.

This holistic learning program sets out education targets for each road user group. The result is a learning program which shows the building blocks of understanding how to get the best chance of survival on the road. The ascending order of complexity of tasks would be:

1. Passenger safety
2. Pedestrian safety
3. Cycling safety
4. Driver safety
5. Road safety for adults

Enforcement and other strategies

Enforcement of regulations by the relevant authorities along with public information campaigns are seen in the context of this program as supports for the education of all road users.

Road safety research, past experience and the development of new technologies do, however, point towards certain strategies for improving road safety, for example:

- The provision of internet access to current road safety related information;
- Advertising via available media; and
- Engineering treatments, measures or solutions accompanied by relevant public information.

Adult road users are the primary source in the development of appropriate sets of knowledge, attitudes and skills in children. As a basic premise at all stages of road use, we need to promote the message that the learning process should aim to satisfy the needs of people and that the learning experience never finishes. Also, as we age we need to make certain allowances and take compensatory measures. It might be added here that it is during the "adult" stage that most people will be passing on the benefit of their experience to the next generation either by example and/or by direct teaching.

The approach taken by the "whole-of-life" program

The approach taken in this program outline does not suggest any particular method, but rather content, ie what needs to be learnt within the broad context of developing on-road behaviour patterns that satisfy simultaneously both the legal requirements and personal responsibility for the safety of all road users. This principle applies to the "adult" stage as well. The skill of predicting the actions/lack of action and mistakes is a vital skill and is one that requires time to develop. Also embedded in the aims of this program are considerations for the environment and animal welfare.

The Program

1. Greater passenger safety

Covered in this section:

- Seat belts
- Which seat to sit in
- Boarding safely
- Alighting safely
- Sufficient ventilation
- The driver needs to concentrate
- Road reading

- Map reading
- The driver becomes ill/incapacitated
- Choosing your driver
- Handling emergencies
- First aid
- Ambulance, fire, police
- Progress chart

NB: Charts such as Table 1 and Table 2 below are available for each section of the program, but have not been reproduced in full in this article. Copies of the full program can be obtained from the author.

Table 1: Passenger safety skill chart

Concept	**Item demonstrated/ shown how to do and has been practised** **please tick**	**Can carry out this skill reliably** **please tick**
Getting in and out using the kerbside door wherever possible		
Appropriate child restraint properly installed and worn		
Seat belt correctly worn		
Getting enough fresh air Guarding against excessive heat and cold		
Helping the driver concentrate on driving		
Learning about traffic signs and signals		
Recognising road markings		
Reading a map		
Operate a satnav		
Stranger danger – not getting into a stranger's vehicle		
Knowing how to call emergency services		

Table 2: Advanced passenger safety skills

Concept	**Item demonstrated/ shown how to do and has been practised** **please tick**	**Can carry out this skill reliably** **please tick**
What you can do if your driver suddenly becomes ill while driving		
Choosing when not to get into a vehicle eg. if the driver has been drinking, is suffering fatigue or is unlicensed		
Knowing how to apply First Aid		
How to manage a crash scene		

2. Pedestrian safety

Key concepts are:

- Holding an adult's hand
- Walking on a footpath
- Surfaces we walk on – when they are slippery and when they are not
- Watching out for vehicles crossing the footpath
- Where to walk when there is no footpath
- Walking in parking areas
- Kerbside drill when not near an intersection – stop, look, listen, think
- Kerbside drill when at different types of intersections – stop, look in all directions that traffic comes from, listen, think
- Knowing what speeds to expect on any given stretch of road
- Fast speeds and slow speeds
- Deciding what is near and what is far away
- Left and right
- Obeying traffic patrol and police officers
- Knowing the meaning and use of traffic signals for pedestrians
- Making sure you can see any approaching traffic and that the drivers can see you
- Wearing clothes that help you to be seen
- Finding appropriate places to cross roads
- Identifying vehicle sizes and their ability to stop
- Being a pedestrian at night
- Roads where pedestrians are not allowed to go eg. freeways
- Identifying mistakes commonly made by drivers
- How to call emergency services
- Giving first aid

The safety factors you understand as a pedestrian and skills you use when you are on foot help prepare you for understanding cycling.

3. Cycling safety

Key ideas needed for pedestrian safety also relate closely to cycling safely

- the dangers presented by driveways
- the use of emergency services
- knowing first aid
- footpaths
- left and right
- the dangers presented by kerbs and drains
- pedestrian crossings
- the need to recognise slippery surfaces
- judging speed

Covered in this section

- Self-preservation
- Buying appropriate equipment
- Caring for equipment
- Understanding what the lawmakers aim to do
- What to wear
- Using your senses wisely
- Being aware of your environment
- Communicating with other road users
- Caring for yourself and other people
- Choosing and wearing a helmet
- Having the right bicycle
- Owner maintenance
- Maintenance/repairs best done by a mechanic
- Road rules
- Left, right, in front, behind
- Surfaces we cycle on
- Judging speed
- Judging distance
- Daytime/night time
- The weather
- Cushion of safety
- Seeing
- Being seen
- Footpaths
- Classes of roads and cycleways
- Driveways and parking areas
- Signalling your intentions
- Intersection types
- Turning left
- Turning right if there is no other traffic
- Turning right if there is other traffic
- Two way to two way street
- Turning right - one way to two way street
- Turning at busy roundabouts
- Road signs, signals and markings
- Giving signals
- Safer places to ride
- Unsafe places to ride
- Vehicle shapes and sizes
- Common errors made by other road users
- Patterns in traffic movement
- First aid

4. Driving safety

Driving according to the prevailing conditions with maximum safety margins is the aim. It is often called "defensive driving" which aims to allow the driver to be fully aware of how to avoid making driving errors and as much as possible not become a victim of the mistakes that other road users make.

Covered in this section

- Getting comfortable behind the wheel
- Caring for yourself and other people
- Buying and caring for appropriate equipment
- Understanding what the lawmakers aim to do
- Using your senses wisely
- Being aware of your environment
- Communicating with other road users
- Your personal limits
- Night driving
- Fitness to drive
- City v country driving
- Road rules
- Road signs, signals and markings
- Visual check before every drive
- Windows to be clear
- Hearing
- Secure your passengers
- Secure your load
- Deportment behind the steering wheel
- Adjust mirrors
- Controls
- Signalling your intentions
- Fuel usage
- Start – manual gears
- Start – automatic gears
- Stop - manual gears
- Stop – automatic gears
- Emergency stopping
- Skids caused by braking
- Skids caused by engine power
- Steer
- Road positioning
- Gears
- Following distances
- Reverse
- Left turn
- Right turn
- U turn
- Three point turn
- Roundabouts
- Park
- Change lanes
- Cornering
- Driving downhill
- Being overtaken
- Overtake
- Towing a trailer
- Emergencies – other road users
- Emergencies – your vehicle
- Vehicle shapes and sizes
- Common errors made by other road users
- Owner maintenance
- Maintenance/repairs best done by a mechanic
- Annual fixed costs
- Protecting your investment

5. Road safety for adults

Background information for the adult stage

- We can learn much from the mistakes of others.
- The development of new technology brings the need for understanding and adaptation.
- Inappropriate road–related habits need to be identified and rectified.
- We encounter emergency situations - some are common, some not.
- Pre-thinking how to handle common emergencies can be advantageous – a child in a locked vehicle, disobedience of traffic control signals, being tailgated, skids, impending hit from the rear and so on are simple examples.
- We age and this has consequences for road safety.
- Our needs and circumstances change necessitating acquisition of new knowledge and skills.
- Complacency is natural for humans and it needs to be well-appreciated and acted against.
- Laws change and we have the responsibility to keep up with the changes, obey and understand them and their aims.

Concepts:

- Monitoring one's health
- Promoting self improvement
- Having access to good information
- Identifying sources of information
- Being a good example
- Learning from experience and this never finishes.
- Appreciating the skills of how to impart knowledge
- "Accidents" don't "just happen" – we need to understand how factors involved in crashes interact.
- Being receptive to learning new skills and adapting to new circumstances
- Adapting to the new technology available to passengers, pedestrians, cyclists, and driver/riders

Covered in the adult stage:

- Attaining personal comfort
- Caring for yourself and other people
- Buying and caring for appropriate equipment
- Understanding what the lawmakers aim to do
- Use your senses wisely
- Being aware of your environment
- Communicating with other road users
- Self assess physical capability
- General health check up done professionally to assess physical fitness – an aid to early diagnosis and treatment
- Professional check on vision
- Self assess one's senses
- Learn from experience and the experience of others how to avoid crashes and injury

- Keep up-to-date with road rules
- Understand new technologies
- Update first aid competency
- Assess/use appropriate transport alternatives
- Report road-related problems
- Suggest road improvements
- Set a good example to other road users
- Impart knowledge/share experience
- Adapt to the use of new equipment
- Adapt to left/right hand drive
- Deal with hot, cold or wet weather
- Tow a large vehicle – trailer/caravan
- Acquire other classes of driving licences as necessary

Conclusion

Learning is a lifelong pursuit driven by our ever-changing needs and circumstances. Knowing how to best prepare ourselves for road use is a never-ending challenge. Review of the currently available educational theory and the application of it to road safety education revealed the need to develop a whole-of-life approach that could be put into practice by parents, caregivers and educationalists.

There have been centuries of educational research on how to structure a learning program and all current programming seeks to provide a scaffold on which to build a suitable scope for each element and an appropriate sequence for those elements. When the tables were constructed, the author referred to education theory as a separate concept and then education theory as applied to Road Safety Education. It is widely accepted in the field of child development that the teaching and learning process needs to be well-structured and with clear aims at all times so that the desired outcomes can be achieved. The learner is the central figure and the appropriate balance needs to be struck between theory and practice. Such education theorists as the oft-quoted Piaget who expounded his theory based on stages, Vygotsky with his social and interactive scaffolding and the multiple intelligences of Gardner, lead one to the conclusion that any road safety education program needs to satisfy the following criteria

- be soundly based educationally
- have the best quality design
- be sequentially structured
- be learner centred
- be targeted at the learner's current and future needs
- be competently delivered
- involve on-going evaluation by the mentors
- be evaluated for its relevance

All of these elements need to combine in order to maximize the positive powers of motivation on the part of the mentor and the learner.

For details of relevant online resources, further reading and educational theory, please contact the author for a list of references and links to pertinent websites.

Asperger's Syndrome: the implications for driver training methods and road safety

by S Tyler, Highlands Drive Safe, member of ADTA and ACRS

Abstract:

Road safety issues often focus on behaviour and attitudes to driving in key age groups. However, underlying conditions such as Asperger Syndrome (AS) are not given enough consideration in the training and testing phase to ensure these road users are sufficiently equipped with the necessary skills to ensure the safety of themselves and other road users.

The prevalence of autism spectrum disorders is approximately 62: 10000 at present. This is steadily rising as diagnostic methods are refined and awareness of the condition increases. This issue must be addressed urgently and infrastructure put into place to ensure this group of potential road users are taught and tested in the most effective way to address any road safety concerns.

This report looks at the educational issues faced by this special needs group and the potential problems at the testing phase when attempting the provisional drivers test. Four case studies have been reviewed to see the real problems faced by supervisors and instructors during training and the strategies that can be implemented to decrease the risks associated for this road user group.

Keywords:

Asperger syndrome, autism, driving, education, testing procedures.

Introduction:

Asperger's (AS) is a condition diagnosed within the autism spectrum criteria and is prevalent in approximately 62 per 10,000 [McDermott et al, 2006] people in the population,

with a higher incidence in boys than girls [Attwood, 2007]. A more recent study [Young Shin Kim, et al 2011] shows the prevalence of autism to be 2.6% of the population. AS is often misunderstood by the general population and an assumption that the tag autism equates to low intelligence is incorrect. One diagnostic criteria includes an IQ above 70 and early speech onset [Baron-Cohen, 2008]. The main issues that arise for many people with AS are: impairment in communication, socialisation and behaviour areas [Wagner, 2009]. These three areas if not addressed early may have a severe impact on the individual's learning and in particular the main focus of this paper will be their ability to drive a motor vehicle safely.

The current AUSROADS Fitness to Drive assessment criteria does not specify the AS area directly, as the diagnostic tools used for AS are relatively new and the causes and treatments of AS are still not fully understood [Austroads, 2003]. Research continues in this area; however support mechanisms need to be implemented to address the rapidly growing number of adolescents at driving age who need specialist training to ensure optimum road safety outcomes for all road users. With the increase in AS within our society, it is crucial that infrastructure is in place now to accommodate the learning needs of this road user group.

What is Aspergers (AS):

"After all, the really social people did not invent the first stone spear. It was probably invented by an Aspie who chipped away at rocks while the other people socialised around the campfire. Without autism traits we might still be living in caves" - Temple Grandin.

Aspergers is a condition within the Autism Spectrum and is often labelled as high functioning autism along with other conditions on the spectrum such as Pervasive Developmental Disorder—Not Otherwise Specified (PDD-NOS). People living with a diagnosis of AS do not always fit neatly into a set of symptoms, although many share similar symptoms. Many diagnostic tools are used to assist clinical practitioners to correctly diagnose a patient within the autism spectrum. However, diagnosis is complex, lengthy and often involves a multidisciplinary team of professionals. These diagnostic tools are developing and changing, as more research is being conducted. The current criteria DSM-IV definition for Asperger's Syndrome (299.80) is currently under review (Appendix A).

Many people with Aspergers display symptoms such as impaired communication, difficulties in social interaction, restricted and repetitive interests/behaviours and possible sensory sensitivities [Garside et al, 2000]. Adults with AS often suffer with depression and/or anxiety [Barnhill, 2004]. As the prevalence in society of Autism Spectrum Disorders increases dramatically, it is acknowledged that early intervention can assist in the social and behavioural skills which these people have the greatest difficulty with [Smith Myles et al, 2002]. People with AS would benefit from specific strategies and services for AS rather than those targeting autism [Attwood, 2007]. A comparison of these two groups was made by Van Krevelen [cited in Wing, 1991], where he notes that "the autistic child lives in a world of his own, whereas the high functioning child with Aspergers lives in our world but in his own way" [Wing, 1991].

The main educational issues for people with ASD:

"A treatment method or an educational method that will work for one child may not work for another child. The one common denominator for all of the young children is that early intervention does work, and it seems to improve the prognosis." - Temple Grandin

The impairment of social skills development can lead to misunderstanding and poor communication within driving lessons. Students with AS have limited ability to 'read' facial expression and gestures - they will often look down or away to avoid eye contact. As a driving instructor, this can impair our ability to gain feedback on the level of effective learning taking place. What has and has not been understood plus the ability to apply the knowledge, is not readily available to the instructor. Alternative strategies need to be employed so feedback can be applied to the teaching process. An important part of teaching students with AS is the need to keep the teaching methods evolving to the needs and abilities of the student.

Direct communication works well for students with AS, where all connotations and double meanings are removed. Students with AS will focus on understanding the mystery behind your comment, rather than focusing on the actual task of driving. There is often a want to over analyse the 'hidden meaning', as they struggle to understand. Children with AS are often off task, distracted by internal stimuli [Williams, 1995].

The main aim of a driving instructor is to develop a rapport with students with AS, to keep their primary focus on driving and to teach them to identify possible and actual dangers. Students with AS are generally 'monotropic' [Lawson, 2003] in comparison to neuro typical students who are multichannelled. Monotropism causes issues when a student cannot see the big picture as Attwood describes: *"perceiving the world through a telephoto lens, rather than a wide angle lens"* [Attwood, 2007], limiting their ability to take in more than one piece of information at a time.

Driving is a process of constantly assessing the big picture; this poses a major challenge to students with AS. Students

with AS are more likely to fixate on a smaller detail and analyse this rather than see the context of that detail within the larger picture. When a student with AS is overloaded with input, their coping switch overloads thus creating fear, frustration, possible anger and stress issues [Roux *et al*, 2008]. Some students observed by the author completely shut down and needed to stop for 'time out' to refocus. Other students became irritated or aggressive and displayed inappropriate behaviour which needed to be addressed in a timely and correct manner. The majority of the case studies explored by the author showed signs of retreating to a safe topic of their interest when placed under stress, causing them to lose focus on driving and become a high risk driver. Intervention is required at this point by a trained instructor to stop driving and refocus on the task through appropriate methods. Common signs of a student with AS losing focus includes: not checking their right of way, entering intersections without visual checks and losing their road position. Many students became distracted to the point of 'forgetting' they are driving until they could be taught to refocus to the task. If correct training techniques are introduced early, many of these issues can be addressed and the driver with AS learns coping strategies to deal successfully with these issues. It is not that attention is poor, rather their focus on irrelevant stimuli prevent a student with AS from making out what is relevant [Williams, 1995].

Repetitive and restrictive topics of interest can be a barrier to learning; however an instructor will need to set strict guidelines whilst driving. Driving is best done in short intervals and to begin with in quiet areas. When new tasks are introduced a trainer will need to incorporate appropriate methods of training that suit the student to reduce anxiety. Students with AS will generally take longer to complete training when learning to drive as they master each skill set and unlike neuro typical students, they need to learn coping strategies and develop social communication skills. Students with AS need to learn methods of reading another driver and the car behaviour displayed whilst driving, very similar to body language we read daily in social situations. This is an area that students with AS struggle with and therefore they need to learn other ways to read people. Road rules and manoeuvres generally pose little problem as these students rote learn these skills and are technically correct; it is the unknown or unpredictable nature of other drivers and situations that poses the largest threat to drivers with AS. The higher order skills needed to transfer knowledge or rules from one situation to a different situation are not easily achieved for a student with AS [Wagner, 2009].

The students reviewed displayed common issues in the areas of problem solving; organisational skills; conceptual development; and making inferences and judgement. All students reviewed lacked higher order thinking skills when dealing with transference of knowledge and the application of a theory to problem solving areas [Roux et al, 2008]. It is well documented that AS individuals have problems with executive function, in particular with working memory, attention and impulse control [Gillberg, 2006]. Deficits in executive functioning can affect their ability to break tasks into smaller components: the more abstract the concept, the more difficult it is to understand. Although rote memory may be good they often need a trigger word to access the information [Barnhill, 2004]. Executive function deficits may impair a driver's ability to transfer learnt responses in specific situations to different situations, as well as maintaining the multifocus needed whilst driving. More research is needed in this area to establish the effects on driving skills and to develop effective training methods.

It is necessary to teach students with AS all the road rules, gestures and courtesies in driving; even the ones not listed in the books. These include situations neuro typical drivers easily understand, such as "Why is the oncoming car flashing their lights at me"? The answer is multifaceted - it could be Police radar, an accident or perhaps to indicate that your high beam lights are on. An AS driver will need to be aware of the possible answers to help them read the situations as they occur and transfer knowledge to different scenarios.

Kathie Harrington [2003], a speech therapist and a mother of a driver with AS, lists specific areas that she believes need to be taught to students with AS. These include: vocabulary, predicting, sequencing, turn taking, memory, telephone use and problem solving. Professional assistance is required to adapt these skills to the task of driving a vehicle.

Asperger himself commented on the need for the teacher to adapt training models to suit the AS student:

"The teacher who does not understand that it is necessary to teach these children seemingly obvious things will feel impatient and irritated …. These children often show a surprising sensitivity to the personality of the teacher…. They can be taught, but only by those who give them true understanding and affection, people who show kindness toward them and yes good humour." Asperger 1944

Testing procedures and issues:

In NSW, a learner driver must currently complete 120 hours of driving (including 20 night hours) over a 12 month period from the age of 16 years. If over 25 years old, a learner can sit the driving test without completing any driving practice as there is no requirement to complete minimum hours or hold a logbook.

If a medical condition listed in AUSROADS is identified, the driver is required to have a doctor complete a medical form and lodge this with the RTA so the condition can be

listed on their licence. Although mandatory, this is not currently enforced and is based on an honesty system. Given the majority of the students reviewed with a variety of medical conditions do not report these to the RTA; the system needs to be changed to ensure this information is captured to reduce road safety issues before they occur.

The RTA medical form does not list Aspergers as a specific medical condition. It does list mental or physical disability that affects driving ability. Many parents, from the author's observations will overlook or refuse to submit these forms even though it is mandatory. This resistance is often due to the stigma the learner may acquire by listing a disorder. Many families fear they will be discriminated or alienated from the mainstream if their child is labelled 'autistic'. This label often brings thoughts of the typical autistic child, where intelligence levels are low. This is obviously not true for Asperger clients where IQ is usually above average. However, the issue is the discrepancy between verbal IQ and performance IQ - often a difference of 25 points, leading to superior verbal intelligence but extremely low IQ in performance [Gillberg 2006]. The peaks and troughs of IQ can further hamper training where an instructor may think the student understands but in reality they cannot perform the complex task well.

One category on the medical form that may encompass these students is the question: Are you taking medication? Many diagnosed AS people are on medication, whether ADD medication or antidepressants. Once they tick yes to this question, a medical is required from their treating doctor. However, as stated this is an honesty system and would require them to actually answer yes to this question. Parents may not answer yes to this question to prevent the child being categorised into the autistic label. Better education on this mandatory requirement is urgently needed to ensure parents and learners understand the legal consequences in the event of an accident, if medication is not declared.

From the learner driver knowledge test (DKT) to the provisional stage there is no enforcement to check the medical status of a driver.

All students with AS reviewed passed the computer based driver knowledge test after one to two attempts; giving them access into the world of driving without the necessary support and training required. Driving instructors are often not informed at the time of the lessons for fear of discrimination or of them forming pre conceived ideas. At the P1 practical driving test, if a medical form has not been completed or the application does not list a medical issue the practical driving test will commence. This poses an occupational health and safety issue for RMS testing officers who will conduct a 'normal' test with objective methods. Inspectors may not be aware of the potential dangers if the student with AS misunderstands directions, has a sensory overload, gets frustrated or upset or has an imbalance in their medication causing focus and decision making issues.

Conclusions:

The prevalence of Autism and Asperger's syndrome is increasing and is becoming a recognised issue for drivers, as our diagnostic tools become more accurate. However, support mechanisms for this particular group of road users are severely lacking for the increasing population this condition affects. The current reporting system for these issues does not encompass Aspergers and yet there is extensive evidence that these conditions and the subsequent medication that is prescribed to these road users can have an effect on road safety for all road users. The most important finding from this report is the need for changes to the reporting methods, teaching methods and the availability of support for this specific road user group. Many are quite capable of becoming safe road users and in many instances are safer than neuro typical drivers as they generally have an inbuilt ability to always follow road rules and techniques they have learnt. This however, could also be seen as a negative attribute when trying to interpret situations and be flexible with the outcome.

We currently have in NSW a total of 724,655 road users in the learner, P1 and P2 categories (Appendix B). Using the statistics of 62:10000 [McDermott *et al*, 2006] children on the autism spectrum, that equates to 4493 of these road users in NSW who are unsupported in the critical learning phase of driving. These people may learn to adjust and adapt to be safer drivers. However, further research on older drivers with Aspergers needs to be undertaken to determine if adapting is done in a positive way or if targeted education and training methods could assist this process to be more effective and have long term positive results. These students may have social, communication and behavioural issues to work through in their lives; however all are unique individuals that have their own strengths and weaknesses that need to be correctly assessed and with support infrastructure put in place to support them.

Currently the AUSTROADS Assessing fitness to drive guidelines do not specifically list this group of road users to be modified or tested. Adjustments need to be made to identify this group of road users before the learner phase and implement support and modifications to balance the ability to drive and ensure the safety of all road users.

Recommendations:

Further study is needed in the area of training models for Asperger drivers, in particular methods of training drivers with AS in a way that best suits their individual learning

style. Testing methods and RMS guidelines should be reviewed to include special needs groups. It is evident from these case studies that drivers with AS and their carers may not understand the need to report the condition or there may be preconceived ideas of discrimination at the time of testing. This issue should be addressed, as reporting incidence must be increased to allow monitoring and adaption of current methods. Training should be implemented for all testing officers in meeting the special needs of test applicants so that fair and equitable testing can be achieved for all road user groups. Training packages are currently being developed for Asperger drivers and their supervisor/trainers to assist the learning process. Government funding could be made available to develop this growing need and to prevent future road safety issues due to ineffective training. Further research is being carried out in the United States at Harvard University with drivers with AS and the use of driving simulators to assist in higher order thinking skills development. Results of this research will be available late in 2012 when further understanding of how to effectively assist this road user group will be known.

Medical testing needs to be introduced at the pre-learner phase for all new drivers to help identify all special needs groups, the ability to drive and any modifications that needs to be made to increase road safety for all road users.

All new learners, not unlike the older drivers, would benefit from being screened and completing a medical assessment form prior to the DKT. Any special needs or medical issues would then be identified; the medical form would then serve as a clearance to allow that person to pursue a driver's licence.

Method:

Over a twelve month period four students attending driving lessons were chosen based on similar age, sex, diagnosis of AS and demographics. These students were all diagnosed by health professionals as Asperger syndrome patients using the DSM-IV definition for Asperger's Syndrome (299.80) guidelines (Appendix A). Students were further assessed by the driving instructor (author) using an educational questionnaire tool for special needs students to ascertain specific educational needs. An individual, tailored program was then developed by the instructor to suit the requirements of the student with AS. Over the following twelve months the four students were monitored and notes compiled on the progression of skills in relation to driving a motor vehicle. These results are compiled here as observations and recommendations of the driving instructor. Male students were chosen over female as the diagnosis of male patients is more easily identified and the characteristics of AS are more pronounced or less camouflaged [Attwood, 2006 and Attwood, 2007]. The following are the results of the observations of the author.

Key focus areas were the student's cognitive ability, medication and the effect on driving skills, focus issues and trigger points as well as general driving ability.

To date there is little research data or information on driver training in relation to students with Asperger syndrome. This may be due in part to the difficulty in diagnosing this age group with AS. A higher percentage of research focuses on early childhood intervention and development. There are currently two areas where this research is beginning to be conducted. The first is in the UK where Julia Malkin, a specialist driving instructor, has developed a training method for autistic clients and the second is in the US at Harvard University where studies are being conducted with teenagers with AS, where the effect of training on driving simulators may assist this needs group in the area of motor vehicle driving.

The lack of raw data worldwide in relation to driving skills and ability of people with AS is an area that needs to be addressed. With the main focus on early childhood and AS, the older age groups that are both diagnosed and undiagnosed with AS currently have little assistance in key living skills areas such as driving a vehicle.

Case Report:

The following is a summary of four cases experienced by the author and the challenges/issues faced in driver education.

Real names have not been used for privacy issues.

Case study 1

James aged 20 (male)

Diagnosis: Aspergers, ADHD

Medicated: Yes

Reported to RTA: No

Problem areas: James was 18 years old at the time of learning to drive. He had delayed driving to develop his concentration skills and maturity. James' diagnosis was confirmed as Aspergers with specific interest areas. His interest areas limited his conversational skills and he was segregated at school by his peers as 'different'. This did not phase him as he seemed indifferent to other's opinions as he continued with his specialist topic.
James has excellent recall skills for obscure facts on his topic and can continue a conversation over extended time periods.
In relation to driving skills he was able to recall technical points well and corrected the instructor when these points

were missing during instruction.
Once distracted, James became dangerous where small things took his focus from the complex task of driving. Friends on the side of the road or specific car types would cause him to focus on that single issue rather than the multitasking required. Manual driving was attempted, however, the recommendation from the instructor was to only drive an automatic vehicle to address the multitasking issues. If James was to drive an automatic vehicle this would allow more focus on traffic situations and hazard perception skills.
James had poor focus when off task and was slower to respond to 'what if?' scenarios when questioned, compared to neuro typical students.
Severe echolia, or repeating of words was a barrier for the trainer to overcome as this interfered with the flow of training.
Gross motor skill deficit caused issues when first learning to steer, however these were overcome with continual practice. Complex tasks such as steering and simple traffic took longer to grasp compared to neuro typical drivers, with real issues in the ability to read other driver's intentions. However, improvement on his technical skills such as reverse parking, to and from the kerb and three point turns were simpler to grasp as they were performed in low traffic areas with little distraction and required repetition to master. James will struggle to remain safe, however he has the skills necessary to pass an RTA driving test and become an unrestricted road user. With medication he may be more stable whilst driving although this is something that may not occur within the family unit.

Strategies:
A parent/learner/instructor workbook for communication was adopted to reinforce the sequencing of tasks and allowed a consistent approach to be incorporated.
Regular lessons were conducted for consistency and focus training.
The use of keywords and structured language in instructions for consistency reduced confusion and anxiety.
Recommended restriction to automatic vehicle use only.

Case study 2
Simon aged 26 (male)

Diagnosis: Aspergers, Anxiety, depression

Medicated: Ritalin, although not on it at present, self medicates when needed, has anxiety attacks.

Reported to RTA: No

Problem areas: Simon has severe social issues; he prefers to work alone; he lives at home with his mother as his primary carer and his focus area of interest is IT, where he communicates through video games and online gaming. He has focus and attention issues as well as high anxiety levels. Simon over-reacts to problems and is easily overwhelmed by complex situations. He has poor concentration levels after 20 minutes of driving. Simon has back problems which interfere with comfort levels, causing distraction during driving. Simon becomes extremely anxious when the car travels over 40 km hr. He shows signs of mild echolia and gross motor skill deficit.
Simon is comfortable having a conversation one-to-one with an instructor once a rapport has been established. He has his own unique sense of humour that he adds to the conversation. However, he is easily distracted if allowed to continue the conversation in his area of interest.
He has a good comprehension of tasks and the learning sequences. The use of video games allows cross understanding and training of some skills used in driving to occur. He learnt pull push steering technique at a neuro typical driver's rate.

Strategies:
The main emphasis was on reducing anxiety levels when travelling over 40 km/hr or with oncoming traffic. Learning could not continue until this barrier had been overcome.
The instructor reduced discussions on his topic of interest to increase focus on the driving task. This was helped by allowing a set time in the lesson when stopped to talk about his area of interest; releasing anxiety in a controlled way.
The instructor ensured medication was up to date and taken on time so it was effective for the lesson. A communication book for the parent, learner and instructor was introduced, breaking tasks down and working through smaller components in sequence to reduce anxiety.
Simon will take repetitive lessons over an extended period of time which due to cost factors may not be possible.
The anxiety levels cause Simon to stall in his progression and cease lessons for periods of time. It is the instructor's opinion that Simon should not be driving unless consistent lessons can be undertaken. His cognitive maturity levels could pose a problematic approach to driving and he may, due to the anxiety levels, become a hazard to other road users. His strong personal belief of being correct and his fixed views of 'everyone else' may not allow a flexible approach to driving, which is necessary in order to identify hazardous situations and to avoid these situations.

Case study 3
John aged 20 (male)

Diagnosis: Aspergers, ADHD, depression (past suicidal tendencies)

Medicated: Yes, anti depressants

Reported to RTA: Yes - just before P1 test after recommended by the instructor.

Problem areas: John has low social skills and lives at home with his mother as a primary carer. He has no comprehension of double meanings or hidden connotations. John has no understanding of humour within the conversation. John has high levels of anxiety and fear of failure when asked to perform a new task. He cannot distinguish facial, social or body gestures, and has a literal understanding of terms within conversations. He has a need to simplify techniques otherwise he has sensory overload resulting in behavioural issues. John has difficulty reading the behaviour of other drivers and their intentions. He has too much trust when approaching an intersection or roundabout and often does not look into the danger areas to have sufficient crash avoidance space (CAS).
John has excellent recall ability for the technical processes, especially the manoeuvres. He has developed a strong understanding of the Safety-First method introduced by the instructor and can apply this to his everyday driving. John has a strong personal attitude of right and wrong and can apply this into his right of way knowledge. However, when other drivers do not follow the same rules he becomes agitated and stressed.

Strategies:
The most important strategy used with John was calming techniques to manage his anxiety. The instructor used many 'what if? 'scenarios to broaden John's understanding of unpredictable drivers and pedestrians. By increasing his exposure to traffic he was put into a wider range of situations and developed a deeper learning of this concept. In essence John built his own mental library of 'what ifs?'. Positive praise for John was crucial as many in his direct support group had focused heavily on what he was not capable of doing. By turning this around to the strengths we found John responded well to the instructor and developed more confidence in his driving. He has a fiercely independent spirit that can interfere with his training, so a more positive approach reduced this to allow further learning to develop.
John had intense training for four weeks before his RTA driving test which focused on general driving skills, familiarisation in the general test areas, RTA language, procedure and instruction, Safety- First and repetition of manoeuvres. This reduced the anxiety he was feeling as a possible fail in the driving test could have provoked suicidal tendencies and depression. John was calm and relaxed for his RTA test and remained focused throughout the drive, scoring 98% with no fail items. He continues to drive safely and adheres rigidly to the guidelines he was taught in lessons. He has specific driving routes and rarely changes these.

Case study 4

Jack aged 18 (male)

Diagnosis: Aspergers, dyspraxia

Medicated: Yes

Reported to RTA: Yes, as recommended by the instructor before the P1 test was due.

Problem areas: Jack is a timid, quiet student currently in his HSC year. Jack lives at home with his parents and is looking forward to attending University next year. He has a very supportive school environment where he has developed a sound attitude toward others and in particular his driving. He has extended his learning phase to over two years and has had various barriers to work through with dyspraxia.
Jack has a good understanding of his own limitations and he adheres to these self imposed restrictions. His depth of field often causes issues whilst driving.

Strategies:
It was important to develop the usual strategies for Asperger students, such as communication book, key words and set routines. However, Jack's diagnosis of dyspraxia required the introduction of strategies for his impaired ability to judge space and distances. The instructor used visual markers for judgement of distance, crash avoidance space and indicator distance rules.

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Appendix A

Currently under review:

DSM-IV definition for Asperger's Syndrome (299.80)

(I) Qualitative impairment in social interaction, as manifested by at least two of the following:

- (A) marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, & gestures to regulate social interaction
- (B) failure to develop peer relationships appropriate to developmental level
- (C) a lack of spontaneous seeking to share enjoyment, interest or achievements with other people, (e.g. by a lack of showing, bringing, or pointing out objects of interest to other people)
- (D) lack of social or emotional reciprocity

(II) Restricted repetitive & stereotyped patterns of behavior, interests, & activities, as manifested by at least one of the following:

- (A) encompassing preoccupation with one or more stereotyped & restricted patterns of interest that is abnormal either in intensity or focus
- (B) apparently inflexible adherence to specific, nonfunctional routines or rituals
- (C) stereotyped & repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or complex whole-body movements)
- (D) persistent preoccupation with parts of objects

(III) The disturbance causes clinically significant impairments in social, occupational, or other important areas of functioning.

(IV) There is no clinically significant general delay in language (e.g. single words used by age 2 years, communicative phrases used by age 3 years)

(V) There is no clinically significant delay in cognitive development or in the development of age-appropriate self help skills, adaptive behavior (other than in social interaction) & curiosity about the environment in childhood.

(VI) Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.

Appendix B

Table 2.1.2 Licence class by licence type as at 30 September 2011

		Licence class						
Licence type	**TOTAL**	**Class C**	**Class LR**	**Class MR**	**Class HR**	**Class HC**	**Class MC**	**Class R**
Learner	299,885	273,965	0	0	0	0	0	25,920
P1	162,537	143,545	0	0	0	0	0	18,992
P2	262,233	256,098	143	1,225	718	0	0	4,049
Unrestricted	4,700,719	3,694,460	85,154	124,985	200,552	111,558	20,233	463,777
TOTAL	5,425,374	4,368,068	85,297	126,210	201,270	111,558	20,233	512,738

Note: A person may hold a rider licence class as well as a driver licence class.

http://www.rta.nsw.gov.au/publicationsstatisticsforms/statistics/registrationandlicensing/tables/table212_2011q3.html accessed 22/12/2011

Road safety management in Australia: a call for more coordinated action

by Lauchlan McIntosh AM
(January 2013)

Summary

This is a conversation paper on national public policy issues relating to reducing Australia's deaths and injuries from road crashes. These deaths and injuries are often termed the "road toll'; a toll or price we do not have to pay. The National Road Safety Strategy 2011-2020 (NRSS) accepts a zero vision - no one should be killed in road crashes. This conversation paper is entirely the view of the author, developed from conversation with a wide range of interested individuals and it will be updated based on comments received. This is the second edition. It is intended to provide an independent constructive commentary with some specific actions to reduce road trauma in Australia.

Two years into the UN Decade of Action for Road Safety 2011-2020, the Australian response and actions in managing a reduction in domestic road trauma could benefit from a more coordinated and action-oriented focus.

Australian governments collectively agreed in May 2011 to reduce deaths and injuries from road crashes by 30% by 2020. While results in some areas are on target, overall Australia is already falling behind its trauma reduction targets. More died and perhaps more were injured in road crashes in 2012 than 2011. Twenty five died every week in 2012 across the country in those crashes. We can estimate that around 500 were seriously injured; every week.

Recognising road safety should be a vital factor in the Australian productivity and national economic debate. There is a strong case for integrating road safety targets and aspirations into all current research, road, vehicle and communication programs; and for assessing and building efficient cooperative State, Local and Federal Government

road safety programs together with business, professional and community groups. There is strong case for having not only a national reduction target for deaths and injuries but also a widely agreed action plan and budget to focus attention and enhance resource coordination.

Funding at sufficient scale could come from new sources and from current road, industry, transport, insurance and health-related areas. That budget though should recognise the size of the problem (i.e. the annual cost to the community of at least $27 billion+) and the scale of the response needed to achieve effective results. The funding is not simply expenditure; it will be investment with a real return.

It is essential to build a consensus across the whole community that there are many solutions, often at relatively low capital and social cost, which can reduce trauma without unnecessarily impacting on mobility.

Specifically national actions should be:

- A decision by COAG to ask the Federal Government to commission a study by the Productivity Commission on the full impact of road trauma on national productivity; the current size of annual expenditure by all government sectors including transport; legal, industry and health; as well as to assess the economic costs and benefits of State, Federal and Local Government -based road safety programs.
- Development of a national road safety research plan and national research budget involving government and industry, which should include a national data base of incidents with research which has a focus on timely and practical results. We need the best facts and evidence, not opinions, to make a difference. We need that research to improve our ability and our capacity to get results. Integration with best practice international researchers should be included.
- Development of a national active plan and budget to facilitate the introduction of safety technologies across vehicles and infrastructure.
- Development of a national road safety communications (and marketing) plan.
- Collective agreement from road safety groups themselves (government at all levels, business, researchers, practitioners) to the action plan which can build national and international partnerships, reduce duplication and which leaders can join and promote.
- Using and extending existing non regulatory, effective programs such as AusRAP, ANCAP, and KEYS2DRIVE, rather than starting duplicate programs.
- Assessing and reporting road trauma as a vital factor in the Australian national economy and national budget, set to ensure that reduction targets are met with safety targets included in all road infrastructure, vehicle and technology related spending as well as in mobility planning.

Road trauma should be assessed as a vital factor in the Australian national economy and a national budget which recognises the real scale of the problem set to ensure that reduction targets are met. Safety targets should be included in all road infrastructure, vehicle and technology-related spending as well as in mobility planning. The scale of potential national savings of at least $10bn pa in 10 years or $55bn over the 10 years will require a priority national COAG plan and perhaps a budget of at least $500m pa. An initial step to resource a Productivity Commission review and to fund a national coordination program of key parties is urgently needed. The benefits will be in lives saved and reduced trauma, savings to the health and legal systems and improved national productivity.

Issues and actors

National

The cost of road trauma in Australia has been estimated at $27bn pa, about 10% more than the annual Australian Defence Budget. At least 30,000 crash victims present at hospitals annually. Many are incapacitated for life. The ongoing costs are unknown.

Australian governments collectively, with general support from relevant non-government groups, have agreed to reduce road trauma by at least 30% by 2021. The benefits for individuals, their relatives and the community will be immense; the economic saving by that time in today's dollars will be $10bn pa, perhaps $55bn over the first 10 years, resulting in, though not clearly identified, national productivity gains. The reduction target of 30% applies to death and serious injuries but by world standards is weak; we seem destined to fall further behind the top performers within Europe with their collective 50% target across all EU countries. Australia's comparative performance has fallen from being in the top 10 to the bottom of the top 20.

The management of 'road safety', a broad term to describe activities which impact on the many factors around safe road use in Australia, is fragmented. State and Territory Governments in general have responsibility and manage programs for road safety; the Federal Government for new vehicle safety, State and Territory police for enforcement of State and Territory laws and regulations and local government for implementation of local infrastructure and programs. Other user groups, national transport agencies, concerned citizen organisations, some insurers, and professional groups also contribute to a range of trauma reduction activities.

Solutions and costs are often simply limited to the transport sector (vehicles roads), and education and enforcement arenas while the benefits are seen in another (health, insurance, industry).

Sections of the corporate sector are increasing their investment and resources to manage road safety risk. Organisations and individuals are changing mode use and travel choices, specifying safer cars and safer roads to eliminate or manage the use of the road infrastructure.

While there is a National Road Safety Strategy for the current decade, there is no single overarching national government, business, professional, research implementation program, action plan or budget to achieve that annual saving of $10bn. (Such an annual saving would support considerable ongoing investment with a real return. A simple cost benefit analysis would show a collective national investment of say $500mpa, $5bn over 10 years, would result in a saving of around $50bn, or a 10:1 benefit.)

Whether such an implementation and investment program is necessary has never been debated and the current fragmented approach appears to be accepted by default.

Considerable political discussion recently in Australia has focused on the problems and successes of our federation and the value of the collaborative Council of Australian Governments (COAG) mechanism. Despite the high cost of road trauma and the savings which can be achieved by real investment, road safety does not appear high on the COAG agenda. A 2009 National Partnership Agreement established a National Road Safety Council in 2009, but November 2012 saw the Council disbanded. No complete national data base exists on road trauma outcomes, the loss of productivity, the costs of duplications, the benefits of competitive State-based management and research, or any independent analysis of the various trauma reduction programs locally or internationally.

Australia does not have a large, autonomous organisation, which independently comments or compares road safety performance such as the Insurance Institute for Highway Safety in the USA, or the European Transport Safety Council. Several consumer, research and professional bodies do make effective contributions. These have and can act effectively in concert, but are resource limited for the size of the task.

Some of the major organisations involved currently include;

- The National Road Safety Executive Group under the National Partnership Agreement of Federal, State and Territory Governments from a COAG process.
- State and local government road, transport and policing agencies with specific responsibilities relating to road construction, operation and enforcement.
- The Federal government with responsibility for new vehicle safety with the Australian Design Rules.
- The National Road Safety Council (now disbanded).
- The National Transport Commission (with the inception of a new proposal for a business and road safety partnership, although Safe Work Australia's role here in unclear).
- The National Road Safety Remuneration Tribunal and the National Heavy Vehicle Regulator.
- Austroads, an organisation with members of the six Australian State and two Territory road transport and traffic authorities, the Department of Infrastructure and Transport, the Australian Local Government Association and the New Zealand Transport Agency (who provide information and advice and fostering research in the Australasian road and road transport sector including safety).
- ARRB, providing research, consulting and information services to the road and transport industry.
- University based research and teaching centres; (CARSQ, TARS UNSW, MUARC, CASR, Curtin-MARC, The George Institute, NeuRA and others).
- User groups, such as Australian Trucking Association (Truck Safe); the Australian Automobile Association with the NRMA, RACV, RACQ, RACSA, RACWA, RACT and AANT (Keys2Drive, AusRAP; UCRS); Kidsafe; the Pedestrian Council; the Motorcycle Council and the Cycling Council, the Australian Road Safety Foundation, the 33900 Non Government Road Safety Network, the Royal Australian College of Surgeons Trauma Committee and many others.
- ANCAP, the Australasian New Car Assessment Program.
- ACRS, the Australasian College of Road Safety.

No national program coordinates or attempts to encourage collaboration and measure the effectiveness of that collaboration of the many involved in reducing road trauma. There is no data on the amounts currently spent or planned to be spent aggregated nationally. There is no recognition of the importance of the need for a professional management approach to that collaboration. There is no evidence of actions to encourage national or international benchmarking, cost efficiency or improving the productivity of the current players and their programs.

International

Australia is an active supporter of the UN Decade of Action on Road Safety program which aims to halt the rise in road trauma in this decade, and is currently the largest single government donor to the World Bank's Global Road Safety Facility. AusAID is increasingly including road safety factors in its aid programs. The WHO Global Road Safety Partnership has built programs with the help of Australian organisations, research institutions and consultants. IRAP, the international road assessment program with links to the AusRAP program has also been successful. In May 2012 in Malaysia, many Australian road safety experts through

ANCAP contributed to the first ASEAN Automotive Safety Week.

While not the subject to this overview, the benefits of linking Australian road safety projects , researchers and practitioners to international programs, as is well recognised in other areas, are valuable to not only the developing countries but to assist in adding skills, experience and knowledge. ***International cooperation is valuable.***

Recent actions

Last year a range of generally unconnected road safety related events and actions occurred with links to national road safety public policy. Some, though certainly not all, were:

- May: In Canberra, ARRB and the ACRS jointly held a seminar to review and track progress against the National Road Safety Strategy after its first year of implementation. The Parliamentary Secretary for Infrastructure and Transport, the Hon Catherine King MP, made an address. Seven specific actions were recommended - only a few have been implemented. A similar event in Canberra with a focus on pedestrian safety is be considered for May 2013.
- June: Both the Parliamentary Secretary for Infrastructure and Transport, and the relevant Opposition Spokesman Mr Darren Chester made addresses specifically relating to road safety initiatives to the national Parliament. These were important addresses to the nation.
- June: The South Australian Government released a comprehensive report from its Thinker in Residence, world road safety specialist; Professor Wegman titled "Driving Down the Road Toll, by building a safe system." This report has many recommendations which apply across Australia.
- June: Bosch Australia, a major supplier of safety-assist technologies offered specific support for the NRSS with recommendations for action to encourage early adoption. Bosch hosted a demonstration event for these technologies in Melbourne.
- July: The Road Safety Remuneration Act established the Road Safety Remuneration System, which commenced on 1 July 2012. This relates entirely to heavy road vehicles.
- June: The National Infrastructure Council reports to COAG that 'road safety is an ongoing concern for the community' and notes some progress for national regulation of road safety, suggesting it will facilitate future events on road safety and productivity, discussing how researchers are focussing on digital technologies to reduce congestion and improve road safety and providing some generic statements on road safety benefits in a range of specific projects.
- July: Michael Deegan, National Infrastructure Coordinator, suggested in a speech to the RAC WA that disbanding the nine separate transport bureaucracies and setting up an independent national body of experts to give Ministers advice would get the "best bang for the buck".
- August: The ACRS held a conference with 250 delegates in Sydney "A Safe System, expanding the reach" with an introduction from the Governor General and also the Parliamentary Secretary. No specific program for future action was recommended. A similar conference with a focus on road safety and the media is scheduled for Adelaide November 2013.
- September: A National Road Safety Forum was held in Canberra as an initiative of the Australian Government, convened by the Parliamentary Secretary. The purpose of the forum was to bring together key stakeholders to discuss several important issues identified in the National Road Safety Strategy 2011-2020. Several recommendations were made although specific reporting progress is unclear. A similar forum is scheduled to be held in Tasmania in 2013.
- October: 330 delegates (many Australians) attended the Australasian Research, Policing and Education Conference held in Wellington New Zealand following the World Safety Conference. No specific program for future action was recommended. A similar event is schedule for Brisbane in August 2013.
- November: The National Road Safety Council, established by a National Partnership Agreement with the Prime Minister, State Premiers and Territory Chief Ministers in 2009 to facilitate the implementation of nationally agreed road safety reforms, is disbanded. A paper by the Chair and Executive Director published in December 2012 suggests an ongoing work program was envisaged. A review of road safety management by the COAG Standing Council on Transport and Infrastructure is proposed.
- October-December: The ACRS and the National Health and Medical Research Council continued discussions on the development of a National Road Safety Research Strategy within the NRSS. A workshop is scheduled for February 2013. Road trauma reduction actions are a preventative health measure, reducing loads not only on trauma management but long term care activities.
- November: The Royal Australian College of Surgeons convened a Road Safety Forum.
- November: MUARC ran a Road Safety Management and Leadership program.
- November: A detailed progress report by SCOTI listed 59 actions to be taken during the first three years (2011-2013) of the NRSS with progress against each item. No economic analysis of any item or of the program was included.

- November: The COAG Standing Committee on Transport and Infrastructure (SCOTI) met and reported; "... the latest progress report on the National Road Safety Strategy, showing that considerable activity is underway across all areas of the strategy…. that road crash deaths in 2011 had reduced by 10 per cent relative to the strategy baseline period (2008–2010), with similar reductions for most of the strategy's key performance indicators. (This was despite an increase in the road toll figures for 2012, which instead of a reduction of 3%, nationally saw an increase of 1.9%, around 70 deaths and perhaps 1400 unnecessary serious injuries).
- December: The COAG communiqué is silent on road safety reform.

Some of these events were regular scheduled conferences, some were specifically arranged as a response to the Decade of Action and some were the initiative of parliamentary leaders. Many were valuable, but in many cases events were obviously unconnected and did not necessarily attempt to build on lessons promoted from earlier activities or events.

The UN Decade of Action has increased road safety event activity but limited coordinated action.

Analysis and recommended actions

Wegman's report to the South Australian Government recommends a list of actions for South Australia. While he encourages a more aggressive target for South Australia to achieve a similar road safety performance in line with Victoria, most of the actions proposed are local and he suggests should be coordinated by a new hierarchy of leadership and specialist committees, education and research programs.

The public events and activities listed above for Australia were basically independent. Actions recommended at the various forums, while perhaps linked to the overall NRSS, are often not part of the current SCOTI 59 point action plan. The NRSS, launched in 2011, has an action plan but no budget or agreed investment expenditure. It could be argued that the many Federal, State, professional and other bodies mentioned above individually have no option but to protect their own role to achieve the best resources for their own programs, rather than recognise and quantify the benefits of collaboration; i.e. efficiency, scale and hence less road trauma. The value or otherwise of Deegan's suggestion noted above for a national body of experts appears not be have been publicly tested.

It is instructive to consider the recommendations of the Wegman report for South Australia to inform a national work program. The report is current and reflects world best practice for improving road safety results. It is also useful in demonstrating where existing programs are overlooked, perhaps misunderstood or already poorly resourced. It would seem pointless limiting Wegman's recommendations to one state only.

In no specific order of importance, key areas for consideration are:

Research

Wegman recommends that the various professionals engaged in research should create conditions for successful implementation of solutions using a broad base of partnership. It suggests that their culture should be more 'results focused' and they should be more accountable for their performance. Road safety research, like any research will benefit from partnerships and scale. The recent example of the mining company Rio Tinto's approach to automated truck haulage for their iron ore operations is an excellent example of scale. Not content with their own research, or even the collegiate research available through the Australian Mineral Industry Research Association, Rio Tinto recognised they had to link up with five of the world's top mining centres (three Australian) and spent $125m over five years. Rio Tinto's annual iron ore revenue is in the order of $16bn; somewhat less than the estimated cost of Australian road trauma at $27bn.

Brian Schmidt, Australia's recent Nobel Prize winner has commented on the value of scale and international research partnerships in driving quality research. This should apply to road safety. Currently in Australia research funding is very competitive; perhaps rightly so. The CRC process does encourage some collaboration, but there has been no national attempt to assess whether competition in road safety research encourages innovation and efficiency or perhaps even discourages the scale necessary for innovation.

We have some good sources for road safety research such as the TAC Victoria, the ACT-NRMA Road Safety Trust, Austroads, the NHMRC, the ARC, IAG, the Automobile Association, other consumer groups and some business.

Vehicle manufactures, communication companies, road accessory equipment firms and others are investing heavily in new safety technologies but remain generally disconnected from each other, the funders mentioned above and governments. It is already recognised in the NRSS and from the May seminar that road safety research and incident data needs considerable improvement. Australia has no scaled plan or budget for these. A workshop coordinated by the ACRS and the NHMRC in February 2013 will attempt to establish a suitable mechanism.

Australia needs a national road safety research plan and national research budget involving government and industry, which should include national data bases of incidents and research, which has a focus on timely and practical results. We need the best facts and evidence, not opinions, to make a difference.

Technology

Wegman recommends creating a Safe System in which human errors are considerably reduced, if not eliminated. Car, truck and motorcycle manufacturers have already developed many new collision reduction or avoidance technologies, and the mobile phone manufactures are rapidly developing new apps which will also assist. These are being introduced into the Australian market at the whim of the manufacturers and in some cases at a rate behind markets in other countries.

ITS Australia in a recent submission to the Victorian Road Safety Strategy says: "Unfortunately the discussion paper (on the Draft Strategy) …does little to flag the significant potential for emerging technology as a lever to improve road safety. Over the next 10 years there will be a transformation in road transport, with a suite of new vehicle and transport technologies delivering a step change in safety."

The National Transport Council with a "Cooperative Intelligent Transport Systems Regulatory Policy Issues Discussion Paper" is currently canvassing regulation issues with assistance from ITS Australia; and a CRC for Safe and Sustainable Transport is currently under consideration by the Federal Government.

BHP Billiton has set a high bar as a major consumer of vehicles and roads; setting ANCAP safety standards which recognise many new safety-assist technologies for its own operations and for contractors. Importantly these are world-wide standards.

Apart from the ANCAP future road map which will reward early introduction of some of these technologies into new cars, and the possible ITS CRC, we have no national program which would see Australia as a leader in the introduction of these lifesaving and injury reducing technologies. No obvious national program seeks to integrate vehicle, road and communications technologies.

Australia needs an active plan and budget to facilitate the introduction of safety technologies.

Communication

Wegman encourages investing in further cooperation of stakeholders to orchestrate communication carefully, keeping every stakeholder aligned with their own responsibility, but having a general goal in mind: reducing the road toll. (Unfortunately some of the key professional groups such as the Australasian Institute of Traffic Planning and Management (AITPM), the Australasian College of Road Safety (ACRS) and others were overlooked by Wegman. In some ways this demonstrates the need for a broad based consortia factual approach. The need to include a wider range of interests, town planners, and health and community specialists to truly embrace a safe travel system is necessary). As ANCAP has learnt, communication of a simple message on safer cars, within a safe system model, is as important as the testing and assessment.

Wegman goes on to suggest the 'media' as stakeholders, to encourage a better road safety culture for drivers. In a safe system all players; transport geographers and urban designers, regulators, road builders, car manufacturers and pedestrians - not just drivers - need to have a better road safety culture. Reducing unnecessary road use itself can be beneficial to reducing the crash rate and hence related trauma. Blaming the drivers only, is unlikely to be productive in the longer term.

At present very few people understand the real implications of safe systems principles, and so the debate often continues to be hijacked by a focus on those drivers who break rules, and calls for personal responsibility, instead of an understanding of the many factors which contribute to crashes and admitting that many of these can be improved.

The lack of co-ordination of messages can be confusing for the community and may discourage any enthusiasm for system reform.

Convincing the people first of the benefits of what can be done with a coordinated, comprehensive campaign with all the current advocates for change working in unison, may well lead to encourage a new level of leadership from government, business and community groups to a safer road safety system.

Some sharing of government media programs occurs; but consumers increasingly have access through social media and the internet to national and international information. Some community and social programs touch on issues but generally operate within specific silos. Road safety professionals themselves have limited guidance on issues outside their own speciality. Marketing what can be done is as essential as knowing what can be done. Wegman's emphasis on a common goal extended across the all the various players is vital.

Australia needs a national road safety communications (and marketing) plan.

Leadership

Wegman recommends that real leadership is needed for this challenging task and recommends that for South Australia leaders such as the Premier, the Minister for Road Safety, the Cabinet and CEOs are all needed to achieve a successful result. Many others have made similar suggestions for leadership over many years. Perhaps it is time to ask ***"Why leave it to politicians?"***

There are already many groups as listed above active in trying to reduce road trauma. Why are they not effective? We have modal interest groups, capacity building organisations, non-government networks, a business partnership program at the National Transport Council, a National Infrastructure Council; many of whom were overlooked by Wegman and the National Strategy.

In the last decade no Premier, Prime Minister or Cabinet has taken a long term leadership road safety role. The current Governor-General and her predecessor have spoken out expressing concern, the addresses to the Parliament in 2012 by the Parliamentary Secretary and the Shadow Secretary were a positive initiative and individual State Ministers have also expressed concern; but the concept of major reform or leadership as a priority COAG topic appears elusive.

There are many other issues which take the leaders' interest. They, and the community have seen the real reductions in road trauma over the last 40 years (with up to 100,000 lives saved) and perhaps are not convinced that a similar result or better over the next 40 years is possible.

The existing road safety interest groups need to collectively agree and define simply and coherently what is possible. To date they have failed to do so. Wegman suggests a Safe Systems Task Force to operate for one year and a Technology Forum to nurture cooperation. While that may be an improvement on the current arrangements, why not encourage national partnerships of the existing groups (and longer term into international partnerships)? Why not make the existing parties responsible, why not encourage them to look for more wider partnerships and scale; who else will have the time to learn what is already known? Corporations are already taking actions; they can encourage other colleagues in similar industries or the service sector, such as insurers.

Political leadership may well follow when the current passionate and informed road safety groups demonstrate the potential of simple actions to make a difference.

Road safety groups themselves (government at all levels, business, researchers, and practitioners) need to collectively agree to an action program which builds national and international partnerships which leaders can join and promote.

New programs

Wegman suggests a Functional Road Classification and Hierarchy for South Australia which endorses a framework for establishing credible speed limits and which integrates road safety into other areas such as planning and design; health and education; plus identifies opportunities that exist with safe vehicles and safe technologies. While there are potential benefits in terms of short term gains from a State based approach, any such program should be national, just as vehicle safety assessment, education and enforcement. These programs should not be constrained by state borders.

Australia should build on existing, successful non regulatory programs such as AusRAP, ANCAP, and KEYS2DRIVE rather than start duplicate programs.

Economics

Wegman references a hierarchical road safety model in assessing the many factor impacts of road trauma. To fill in that model, to make it active and relevant we need an independent economy-wide assessment of road trauma as set out earlier in this paper. The current national government has not been convinced to undertake such an assessment using the Productivity Commission, perhaps confirming the failure noted above of the current groups' ability to convince their political leaders to step outside the transport sector and look across other sectors such as health, workplace safety, insurance, workplace and national productivity, for example.

We know the annual costs are at least $27bn pa and that an annual saving of $10bn is possible yet we have no comprehensive assessment of where those benefits will accrue to the Australian economy, no priority work program based on those benefits, and certainly no comprehensive national budget to achieve them. We need a new cohort of economic data first. We cannot expect 'political or other leaders' who already have life experience as users of the current road system, with the focus on the 'blame the driver model' and limited understanding of what the costs really are, to understand why an economy-wide assessment is necessary. (Equally they are unlikely to readily accept what is actually achievable. It hs been suggested by Infrastructure Australia Deegan that an analysis of various scenarios to effectively reduce duplication and get a more efficient use of current resources would be one possible approach, but this has not been actively publicly canvassed. Improving data collection, identifying opportunities for greater collaboration between jurisdictions and with non-government road safety entities was a recommendation from the May 2012 ARRB/ACRS Forum.

Road funding, industry support programs for vehicles, and communication technology support programs are major components of both Federal and State Budgets. Why are there programs which have no guaranteed road safety outcomes? Why are there not standard safety and modal use assessments for projects just as we have environmental assessments? New funds may not be required, but all current funds should be subject to a roads safety benefit analysis. International work has suggested up to 10% of road funding for example, could be set aside for specific road safety programs. Maybe we already do that, but we certainly do not report it, or even aspire to it.

Reducing road trauma should be assessed as a vital factor in the Australian national economy and a national budget set to ensure that reduction targets are met with safety targets included in all road infrastructure, vehicle and technology-related government spending.

What do we do for other similar problems?

It is difficult to make specific comparisons, but here are areas where a coordinated, national approach is being made to address issues where there is community concern.

Alcohol Misuse

The estimated cost of alcohol abuse by drinkers in Australia is $15.3 billion, as identified in a report published in 2008 by D.J. Collins and H.M. Lapsley. A landmark report in 2010 unearthed a new dimension in the national alcohol debate, for the first time identifying the cost of alcohol-related harms to those other than the drinker themselves. The newly identified $20 billion annual cost of alcohol's harm to others enabled the report's authors to estimate a new total annual cost of alcohol misuse in Australia. Through careful and comprehensive analysis of the report's findings and the extent to which they overlapped or added to the existing costs identified by Collins and Lapsley in 2008, the total cost of alcohol misuse in Australia was conservatively estimated as being $36 billion every year.

In 2001 the Australian Parliament established in 2001 the Foundation for Alcohol Research and Education with a $115 million grant.

Superannuation information for consumers

The Federal Government has recently announced it will provide $10 million over three years as a contribution to an investment fund, the earnings of which will be used to fund the on-going costs of a non-profit organisation with a primary focus on superannuation policy research and advocacy. The Government's contribution will be contingent on matching funding being provided by industry. Industry support for the centre provides an opportunity for the superannuation industry to demonstrate its commitment to ensuring that the interests of superannuation consumers are well represented in the development of reforms and will help to ensure that the centre is well resourced to perform this important role.

The Government has announced it will invite expressions of interest from the private sector.

Building cooperative and productive workplaces

A $3 billion Building Australia's Future Workforce package of funding was part of the May 2011 Budget. The Trade Union Education Fund received a grant of $11m in 2012 to establish a long term program of education and skills development to support cooperative and productive workplace relations that promotes national economic prosperity and social inclusion for all Australians. This was part of a $22m package of funding paid to The Union Education Foundation ($11m) and two employer organisations: Australian Industry Group ($5.5m) and Australian Chamber of Commerce and Industry ($5.5m).

The Green Car Fund

The Rudd government set up a Green Car Fund as part of its $6.2 billion car plan, which was unveiled at the depths of the financial crisis in late 2008, when the local car industry was on its knees. Up to $500m of Federal funding was offered for co-investment programs with car manufactures. While some of that funding was axed to fund flood relief, it demonstrates the potential size of funds available if the community is seen to demand it.

So where to for road safety?

A well-funded national long term action plan is needed to reduce road trauma with a safe systems factual approach, based on quality practical research, with a coordinated communications program, using existing road safety groups and programs, including an active plan and budget to facilitate the introduction of safety technologies across vehicles and infrastructure.

Critical cost effective assessment, international benchmarking, and a concerted effort to reduce duplication across the country will result in less deaths and less injuries.

There needs to be a recognition that road safety groups themselves (government at all levels, business, researchers, practitioners) can collectively agree to an action program which builds national and international partnerships which leaders can join and promote.

International studies, well researched recommendations (such as the Wegman report) all point to the value of national political leadership in road safety public policy. The transport system is a public good and on that basis alone, it can be argued that governments, including the Federal Government should make safety of the transport system a priority. Transport system productivity is hindered and impeded due to unnecessary trauma levels which must be a national concern. While the key role may be for governments, other groups such as the ACRS, 33900, AAA, ATA, Police, Research Institutes, other user and interest bodies and individuals working together will make a difference. New groups such as insurers should be encouraged to join in.

Collectively they could provide an independent contribution similar to that of the European Transport Council or the Insurance Institute of Highway Safety.

Road trauma should be assessed as a vital factor in the Australian national economy and a national budget which recognises the real scale of the problem set; to ensure that reduction targets are met. Safety targets should be included in all road infrastructure, vehicle and technology-related spending as well as in mobility planning. The scale of potential national savings of at least $10bn pa in 10 years or $55bn over the 10years will require a priority national COAG plan and perhaps a budget of at least $500m pa. An initial step to resource a Productivity Commission review and to fund a national coordination program of key parties is urgently needed. The benefits will be in lives saved and reduced trauma, savings to the health and legal systems and improved national productivity.

(The analysis and comment here is not intended to cover all activities and all those involved but are the key factors recognised by the author. While others have contributed, the views are his alone and not necessarily those of the road safety organisations with which he is associated.)

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By writing for the journal, you have the opportunity to contribute to the important exchange of views and information on road safety. Articles on any aspect of road safety are welcome and may be submitted as papers for the peer-reviewed section of the journal of as contributed articles. **Articles are now invited for issues in 2013**.

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Letters to the Editor and items for the News section will also be considered for publication; feedback or suggestions about journal content are also welcome. Please submit all articles/contributions to the Managing Editor at journaleditor@acrs.org.au.

Next issue: The next issue of The Journal, Vol 24 N 2 will be a Special Issue coinciding with the Second Anniversary of the UN Decade of Action and development of the National Road Safety Strategy. Articles are invited to celebrate, discuss or debate this issue, to be published in May 2013.

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