Vol 26 No 1, 2015

Journal of the Australasian College of Road Safety

Formerly RoadWise – Australia's First Road Safety Journal

Special Issue: Driver Behaviour

Peer-reviewed papers

- Young drivers' perceptions of road safety messages and a high performance vehicle advertisement: a qualitative exploration
- Review of contributing factors and interventions for dangerous driving
- A GPS-based examination of the mobility and exposure to risk of older drivers from rural and urban areas
- Effect of mobile phone use and aggression on speed selection by young drivers: a driving simulator study

Contributed articles

- Naturalistic driving study
- NSW Transport: Ride to Live
- Driver behaviour
- Creating a driver safety culture


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NSW GOVERNMENT
Transport for NSW

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Developed by road safety systems and engineering specialists LB Australia Pty Ltd *ImpactProtect* reduces the risk of serious injuries to motorcyclists and cyclists during an impact with a roadside post or pole.

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For the road safety industry this a unique, bespoke solution offering the engineer options, with layers of protection to ensure a level of safety appropriate for the site.

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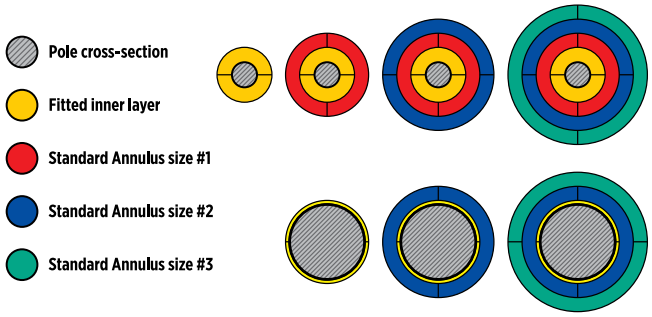

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2015 AUSTRALASIAN ROAD SAFETY CONFERENCE

Inaugural Conference - Call for Papers

ACRS - Austroads - CARRS-Q

On behalf of the Australasian College of Road Safety, Austroads and the Centre for Accident Research and Road Safety – Queensland (CARRS-Q), we are delighted to invite you to be part of the 2015 Australasian Road Safety Conference (ARSC2015) to be held at the Gold Coast Convention and Exhibition Centre, Queensland, Australia, from **Wednesday 14 to Friday 16 October 2015**.

The ARSC conference is the result of a successful merger of Australasia's two premier road safety conferences: the Australasian College of Road Safety Conference, and the Australasian Road Safety Research, Policing and Education Conference.

"This inaugural conference will bring a point of new emphasis. A progressive change to engage with a greater mix of stakeholders."

ARSC2015 recognises and encourages greater diversity in road safety solutions, by expanding the network of road safety stakeholders and advocates from our region and internationally in order to reduce road trauma. This wider focus will foster more diverse thinking, which has the flow-on effect of producing greater productivity. In terms of road safety, this increased productivity translates to saving families and communities so much of the trauma caused by road crashes.

To increase collaboration, presentations and contributions are encouraged from all sectors – government, community, corporations, emergency response, police, educators, research, manufacturers and business (to name a few) – responsible for road safety.

Abstracts Open for Submission on February 20 and Close on May 15

Register | Submit an Abstract | Sponsor or Exhibitor

February 20 - May 11

http://australasianroadsafetyconference.com.au

2015 AUSTRALASIAN COLLEGE OF ROAD SAFETY AWARDS

ARSC2015 will include the Australasian College of Road Safety Awards, recognising and celebrating exemplary projects and people working so hard across our region to save lives and reduce injuries on our roads.

The 2015 Australasian College of Road Safety Awards will continue the tradition of the original Australasian conferences by recognising and celebrating exemplary projects and people working hard across our region.

These awards will include the following presentations:

- The prestigious Australasian College of Road Safety Fellowship Award in recognition of an exemplary contribution being made by an individual to road safety in Australasia.
- Australasia's premier road safety award recognising projects that exhibit exemplary innovation and effectiveness to save lives and prevent injuries on roads – the 3M-ACRS Diamond Road Safety Awards.
- ARSC2015 Conference Awards
- Other awards as deemed appropriate by the joint hosts for 2015: ACRS, Austroads and CARRS-Q.

We look forward to bringing you more information about the awards shortly. Most importantly we encourage your participation at this important event, which recognises our outstanding individuals, organisations and projects as we all strive to reduce road trauma.

More information is available at:
http://theaustralasianroadsafetyconference.com.au

To join the mailing list contact: eo@acrs.org.au

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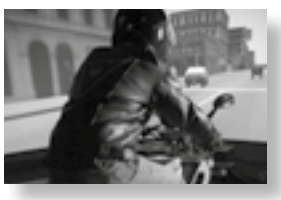

Cover image

An advanced driving/riding simulator used by researchers at the Monash University Accident Research Centre (MUARC) provides data which over many years has contributed to the understanding of road safety issues in key areas, including young driver training programs; driver distraction; drugs and alcohol; in-vehicle design; and vision impairment studies. Image provided by MUARC.

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Editorial Policy
The aim of the *Journal of the Australasian College of Road Safety* is to provide a medium for expression of views and debate on all facets of the study of road safety. Articles are accepted from a variety of disciplines, such as health and medicine, road and automotive engineering, education, law, behavioural sciences, communication, history, management, and urban and traffic planning. Interdisciplinary approaches are particularly welcome.

The College encourages interested persons and organisations to submit articles, photographs or letters for publication. Published letters would normally show the name of the writer and the state or territory of residence. The journal provides the opportunity for researchers to have their work submitted for peer review, in order to improve the quality of their research papers. However, peer review cannot guarantee the validity of research nor assure scientific quality. The publisher reserves the right to reject submissions or, with approval of the author, to edit articles. No payment is offered for articles published.Material in this journal may be cited with acknowledgement of the full reference, including the author, article title and the year and volume of the journal. For permission to reprint articles, please contact the Journal Managing Editor.

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ACRS office contact details
Submissions to the journal, and any queries or comments about journal content, should be addressed to the Managing Editor. Inquiries regarding journal subscriptions, changes of address and back issues should be addressed to the Finance and Administration Officer.
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From the President

Dear ACRS members,

This edition of our Journal has a focus on driver behaviour. This continues our contribution to the UN Decade of Action on Road Safety program, as "enhancing the behaviour of road users" is one of the five key pillars of proposed action.

Our roads are used by everyone, for a wide range of purposes, from street parties to rights of way from one part of the world to another.

As bus passengers, goods users and residents we have a very passive interest in an effective and safe road system. As pedestrians and cyclists we have a more active interest while as vehicle users we have a more deliberative role. Being skilled to take that role safely occupies a very large component of road safety research and practice.

Young drivers, older drivers, dangerous drivers, distracted drivers, good drivers, bad drivers have become part of our lexicon descriptions as we try to compartmentalise and understand how to reduce crash rates though specific targeting of programs for those many classes of drivers.

New data monitoring technologies are making it easier for us to collect an enormous amount of data on driver behaviour and actions with "naturalistic" studies. The results of these will help us not only develop a better focus for driver training, but also a better understanding of exactly what features are necessary to develop vehicles which will be easier to operate safely and even be able to operate safely irrespective of the type of driver. They will of course have to operate safely with the other road users. I noticed recently a new bicycle in the UK equipped with electronic collision warning devices. (As a pedestrian in Europe recently I wish I had had such a device for helping me determine which side of the pedestrian walkway I should walk on safely!)

Bringing together all road users to discuss and develop further actions towards safer roads in this Decade of Action will be a key focus of the program for the Australasian Road Safety Conference in October at the Gold Coast this year. This Conference is the result of the merger of the Road Safety Research, Policing and Education Conferences and the ACRS Conferences held previously. Working together we expect will increase our reach to a wider community.

I hope you as a reader will be able to join us at the Conference and I encourage you to invite your colleagues to participate as well.

Lauchlan McIntosh AM FACRS
ACRS President

Diary

15-25 March 2015
Safer Roads by Design: Across Six Continents
IRF Certified Training Executive Seminar,
Grand Millennium Hotel,
Kuala Lumpur, Malaysia
https://www.irfnews.org/event/safer-roads-by-design-1503/

19-21 March 2015
Trucking Australia 2015
Grand Chancellor Hotel, Hobart, Tasmania
http://www.truck.net.au/public/trucking-australia

23-26 March 2015
9th International Conference on Managing Fatigue
Esplanade Hotel Fremantle
http://www.fatigueconference2015.com.au/index.html

24-25 March 2015
Australian Road Engineering and Maintenance Conference
Australian Technology Park, Sydney
http://www.lgnews.com.au/10th-australian-road-engineering-maintenance-conference-2015

14-15 April 2015
Australasian Fleet Management Conference
Melbourne Convention and Exhibition Centre, Melbourne
http://www.afma.net.au/eventsinformation/2015-australasian-fleet-conference-exhibition

4-7 May 2015
IRF A Regional Conference for Asia and Australasia 2015
http://www.roads.org.au/conference2015

28-31 July 2015
AITPM National Traffic and Transport Conference
Brisbane Convention and Exhibition Centre, Brisbane
http://www.aitpm.com.au/Conference/About-Conference

6-8 October 2015
Road Safety and Simulation International Conference
Orlando Florida, United States
http://stc.utk.edu/STCevents/rss2015/

14-16 October 2015
Australasian Road Safety Conference
Gold Coast Convention and Exhibition Centre, Queensland
http://australasianroadsafetyconference.com.au/.

College news

Head Office news

Chapter reports

ACT and Region Chapter

In our last report, the ACT and Region Chapter outlined its program for the rest of the current fiscal year. As with many plans, things keep changing and we have needed to adapt.

In the ACT there has been a change of Chief Minister and in the ministerial responsibility for road safety. The Government has also announced that the NRMA-ACT Road Safety Trust will cease operations and there will be one last funding program. The Chapter has relied on financial support from the Trust over the years, but we had realised that we would need to seek alternative support in due course.

The ACT Government is yet to announce what alternative arrangements will be introduced to assist road safety programs in the Territory. We are hopeful that any new arrangements will enable the Chapter to seek moderate levels of support.

The Motorcycle Safety seminar, ***Whose responsibility is it?*** held on 22 October 2014, was very successful and around 50 people attended. This was a joint initiative with MRA ACT and we were grateful for their cooperation.

The outcomes of the seminar will be fed into the community views on how to implement the ACT Government's response to the recommendations of the Vulnerable Road User report on motorcycle safety initiatives.

The ***Vulnerable Road User Forum*** which the Chapter is organising for the ACT Justice and Community Safety Directorate (JACS) has been rescheduled to 18 February 2015, subject to agreement of the new Minister. Our National Vice President, David Healy, has generously agreed to moderate the proceedings of the Forum. We are hoping that the Forum may provide a base for ongoing joint activities of this nature with the ACT authorities.

The first Annual Road Safety Seminar (in conjunction with the ACT Government) is scheduled for May 2015.

The remaining activity for the current year is the Communications Seminar as part of the ACRS national series of seminars – to be announced later in 2015.

Finally, the Yass Valley Council, which is an active member of the Chapter, is running ***You Don't have to be speeding to be driving too fast on country roads*** campaign launched by the Yass Valley Council prior to Christmas 2014. It has been designed to address the problem of speed crashes in the Yass Valley Council region.

The project is a great example of what can be achieved by cooperation. Yass Valley Council participated in the Chapter's May 2013 Seminar, "Trauma on ACT and surrounding NSW roads". The council then built on studies undertaken by the NRMA-ACT Road Safety Trust on crashes involving ACT drivers in regions outside the Australian Capital Territory. The Trust is assisting in funding the campaign.

Melissa Weller, the Council's RSO, has been keen to encourage regional cooperation for the initiative. She has obtained the support of surrounding road safety officers, the NSW Police Service, and the ACT Justice and Community Safety Directorate, plus ACT Policing. If the trial proves successful, she hopes other Road Safety Officers in New South Wales may want to introduce it into their areas.

Keith Wheatley, ACT and Region Chapter Secretary

Victorian Chapter

Happy New Year! The Victorian Chapter is very excited to welcome 2015 and to bring to our members a range of interesting and exciting road safety seminars on a diverse range of topics. Planning for our first seminar of the year is underway so stay tuned for more information. The Chapter is always open to new ideas and hope to increase our membership base and would welcome people to come and join our growing committee! We wish everyone a very happy and safe 2015 and look forward to working with you to move towards our goal of zero deaths and serious injuries on our roads.

Jessica Truong - Chair, Victorian Chapter

Other news

2014 ACRS Awards

The Australasian College of Road Safety (ACRS) Fellowship and 3M-ACRS Diamond Road Safety Awards were presented by the ACRS Patron, the Governor-General of Australia, His Excellency Sir Peter Cosgrove.

The College was delighted that our Patron, the Governor-General of Australia Sir Peter Cosgrove AK MC, was able to join us in celebration of excellence in road safety, and to present the 2014 ACRS awards at a Cocktail Reception held on Thursday 13 November at the Grand Hyatt, Melbourne.

Over 250 of Australasia's foremost road safety professionals and advocates were present to hear the Governor-General make an introductory speech emphasising his support for the work of the College and our supporters and members, in particular commending us all on our commitment to ending this 'innocent war on our roads'. Photographs from the evening and links to the YouTube video of the Governor General's speech are available from the ACRS website.

The highlight of the evening was the presentation of the prestigious 2014 ACRS Fellowship to an outstanding road safety professional and advocate, Mr Iain Cameron, followed by the 3M-ACRS Diamond Road Safety Awards; with the major prize being taken out by the Amy Gillett Foundation.

2014 ACRS Fellowship Awarded to Iain Cameron

The Fellowship Award is in recognition of an exemplary contribution made by an individual to road safety in Australasia. The College first instituted the award of Fellow in 1991 to enable colleagues and co-workers to nominate someone who is outstanding by virtue of contributions to road safety, rather than position. The contributions must be of such a nature that they have led to substantial growth and improvement in an important institution or organisation, body of knowledge or aspect of thought and practice associated with road safety.

In detailing the award, ACRS President Mr Lauchlan McIntosh AM, said "Iain Cameron has been a leader in road safety management in Western Australia. He was instrumental in what was an innovative approach, the Towards Zero 2008-2020 Road Safety Strategy; effectively reducing road trauma. He has been an active professional and an ambassador in developing similar strategies across Australasia and the OECD."

Mr Cameron has for over 15 years led the Office of Road Safety in Western Australia. He championed the Towards Zero approach which is the focus for the Western Australia's road safety strategy for 2008-2020. WA was the first State to adopt the Vision Zero approach.

Iain then oversaw the Main Roads WA Road Safety Strategy 2011-2015 "The Road Towards Zero – No more death or serious injury on our roads". In 2013, compared to baseline 2005-2007, WA has achieved a 19.5% drop in fatalities and a 19% drop in people killed or seriously injured. This represents 161 deaths in 2013 compared with 235 in 2007.

Mr Cameron is a significant contributor as an Independent Director on the Board of the Australasian New Car Assessment Program (ANCAP) and also the WA Road Safety Council; and Chairs the Austroads Safety Taskforce, managing research and policy development for Ministers nationally.

ACRS President Lauchlan McIntosh, His Excellency Sir Peter Cosgrove and ACRS Fellow Iain Cameron

From Left: ACRS President Mr Lauchlan McIntosh; the Governor-General of Australia, His Excellency Sir Peter Cosgrove; Tracey Gaudry (CEO - Amy Gillett Foundation) and Mr Marino Mystegniotis (General Manager – 3M ANZ Safety and Graphics Business Group, 3M Australia)

Iain has recently been recognised for his long term international road safety work, accepting the role of Chair of the Organisation for Economic and Co-operation Development's (OECD) Working Group on Safe System Implementation.

With this award, Iain now joins an elite group of eminent road safety professionals who have been recognised with the honour of an ACRS Fellowship.

3M-ACRS Diamond Road Safety Awards

The 3M-ACRS Diamond Road Safety Award, recognising projects with exemplary innovation and effectiveness to save lives and injuries on roads, has been awarded to the Amy Gillett Foundation (AGF).

ACRS President, Mr Lauchlan McIntosh AM, said "the winner this year, like our previous winners, demonstrates an effective and innovative approach to a complex issue – cycling safety. The AGF offers collaborative solutions, with a concept which can be used by other road users. Reducing unnecessary road trauma needs many solutions such as those offered so competently by the AGF. The 3M-ACRS Diamond Awards recognise so many features of such solutions."

Judges considered the specific features of the many projects submitted, particularly in terms of innovation in thinking and technology, problem-solving as well as the real benefits in reducing trauma. Cost-effectiveness and transferability to other areas were other key criteria.

Finalists for this hotly-contested award came from many areas. These included new ideas and actions from local and state government groups, collaborative programs led by local and regional police groups, individuals passionately pursuing specific projects to reduce risk, industry associations and transport companies implementing programs with targets to ensure safe operations, news programs, and specific education for specialist groups. These are just a few examples of the successful projects awarded as Finalists (18 in total) and Highly Commended (3) winners this year.

2014 Highly Commended Winners

"Speed Adviser"
Transport for NSW
Team Leader: **John Wall**

"Road Safety – A core element of planning"
Wyong Shire Council
Team Leader: **Adam Mularczuk**

"Our safety vision is to be world-class in safety"
FBT Transwest Pty Ltd
Team Leader: **Cameron Dunn**

Tracey Gaudry, CEO of the Amy Gillett Foundation stated "It is an honour for the Amy Gillett Foundation to be recognised with the 3M-ACRS Diamond Road Safety Award for 2014. We are delighted to accept this award for innovation in road safety for Cycle Safe Communities, our online resource that provides bike rider safety campaigns to the community."

"In Australia we need direct action to improve safety for everyone when they ride their bike; greater awareness and education about how to share roads with people riding bikes can make a tangible difference. The recognition of 3M Global and the Australasian College of Road Safety, is confirmation that the safety of our community that is embracing bike riding for transport, fitness and leisure, is an important priority."

"The 3M-ACRS Diamond Road Safety Award 2014 provides us with an opportunity to share the Amy Gillett Foundation's work in support of our collective vision for zero road fatalities."

Since 3M first pioneered the world's first retro-reflective sheeting 75 years ago, 3M has remained at the leading edge of traffic safety innovation worldwide. Their commitment to improving, protecting and saving lives extends far beyond the products and technologies. 3M are a company driven by the passion to improve every life through their unique approach to innovation.

Mr Marino Mystegniotis, General Manager 3M Safety, says "This 3M-ACRS Diamond Road Safety Award is modelled on that process – creating an environment where innovative ideas can come together, be shared, collaborated, celebrated, and most importantly, replicated in other regions or capacities to make a much bigger impact on road safety."

The team leader from the winning project will travel to the USA to attend and present their project at America's largest road safety conference in Tampa, Florida, and 3M Headquarters in Minnesota to learn about 3M's innovation in road safety.

2014 Finalists

"'At the end of the road' (broadcast 1 Dec 2013) and 'The explosive risk of fuel tankers' (broadcast 16 Feb 2014), both for ABC Radio National's 'Background Briefing' program, plus associated articles"
ABC Radio National
Team Leader: **Ann Arnold**

"Advocating for improvements in Australian school bus safety standards"
Independent advocate
Team Leader: **Leon Hain**

"Truckies Lighting Up For Safety Gippsland"
VicRoads
Team Leader: **Alan Pincott**

"Central Region Road Safety Week 2014"
Queensland Police Service
Team Leader: **Assistant Commissioner Mike Condon**

"Kindy Kits"
Bathurst Regional Council & Blaney Shire Council
Team Leader: **Iris Dorsett**

"Crash Scene Investigation – Road safety education down to a science"
South Australia Police
Team Leader: **Sgt John Illingworth**

"Safety Truck - the trucking industry's road safety exhibition"
Australian Trucking Association
Team Leader: **Steve Power**

"Victoria Police Road Safety Strategy 2013-2018"
Victoria Police – Road Policing Command
Team Leader: **Assistant Commissioner Robert Hill**

"The evolution of the 'Joint Heavy Vehicle Taskforce' in addressing speeding practices by transport operators in NSW and across Australia"
NSW Police Force – Traffic & Highway Patrol Command
Team Leader: **Assistant Commissioner John Hartley**

"MARSS Learn to Drive Program"
Migrant & Refugee Settlement Services
Team Leader: **Dewani Bakkum**

"Educating the community & raising awareness - court ordered /traffic offenders"
Road Trauma Support Services Victoria
Team Leader: **Gillian Scaduto**

"BetterDriver Project"
Road Safety Education Ltd
Team Leader: **David Murray**

"Supabrite LED enhanced road signs"
Hi-Vis Signs & Safety
Team Leader: **Brett Watson**

"Review of Default speed limits on City of Wanneroo Roads"
City of Wanneroo
Team Leader: **Ryan Gibson**

"Improving pavement markings - durability and retro-reflectivity"
City of Salisbury
Team Leader: **Jarred Collins**

"Yellow Ribbon National Road Safety Week"
Safer Australian Roads and Highways Inc
Team Leader: **Peter Frazer**

"Specifying 3M material to be used on new trains"
Caligraphics
Team Leader: **Wayne Preston**

"Road Policing Command: innovative strategies to reducing road trauma and offending behaviour on the road network"
Queensland Police Service
Team Leader: **Assistant Commissioner Michael Keating**

2014 ACRS Award Ceremony

Thursday 13 November 2014 – Grand Hyatt, Melbourne

With the ACRS Patron - The Governor General of Australia His Excellency the Honourable

SIR PETER COSGROVE AK MC

Highlights from the 2014 Australasian Road Safety Research, Policing and Education (ARSRPE) Conference

Held in Melbourne in November the ARSRPE conference was attended by over 400 delegates from Australasia and internationally. The theme was inspired by the Nelson Mandela quote 'It always seems impossible until it's done' and was largely in reference to the goal of achieving zero deaths and serious injuries on our roads. Some of the key highlights were:

- A video welcome message from Zoleka Mandela, granddaughter of Nelson Mandela, to encourage delegates to take action and make a difference in road safety;
  Keynote presentation from Georgie Harman, CEO of BeyondBlue on the journey of awareness raising of anxiety and depression and how we can learn from other health fields on how to overcome challenges to achieve our goals;
- A lively panel discussion facilitated by Virginia Trioli, co-host of ABC TV's News Breakfast, on 'What can Australasia learn from other fields to achieve the seemingly impossible goal of zero road deaths and serious injuries'. Discussions from the session certainly confirmed that the goal is very possible provided we show brave and strong leadership and take the right actions when the opportunities arise;
- Keynote presentation from Dr Peter Sweatman, Director of the University of Michigan Transportation Research Institute, about the world's largest deployment of connected vehicles in Ann Arbor. Peter gave delegates a taste of what the future holds and what we need to start preparing for these changes and;
- A very entertaining and informative debate from leading road safety professionals on whether we will achieve zero deaths and serious injuries on Australasia's roads in our lifetime. Both teams did a fantastic job and certainly gave delegates food for thought on the enablers and barriers to achieving this goal.

Congratulations go to the winners of the conference awards: Chris Jurewicz, ARRB (Peter Vulcan Award for Best Research Paper); Paul Graham, New Zealand Transport Agency (Road Safety Practitioner's Award); Cassandra Gauld, CARRS-Q (John Kirby Award for Best Paper by a New Researcher); and Paul Durdin, Abley Transportation Consultants (Road Safety Poster Award).

2015 Australasian Road Safety Conference (ARSC)

For 2015 the inaugural ARSC conference will be held as the result of a successful merger of Australasia's two premier road safety conferences: **The Australasian College of Road Safety Conference;** and **The Australasian Road Safety Research, Policing and Education Conference**.

The Australasian College of Road Safety, Austroads and the Centre for Accident Research and Road Safety – Queensland (CARRS-Q) are inviting participation in the 2015 Australasian Road Safety Conference (ARSC2015) to be held at the **Gold Coast Convention and Exhibition Centre, Queensland, Australia, from Wednesday 14 to Friday 16 October 2015**.

ARSC2015 is a direct response to the United Nations call for a Decade of Action on Road Safety. The conference will deliver research results, showcase innovative solutions, and provide educational and networking opportunities across disciplines in all five pillars of the United Nations call for a Decade of Action on Road Safety:

Improving road safety management - building capacity and collaboration across all sectors; Safer roads; Safer vehicles; Safer road users; and Improving post-crash care.

ARSC2015 will be hosted by the Queensland Chapter of the ACRS, and will be chaired by Professor Narelle Haworth from CARRS-Q. Professor Haworth is widely recognised for her outstanding contribution as an internationally renowned researcher in the road safety field, and for her major contribution as a policy advisor at the state, national and international levels.

"This inaugural conference will bring a point of new emphasis. A progressive change to engage with a greater mix of stakeholders."

With this united aim to increase collaboration, presentations and contributions are encouraged from all sectors – government, community, corporations, emergency response, police, educators, research, manufacturers and business (to name a few) – responsible for road safety.

The conference will include the inaugural **Australiasian College of Road Safety Awards**, recognising and celebrating exemplary projects and people working so hard across our region to save lives and injuries on our roads.

Austroads, CARRS-Q and the ACRS look forward to your participation in this important event which aligns with international, Australasian and national road safety efforts, and is a significant step forward in Australasia's road safety strategy.

More information is available from http://australianroadsafetyconference.com.au

Certificate of appreciation awarded to ACRS from the Safer Australian Roads and Highways (SARAH) group

Safer Australian Roads and Highways (SARAH) Inc. is a not-for-profit incorporated association with the mission to promote initiatives that will bring about improved road safety, as well as support those affected by road tragedy.

From left: ACRS President, Lauchlan McIntosh, ACRS Executive Officer Claire Howe and SARAH President, Peter Frazer

The research started as a result of the Hume Highway crash of 15 February 2013 and from that research, the foundation for the group's actions became a Vision Zero Initiative. The group is committed to promoting the "Vision Zero" Road Safety philosophy as an instrument for improved road safety.

The College was fortunate to receive a visit from Peter Frazer, President of the Safer Australian Roads and Highways (SARAH) organisation to be presented with a certificate of appreciation for the support of Yellow Ribbon Road Safety Week. This annual event coincides with the UN Road Safety Week in May each year, and all are encouraged to continue to coordinate activities in support of Yellow Ribbon Road Safety Week. Go to http://www.sarahgroup.org/ for more information.

Australian Road Safety Award for Road Accident Action Group (RAAG)

In November 2014 the RAAG project "33900: Peak Downs Highway Decade of Action" took out the Australian Road Safety Award. The judges liked the scope and achievements of the project too, with RAAG also awarded the national "Community Programme Award" presented by Kia.

The Peak Downs Highway Decade of Action included RAAG's education campaigns of: Lights on and Live; Stock on Roads; Headlights and Responsible use of Foglights; and Distractions, plus the 3 2 1 Reflector Project; Rest Areas and Stopping Project and other actions including the Eton Range, Walkerston By-pass and Nebo Road Safe September.

Road Safety Coordinator Graeme Ransley said that "exposure by winning this award can only trigger the challenge of how we can engage with motorists to change their driving behaviour for the benefit of themselves and their families. Everyone can then work together to reduce road crash trauma in the Bowen Basin."

More information on the 33900 Peak Downs Highway Decade of Action initiative or any of RAAG's road safety campaigns is available from www.raag.com.au.

Receiving the Community Programme Award at the Australian Road Safety Awards. Left to right: Graeme Ransley, Cr Chris Bonanno, Brett Hoskin, Mick Doohan and Carol and Ian Single.

TRANSPORT AND INFRASTRUCTURE COUNCIL

NATIONAL ROAD SAFETY ACTION PLAN 2015–2017

The Action Plan outlined in this document is intended to support the implementation of the *National Road Safety Strategy 2011–2020* (NRSS). It addresses key road safety challenges identified in a recent review of the strategy (NRSS Review) and details a range of priority national actions to be taken by governments over the three years 2015 to 2017.

The Action Plan was developed cooperatively by Commonwealth, state and territory transport agencies, and was endorsed by Ministers of the Transport and Infrastructure Council in November 2014. It does not replace the broader 10-year agenda of the NRSS, but will help to ensure that national efforts in the next three years are focused on strategically important initiatives.

November 2014

Summary of actions

Prioritising our investments in infrastructure

1. Prioritise and treat high-risk rural and urban roads, focusing on the main crash types and vulnerable road users.
2. Assess road safety risk on state and territory controlled roads carrying the highest traffic volumes.
3. Review road infrastructure safety programmes to establish best practice processes for identifying, prioritising and developing projects based on fatal and serious casualty reduction criteria.
4. Establish an assessment framework and training package to help translate current Safe System infrastructure knowledge and research into practice.
5. Apply national willingness-to-pay values for infrastructure investment and other road safety project appraisals.

Improving the safety of our vehicle fleet

6. Mandate pole side impact occupant protection standards for new vehicles.
7. Mandate anti-lock brake systems for new motorcycles.
8. Mandate electronic stability control (ESC) for new heavy vehicles.
9. Promote the market uptake of new vehicle technologies with high safety potential.

Encouraging safer road use

10. Strengthen speed compliance provisions in the Heavy Vehicle National Law (HVNL).
11. Implement measures to improve heavy vehicle roadworthiness.
12. Expand the application of lower speed limits in areas with high pedestrian and cyclist usage.
13. Implement programmes to build community understanding and support for effective speed management measures.
14. Continue to review and adjust alcohol interlock programmes to improve their effectiveness in addressing convicted drink driving offenders.
15. Strengthen national police enforcement operations to improve road safety compliance.

Advancing the Safe System

16. Establish an operational framework to enable the introduction and operation of Cooperative Intelligent Transport System (C-ITS) safety applications in Australia.
17. Implement and promote a range of Safe System demonstration projects in urban settings, with a focus on the safety of vulnerable road users.
18. Encourage private sector organisations to implement best practice fleet and workplace safety policies.
19. Examine and progress options to improve measurement and reporting of non-fatal and disabling injury crashes, particularly through the development of matched crash and hospital database systems.

The action plan is intended to focus national efforts on activities that will deliver or support significant long-term improvements to the safety of Australia's road transport system, especially through strategic investment in infrastructure safety, vehicle safety and capacity building work.

The new action plan can be downloaded at: http://www.transportinfrastructurecouncil.gov.au/publications

Peer Review Papers

Young drivers' perceptions of road safety messages and a high performance vehicle advertisement: a qualitative exploration

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Abstract

While road safety messages that focus on physical threats have shown some effectiveness, messages that include social threats and gains/rewards may be an alternative approach to encourage safer driving behaviours. In addition to message frame and type, motor vehicle advertising exposure may also influence the persuasiveness of road safety messages. Using qualitative methods this preliminary study explored young drivers' (N = 17, 11 males) perceptions of the persuasiveness of four anti-speeding messages and a fictional high performance vehicle advertisement. The majority of males perceived the social loss/gain-framed messages to be more persuasive (sense of responsibility and personal relevance themes), whereas females tended to perceive the physical loss/gain-frame messages (social esteem theme) to be more persuasive. Males appeared to be, while females appeared not to be, persuaded by the vehicle advertisement. The findings suggest that a range of road safety messages may be required to reach and influence young drivers.

Keywords

Message design, Motor vehicle advertising, Persuasion, Road safety advertising, Speeding behaviour, Young drivers

Introduction

Individuals are exposed to a wide range of health messages and product advertisements that may contain conflicting information cues. While health messages aim to persuade individuals to adopt healthier attitudes, intentions and ultimately behaviours [1], commercial advertisements are designed to promote and encourage consumers to purchase products. Speeding behaviour is one prevalent health issue that has been addressed in health messages (i.e., anti-speeding messages that aim to prevent speeding behaviour) and implied within motor vehicle advertisements (e.g., advertisements that promote high performance vehicles). While previous research has reported that some motor vehicle advertisements contain unsafe driving practices [1, 2], limited research has explored the impact that exposure to such advertisements may have upon the persuasiveness of road safety messages and, ultimately, safer driving behaviours, within the same study. As such, this preliminary study explored the first key issue of investigating mixed advertising cues by using qualitative methods to explore young drivers' thoughts and feelings towards a range of anti-speeding messages, differing in frame (gain versus loss) and type (physical versus social), and towards a high performance vehicle advertisement.

Young drivers are more susceptible to being involved in road crashes compared with older age groups [4]. Representing only 13% of the total driving population, in 2013 young drivers accounted for 19% of all driver related fatalities on Australian roads [5]. Risky driving behaviours contribute to the majority of these crashes and speeding in

particular, accounts for approximately 25% of all fatalities [6]. Evidence suggests that speeding contributes to both the frequency as well as the severity of injuries sustained if a crash occurs [7]. While individuals acknowledge that speeding contributes to road crashes [8], drivers still continue to engage in this risky behaviour. For instance, Fleiter and Watson [9] reported that speeding was viewed as an unacceptable driving behaviour by approximately two-thirds of their sample of 320 Australian drivers; however, of those respondents, 58.4% reported speeding in 100km/hr zones and 34.4% reported speeding in 60km/hr zones. Previous research has also found that young drivers may underestimate their susceptibility to, and severity of, speed related crashes and, thus, are more likely to participate in this behaviour [10, 11]. In an attempt to counter such attitudes and encourage drivers to adopt safer driving behaviours, including obeying the speed limits, various countermeasures such as road safety messages, are implemented.

Road safety messages

Australian road safety campaigns typically use threat appeals, that is, loss-framed messages that typically focus on physical injury, to encourage safer driving through emphasising the negative consequences of speeding behaviour [1, 12]. While evidence is mixed regarding the effectiveness of threat appeals [13], additional factors, such as personal relevance [14], pre-existing attitudes [15] and individual differences such as gender [16], have been found to influence the relationship between threat appeals and message persuasion. More recently, there is growing evidence that gain-framed messages (i.e., messages that focus on the positive consequences of not performing a particular behaviour or performing the alternative, 'safe' behaviour; [17]) may be an alternative option to persuade young drivers to adopt safer driving behaviours [18, 19].

Road safety messages can be categorised by message type; for instance, physical versus social [17]. In terms of anti-speeding messages, physical loss-frame messages may highlight the physical injuries sustained in the event of a crash due to speeding, while social loss-frame messages may focus on the social disapproval that one may experience by not obeying the speed limit. Alternatively, both physical and social messages can be framed to represent gains (e.g., preventing injuries for physical gain-frame messages or receipt of approval for social gain-frame messages).

Past research has found that males and females respond differently to road safety messages by theme/threat type [16, 19, 20]. For instance, compared to male drivers, female drivers are more persuaded by road safety messages that contain physical threats [16, 20]. In contrast, male drivers may be more persuaded by road safety messages that consist of social threats and/or gains [15, 19]. As such, a range of both physical and social threat anti-speeding messages may need to be implemented to persuade both males and females to comply with the speed limits.

Conflicting message cues

Adding to the complexity of the persuasion task, road safety messages must compete with a wide range of other advertisements, some of which may be considered as containing conflicting information, such as high performance motor vehicle advertisements. While there is limited evidence linking exposure to motor vehicle advertisements and subsequent engagement in risky driving behaviours [21], at the least it is arguable that exposure to high performance vehicle advertisements that contain unsafe driving practices may potentially influence (counter) the persuasiveness of road safety messages through presentation of conflicting cues about driving behaviour.

Drawing upon evidence from the alcohol-related advertising context (i.e., the negative effect that alcoholic beverage commercials have on anti-drinking messages; [22, 23]), motor vehicle advertisements may have a negative (countering) influence on the persuasive effects of road safety messages and subsequently, safer driving behaviours. For instance, Austin et al. [23] had participants watch five promotional alcohol commercials and five anti-drinking messages. Participants who reported higher levels of alcohol consumption perceived the anti-drinking messages to be less effective (in terms of persuasiveness) and the promotional alcohol commercials to be more effective than those who reported lower levels of alcohol use. Thus, these findings may suggest that alcohol promotional commercials could potentially influence drinking behaviour, particularly for those higher risk individuals. Consequently, counter advertisements (i.e., health messages designed to counter the potential negative effects of a promotional commercial; [24]) have been developed in the alcohol industry to raise awareness and educate consumers about the potential negative health consequences associated with alcohol consumption.

Since road safety messages exist in a similar environment in terms of competing information cues delivered via some types of motor vehicle advertising, research is needed to understand more about not only the influence of different types of road safety messages but, also the potential counter, mixed cues effects introduced by conflicting messages such as motor vehicle advertisements. Thus, the current study, along with providing insight into the manner in which young drivers respond to different types of road safety messages, also explores young drivers' perceptions towards a promotional vehicle commercial after viewing four anti-speeding messages.

Motor vehicle advertisements

Codes of Practices have been introduced in many counties worldwide to restrict the content that can be presented in motor vehicle advertisements. Indeed, these Codes of Practices were implemented due to concern that exposure to promotional vehicle advertisements that contained illegal and/or unsafe driving practices may have a negative influence on drivers' road behaviour [25]. In Australia, the Advertising for Motor Vehicles Voluntary Code of Practice

governs the content that can be shown in motor vehicle advertisements [26]. For instance, this Code of Practice states that motor vehicle advertisements are unable to promote illegal driving behaviours or show individuals driving in an unsafe manner, such as speeding behaviour.

Since the introduction of the Advertising for Motor Vehicles Voluntary Code of Practice in 2002, motor vehicle advertisements that directly promote performance based behaviours, such as acceleration and speed, have significantly decreased [25]. However, recent research has shown that some vehicle advertising campaigns indirectly promote these risky driving behaviours [2, 27, 28]. Donovan et al. [2] presented participants with two (of three) motor vehicle advertisements that had been previously shown on Australian television. Approximately two thirds of the respondents perceived the advertisements to be promoting unsafe driving behaviours, such as speeding behaviour. Similarly, Redshaw [28] found that some of the young driver participants (18-25 years) perceived a vehicle advertisement televised in Australia as promoting reckless and irresponsible driving behaviours. Thus, despite the existence of the voluntary adherence Code of Practice, some recent Australian vehicle advertisements are still perceived by consumers to promote risky driving behaviours, including speeding.

The present study

The aims of the present study were two-fold. As limited research has focused on participants' reactions towards a range of message concepts that all focus on the same driving behaviour in the one study, the first aim of this research was to explore young drivers' perceptions of four purposefully designed road safety messages that differed by message frame and message type (i.e., social loss-frame, physical loss-frame, social gain-frame and physical gain-frame). The second aim of this research was to explore participants' reactions towards a high performance vehicle advertisement, also purposefully designed for this study, following their exposure to the anti-speeding messages. For the purpose of this study, the motor vehicle advertisement was intentionally devised to highlight the high speed capabilities of a performance vehicle. As limited research has explored young drivers' responses to potential conflicting information cues (which may result from exposure to both anti-speeding messages and motor vehicle advertisements), qualitative research was considered by the researchers to be the most appropriate analysis for offering preliminary insight and the opportunity for participants to comment freely on any/all issues that they considered when responding to the messages that they were exposed to.

Method

Participants

Seventeen young licensed drivers (11 males, 65%), were recruited from an undergraduate student cohort via email and course websites to take part in interviews or small group discussions of up to three individuals. Three interviews and six group discussions were undertaken over the course of the data collection. Table 1 provides a summary of participant groups:

Table 1. Summary of participant groups

Group number	Group type	Number of participants	Participant descriptives
1	Discussion	3	19F; 19M; 23M
2	Discussion	2	19F; 21F
3	Interview	1	18F
4	Discussion	2	19M; 20M
5	Discussion	2	17F; 19F
6	Discussion	3	19M; 19M; 20M
7	Interview	1	19M
8	Discussion	2	21M; 21M
9	Interview	1	20M

Note. 19F is a 19 year old female; 19M is a 19 year old male.

Thus, using triangulation of method (i.e., conducting group discussions and interviews simultaneously; [29]) enabled the researchers to achieve a greater understanding of young drivers' perceptions towards road safety messages and a motor vehicle advertisement and reach data saturation. Out of respect for an individual's time and interest in the study, an interview was conducted if one participant signed up or attended a group session. From this point forward, the term 'discussions' will be used when referring to interviews and group discussions.

Data collection and analysis were occurring simultaneously, an approach added by the fact that the facilitator of the groups was also the primary analyst of the data. At the point of the interview with the 17th participant, it was evident that no further or new information was emerging and therefore data saturation was deemed to have been achieved and data collection ceased [30]. Selection criteria required participants to be between 17 and 25 years of age (M = 19.65, SD = 1.37) and to hold a current Australian drivers licence; specifically, either an open or full licence (which is a licence without any restrictions) or a Provisional drivers licence which is associated with novice driver-related restrictions (n = 3 Open/Full licence, n = 14 Provisional/ restricted licence [31]). Acknowledging both that speeding is a transient offence (relative to a behaviour such as drink driving) and thus able to be engaged in or not on a moment-to-moment basis while one is driving, together with evidence that speeding remains the most commonly engaged in driving violation [e.g., 32] it was believed that drivers who held a current drivers' licence could be assumed to have the opportunity to speed and therefore that anti-speeding messages could be considered relevant to them. Further, comments by participants seemed to suggest

that they regularly reported driving over the recommended speed limit (sample comments are provided in later sections of this article). Taken together, this study's anti-speeding messages and vehicle advertisement were deemed to be potentially relevant to the current sample. Participants were provided with light refreshments and received course credit for their time.

Materials

Four message concepts, all addressing speeding (i.e., physical gain-frame, physical loss-frame, social gain-frame, and social loss-frame messages) and one vehicle advertisement (i.e., an advertisement that highlighted the high speed capabilities of a high performance vehicle; see Appendix A) were purposefully devised for use in the current study. The four anti-speeding messages have been used by the current authors in past research and are published elsewhere [18]. However, for the purpose of this study, an extra sentence was added to the physical messages to match the social messages on word length (i.e., "Driving over [under] the posted speed limit increases [decreases] the number of physical injuries one may sustain in the event of a crash" for the physical loss-frame [gain-frame] messages). Further, both the social and physical messages contained the same concluding sentence representing provision of strategies to reduce/prevent speeding (i.e., "Slow down, monitor your speed; [33]).

As recommended by past research [34], the information presented in the gain-framed and loss-framed messages were identical although reversed as appropriate depending on frame type (e.g., "your friends will feel more comfortable and more confident with you as a driver when you don't speed" vs. "your friends will feel less comfortable and less confident with you as a driver when you do speed" in the social messages). By creating four road safety messages that focused on one aspect of driving behaviour, speeding, the current study was able to explore if participants' thoughts and feelings varied towards these different message types and frames. A semi-structured interview guide was used to guide discussions (see Appendix B for interview guide). In the current study, participants were informed that message persuasiveness referred to the extent to which they perceived the message(s) to be successful at convincing both themself and other road users to reduce their speeding behaviour. Further, all messages were presented to participants as written concept outlines and each typed in 16-point font on a separate A4 sheet of paper.

Procedure

The research was granted ethical approval (Reference number 100001188). Discussions were undertaken in a small quiet room located on a university campus, with most participant discussions ranging from 35 minutes to 1 hour. All sessions were audio recorded and the moderator, the first author, took notes during the sessions to record any key comments and non-verbal cues. To increase the likelihood that the participants would feel comfortable to share their thoughts and feelings and to provide honest information, the moderator and participant(s) were the only persons present during the discussions.

Prior to the discussions, participants were asked to sign a consent form and to complete a short self-report questionnaire that consisted of demographic items (e.g., age and gender). At the start of each session, the participants were informed that the purpose of the research was to gain a greater understanding of young drivers' perceptions of road safety campaigns. The moderator commenced the discussions by asking general questions on current road safety campaigns to engage participants in the topic of interest. Once the moderator perceived that all participants appeared comfortable sharing their thoughts and feelings towards current road safety campaigns, participants were presented with the anti-speeding messages. To enable the moderator to explore participants' thoughts and feelings to each individual message, all messages were presented to each participant, however each was presented one at a time and they were counterbalanced throughout the sessions to reduce potential order and/or fatigue effects. Further, to avoid influencing participants' responses towards the messages, participants were not informed that the anti-speeding messages differed in message frame or type.

On completion of discussing the anti-speeding messages, participants were provided with and read the motor vehicle advertisement. The motor vehicle advertisement was presented last in each session as the first key objective was to assess participants' responses to the road safety messages, prior to assessing their responses to the motor vehicle advertisement and the potential persuasive (or dissuasive) effects associated with conflicting information cues. All discussions concluded with the moderator providing a summary of key points to the participants to check for understanding and to clarify any discrepancies. No discrepancies were stated by the participants.

Data analysis

Discussion recordings were transcribed verbatim by the first author. By moderating the discussions and transcribing the data, the first author was able to become familiar with the data, enhancing the reliability and trustworthiness of the analysis. Thematic analysis was conducted to provide a systematic analysis of the data and concept-driven coding was used to generate initial codes [35]. The codes were initially derived separately for each road safety message and the motor vehicle advertisement. However, to ensure that any unexpected findings were not overlooked, additional codes were created for responses that were outside the key areas of interest. Themes were then identified by reviewing the frequency, elaboration, and extensiveness of the coded data across all transcripts [36]. Frequency was considered in the identification of themes (i.e., a particular concept/category needed to be noted by at least two respondents) and elaboration and extensiveness were evaluated by the extent to which a particular issue was discussed. The process of creating and reviewing themes from the coded data continued until no new themes were identified. To enhance both the reliability and the validity

of the data, the co-authors (who were also involved in the study's design and are experienced researchers in road safety and young drivers) worked together with the first author to refine the themes. Themes are highlighted by direct participant quotes. To ensure participants' anonymity, all quotes provided are cited only in terms of age and gender of the participant (e.g., 17M is a 17 year old male).

Results and discussion

The findings are presented according to the two overarching themes: (1) the perceived persuasiveness of the road safety messages and (2) the perceived persuasiveness of the promotional motor vehicle advertisement. These findings are presented in conjunction with the discussion to allow for comparison between the current themes and previous road safety research.

Message manipulation

Without being prompted, all participants identified that the loss-frame messages included negative cues and that the gain-frame messages included positive cues, thus supporting the researchers' a priori expectations. Further, the social messages were perceived by the participants to consist of social cues (e.g., social disapproval and approval for the loss and gain-framed messages, respectively) and the physical messages were perceived to contain physical cues (e.g., increasing physical injuries for the physical loss-framed message and preventing physical injuries for the physical gain-framed message). However, the words "protecting yourself and your loved ones" in the physical messages were interpreted by some participants as social cues. Despite participants perceiving the words "protecting yourself and your loved ones" to be social cues, overall it was still considered that these messages contained appropriate physical cues (e.g., increasing [decreasing] injury and death for the loss and gain-framed messages, respectively) to be classed as physical themed messages.

Persuasiveness of road safety messages

Loss-frame anti-speeding messages

For the loss-frame messages, two main themes were identified. The first theme, sense of responsibility towards passengers was identified to influence the persuasiveness of the social loss-frame message. Message repetition effects, in terms of potential desensitisation from previous media exposure to physical loss-framed messages, were identified as an influence on the persuasiveness of the physical message among this sample of young drivers.

Sense of responsibility towards passengers

Only male participants (all except one male) perceived the social loss-frame message to be persuasive, stating that they felt a stronger sense of responsibility towards their passengers after viewing the social loss-frame message. After reading the social loss-frame message, the majority of male participants acknowledged the impact that their own speeding behaviour would have on their passengers and/or their friends.

> "The idea of making someone feel uncomfortable, especially someone that you care about, that might be a bit more of a reason to slow down as opposed to making friends feel comfortable" (20M)

> "I can almost picture it, you're speeding with your friends in the car and for me I can just see myself doing that and now I'm thinking well I am endangering my friends' lives" (19M)

> "After reading the first sentence it made me think from the perspective of a passenger. It just instantly made me realise that this is true, this is probably how people think in the car with you and even just from the first word, I'm paying attention, I'm absorbing it" (19M)

Research has reported that young male drivers are more likely to participate in risky driving behaviours, such as speeding, compared to their female counterparts [37]. Thus, it has been well acknowledged that road safety messages need to be specifically designed to target this high risk group. As shown in the current study and supported by previous research, social loss-frame messages may be an alternative option, compared to the more predominant physical threat messages to persuade young male drivers to adopt safer driving behaviours [19].

In contrast, and reflecting a point of departure between males and females, female participants (with one exception) expressed negative reactions towards the social loss-frame message.

> "I kind of get annoyed by that message, purely because I think that it's a bit of a generalisation that friends would think that you're not caring about them" (19F)

> "It does annoy me because it's telling me this assumption that you don't care about your friends" (17F)

> "It makes you a bit annoyed actually... you're assuming that I speed with my friends, well I don't" (21F)

These responses suggest that most female participants were unlikely to be persuaded by the social loss-frame message. In particular, the majority of female participants perceived that this message was suggesting that they do not care for the safety of their friends and found this inference somewhat offensive. Findings revealed, however, that female participants showed more favourable responses towards the social gain-framed message, even though the content in the social loss-frame message was exactly the same as the content in the social gain-frame message expect for message frame. Thus, this finding suggests that message frame may be an important influence upon the persuasiveness of road safety messages for young drivers and, that such subtleties need to be considered carefully in advertisement design.

While young female drivers have a lower crash risk compared to their male counterparts [38], recent research has reported that young female drivers are becoming more susceptible to road crashes due to an increase in risk taking behaviours [39]. In the current study, both male and female participants reported that they drove over the posted speed limit.

> "Going over 10% I know that I'm speeding, but I do it anyway" (20M)
>
> "I could go over 100 [in a 60km/h zone] and sometimes I do when I'm running late to work" (19M)
>
> "I generally drive according to the road… I tend to ignore speed limits" (19M)
>
> "When I'm on a long road [in a 60km/h zone], I'd be going something like 80 [km/h] if I knew that there weren't any cops around" (19F)

Thus, it appeared that gender differences towards the perceived persuasiveness of the social loss-frame messages was not due to differences in the extent to which males and females (self) reported engagement in speeding behaviour.

Message repetition effects

The second main theme that was identified for the loss-frame messages was that some participants reported that previous exposure and repetition of physical threats in the media for road safety campaigns (e.g., death and injury) reduced the persuasiveness of the physical loss-frame message. While the current study's messages were not considered threat appeals, similar terminology (e.g., death and injury) used in the physical loss-frame message is consistent with the terminology used in current road safety campaigns that focus on physical threats.

> "They're all the same, you've seen one of them, you've seen them all" (19M)
>
> "It gives you a statistic and tells you that if you speed you might injure or kill yourself which is something that you've already been told like a thousand times over" (20M)
>
> "I assume that these campaigns [threat-based messages] have been around 20-30 years, so I guess our generation is..." (23M), "Bored with them" (19F), "Maybe desensitised to them, cause they've just been around forever, our whole life spans" (23M)

While previous research has reported that fear has the greatest effect immediately following exposure [19, 40], message wear out effects mean that message persuasiveness decreases over time and exposure [41, 42]. Road safety campaigns in Australia typically use physical threat based appeals to emphasise the negative consequences of speeding behaviour [1, 12]. However, as these findings highlight, some young drivers felt desensitised to these physical consequences due to previous media exposure. In particular, male participants were more likely to report message repetition effects than female participants.

Consistent with previous research [16, 20], this finding further supports the suggestion that male drivers may find road safety incorporating social consequences to be more persuasive whereas female drivers may be more persuaded by road safety messages that focus on the physical consequences.

Gain-frame anti-speeding messages

Personal relevance and social esteem were identified as the two main themes in terms of factors influencing the persuasiveness of the social and physical gain-frame messages, respectively.

Personal relevance

Gain-frame messages that focused on friends and family were perceived by some participants to be more relevant than those messages that focused on other road users.

> "You'd be more conscious of what you're doing [with friends in the car]" (19M)
>
> "I think that if they could target responsibility, they would get a lot further. That [social gain-frame message] is a good way of doing it" (19F)
>
> "I think the idea of being a good friend and having the responsibility for other people, it's just more immediate than a random figure of the people who will die or have injuries" (21F)
>
> "If it's just 400 random people, I know that that's still much larger but, if its people close to you, I reckon that will help stop, prevent or deter people" (18F)
>
> "This is probably going to sound horrible but, 400 people out of that many [the number of people who drive] doesn't seem like a lot. It would probably be different it was someone that you cared about or who was close to you" (19F)

As the above comments highlight, some participants appeared to express greater concern for protecting their friends and family than for other road users. Past theoretical (e.g., Elaboration Likelihood Model; [43]) and empirical evidence [14, 16, 34] has reported that individuals who perceive health messages as being personally relevant are more likely to be persuaded by a message. For instance, Millar and Millar [34] found that individuals who had previously been involved in a traffic crash (i.e., higher issue involvement/personal relevance) had reported greater intentions to comply with the gain-frame road safety messages compared to those individuals who had never been involved in a traffic crash (i.e., lower issue involvement/personal relevance). One way to enhance personal relevance is to tailor the message to the target audience [44]. Thus, road safety messages that emphasise the positive consequences that obeying the speed limit would have on one's friends and/or family (e.g., protecting the lives of their loved ones), may be more relevant to young road users. Further, these messages may be more persuasive for this age group than messages reflecting consequences for the broader community.

Social esteem

In terms of the physical gain-frame message, promoting a sense of social esteem was reported by some participants to increase the persuasiveness of the message. In this context, the researchers defined social esteem as feeling good about one's self by obeying the road rules and protecting the safety of other drivers.

> "I think that everyone likes to be a little heroic" (21F)

> "Cause of the positive spin, it's nice. It's like you have the opportunity to save lives as opposed to, you have the possibility not to die, like, everyone wants to feel like a hero" (19M)

> "It's more reaffirming [than the loss-frame messages], almost praising them for safe driving and it gives people the idea that when you're safe you're achieving something" (19M)

Overall perceived message persuasiveness

After participants were exposed to the four anti-speeding messages they were asked, "Of the four road safety messages, which message(s) would you find most effective?" Responses to this question varied among participants. While some participants reported the loss-frame messages, a few others reported the gain-frame messages, to be more persuasive. Further, some participants overlooked message frame and instead based their decision on the type of message (i.e., physical or social messages; see Table 2 for a summary of participant responses). This finding supports the notion that 'one size does not fit all' and further emphasises the need to implement a range of both loss-frame and gain-frame road safety messages to adequately capture the attention of and ultimately persuade all young drivers.

Table 2. Message effectiveness ratings for male and female participants

Age	Anti-speeding message(s) that participants perceived to have greater effectiveness
Male Participants	
19	Social loss-frame
19	Social loss-frame
19	Social gain-frame
19	No message
19	Social loss-frame & physical gain-frame
20	Social loss-frame
20	Social gain-frame & physical gain-frame
20	Social loss-frame & physical loss-frame
21	Physical loss-frame
21	Social loss-frame
23	Social gain-frame & physical loss-frame
Female participants	
17	Physical loss-frame
19	Physical loss-frame
19	Social gain-frame & physical loss-frame
19	Physical gain-frame & social gain-frame
19	Social gain-frame & social loss-frame
21	Physical gain-frame & social gain-frame

All but one participant indicated that they would find at least one of the anti-speeding messages to be persuasive. However, some participants, particularly the males, stated that other groups of road users (i.e., learner and middle aged drivers) would be more persuaded by the four road safety messages than young drivers. Consistent with previous road safety research that has explored the construct of the third person effect [16], this finding suggests that young male drivers may perceive that other drivers are more persuaded by road safety messages than themselves. Further, as one participant noted, young drivers may be less inclined to abide by road safety messages as they may perceive other road users as having a greater crash risk compared to themselves (i.e., existence of optimism bias in the road safety context; [11]).

> "I think [the physical messages would be more effective for] maybe older people more than younger people, just knowing my friends, I think they'd be like, yeah whatever, this message doesn't really appeal to me, it doesn't really matter... because I'm not going to kill them" (19F)

Evidence has reported that young drivers have a greater crash risk than both learner and middle aged road users [45, 46]. As such, road safety messages need to be specifically designed to appeal to young road users.

Persuasiveness of a high performance vehicle advertisement

All participants perceived that the motor vehicle advertisement was promoting speeding behaviour. Further, all participants believed that this advertisement was designed to target young male drivers. However, as found in relation to the road safety messages, participants' reactions towards the motor vehicle advertisement appeared to differ according to gender. Comments expressed by participants seem to suggest that while most of the males in this sample found the motor vehicle advertisement to be persuasive, most of the female participants were not persuaded and instead tended to report the advertisement to be irresponsible. While it is acknowledged that the current sample of participants consisted of more males than females, the current findings provide some insight into the different perceptions towards motor vehicle advertisements

in relation to gender differences. However, while males are often the intended audience of such motor vehicle advertisements, future research is still required to examine if similar findings are found in a sample size that consists of a higher proportion of female participants.

Potential negative influence on driving behaviours

Male participants responded favourably towards the motor vehicle advertisement and all but one male stated that they wanted to test drive the vehicle presented in the advertisement.

> "It's awesome, I want this car" (19M)
>
> "Driving cars like that is fun..." (21M)
>
> "It's not really about the 'envy of all your mates', screw my mates, I just want to drive that car" (19M)
>
> "If I had the opportunity I would test drive it [the car]. I would be like, yes please" (20M)
>
> "I would test drive it [the car]... it would be pretty fun I think" (21M)

Such comments suggest that the male participants liked and were potentially persuaded by this vehicle advertisement. One factor that seemed to influence the persuasiveness of the advertisement was the speed capabilities of the high performance vehicle.

> "It's pretty amazing that it can accelerate that quickly.... even though I'm not a rev head, I wouldn't mind experiencing getting to 100ks in 6 seconds" (20M)
>
> "The first thing that I felt when I read 100km/hr in 0-6 seconds, I was just like I want to have a dig, I want to trial it [the car]. To experience 0-100 in 6 seconds, that sort of acceleration would be exciting" (20M)

As these comments highlight, speeding behaviour that is implied within motor vehicle advertisements may potentially encourage young male drivers to participate in reckless and risky driving behaviours. While it is acknowledged that the vehicle advertisement in this study was designed specifically to highlight the speed capabilities of a high performance vehicle to maximise the likelihood of detecting potential counter mixed cue effects, speeding behaviour that is indirectly implied within motor vehicle advertisements may have a negative impact on intentions to drive safely. Further, as the following spontaneous comment from a young male participant suggests, exposure to motor vehicle advertisements that promote high performance vehicles may actually have a negative (counter) influence on the potential persuasiveness of road safety messages.

> "I'm more interested in driving this car, than worrying about these [road safety] messages" (23M)

Prior to viewing the motor vehicle advertisement, this participant had stated that he would find the social gain-frame message and physical loss-frame message to be persuasive. However, as indicated in his subsequent comment, the motor vehicle advertisement had a negative influence on the persuasiveness of the previously viewed road safety messages. Given that road safety messages share the same advertising space as motor vehicle advertisements, this response highlights the need for future research to examine the potential implications that motor vehicle advertisements may have on the persuasiveness of competing road safety messages, particularly for young male drivers.

Potential positive influence on driving behaviours

In contrast to the male participants, female participants appeared not to be persuaded by the motor vehicle advertisement and instead identified that it promoted dangerous behaviour.

> "That's a dangerous car. I guess that guys would like it. It doesn't really appeal to me cause I don't want a dangerous car" (18F)
>
> "It doesn't say that speeding is good but, it kind of says like, look, this is what you can do" (19F) "Totally irresponsible" (21F) "Like come buy our car and jump on the highway and go insane" (19F) "It's like challenging people almost. See how fast you can go without getting caught" (21F) "That's exactly what it's like" (19F)
>
> "It just doesn't appeal to me because just driving at 110 is a bit scary for me" (17F)

Such findings suggest that the promotion of high performance vehicles in advertisements may not appeal to young female drivers. Unlike male participants, female participants perceived the vehicle in the advertisement to be dangerous and unsafe. One explanation for this finding may be that male drivers consider risky driving behaviours to be more acceptable compared to female drivers [47]. Further, previous research has reported that male drivers invest more of their identity into the performance of a motor vehicle than female drivers [48]. Thus, since male drivers may place stronger importance on the performance of their vehicles, exposure to high performance advertisements may be more appealing to this cohort of drivers compared to female drivers. However, it should also be noted that viewing the road safety messages first may have primed female participants to have heightened negative reactions towards the vehicle advertisement. Further research is therefore required to examine if order effects introduced through first viewing anti-speeding messages may have influenced young drivers' acceptance of a motor vehicle advertisement that promotes high performance vehicles. More specifically, future research should continue to include a range of road safety messages and motor vehicle advertisements to investigate the potential influence that mixed message cues may have on young drivers' acceptance of road safety messages with a larger and more representative sample.

Summary and conclusion

This study revealed that designing anti-speeding messages that make drivers feel good about themselves, may be an alternative option to encourage young drivers to abide by the road rules. For instance, social esteem was one concept that emerged from these findings that may increase the persuasiveness of anti-speeding messages for some young drivers. Further, and consistent with previous research [1, 18, 19], the current findings suggest a need to introduce a range of road safety messages to effectively capture and persuade different groups of young road users to abide by the road rules. One way to increase young drivers' perceptions of relevance for anti-speeding messages may be to focus on the positive consequences that safer driving behaviours leads to for one's family and friends (e.g., protecting the safety of your family and friends, gaining social approval).

The current study helps to address a gap in knowledge: specifically, this study explored young drivers' thoughts and feelings to four message concepts that all addressed one risky driving behaviour, speeding, and which were intentionally designed to vary only the message type and frame. Unlike previous research, this study has controlled for potential confounds (e.g., different road safety behaviours) that could have influenced the interpretation of the current findings [49]. Specifically, the findings indicate that participants' reactions to these messages differed according to message frame (gain and loss) and message type (physical and social). However, while these findings provide an insight into young drivers' perceptions towards different messages, future research is required to examine if these findings can be replicated in other contexts such as, exposing participants to already existing anti-speeding messages and motor vehicle advertising campaigns to further assess the influence that mixed message cues may have on the persuasiveness and acceptance of road safety messages.

For the high performance vehicle advertisement, this study found that this advertisement was perceived by this sample of male drivers to be persuasive, whereas female drivers perceived it to be dangerous and unsafe. Thus, in combination with road safety messages, future research should examine the effects that motor vehicle advertisements may have on the driving behaviour of young drivers. It is acknowledged, however, that consistently exposing all participants to the road safety messages prior to the motor vehicle advertisement could have influenced participants' responses towards the latter. In everyday exposure to television advertising, multiple conflicting messages (e.g., media advertising, family, and peers) are likely and it is possible that there could be order effects in regards to whether an individual is first exposed to a road safety message followed by a motor vehicle message or vice versa. The current study was particularly interested in whether the persuasive effects (either positive or negative) of anti-speeding messages could be influenced by subsequent exposure to a motor vehicle advertisement; however, in order to address any potential order effects, it is recommended that future research employ a quantitative design which features counterbalancing of the order of presentation of the motor vehicle and road safety messages. While the qualitative nature of this design provides a preliminary investigation of the influence that mixed message cues may have on the persuasiveness of road safety messages, quantitative research that comprises a larger, more representative sample of young drivers is needed to further investigate the influence of the potential counter mixed cue effects that motor vehicle advertisements may have on the persuasiveness of competing road safety messages.

In summary, this study provides an initial understanding of young drivers' thoughts and feelings towards four message concepts that all addressed speeding behaviour and differed in message frame and type. Further, this study's findings highlight the need for further research to examine the potential counter effects that a high performance vehicle advertisement could have on the persuasiveness of road safety anti-speeding messages in instances where the order of presentation varies such that the motor vehicle advertisement is presented first and its impact on the subsequent persuasiveness of the road safety messages is explored. Subject to replication of the current findings via a quantitative study with a large sample of young drivers, the current findings do add further support for the importance of designing a variety of road safety messages to target a range of different young road users. In addition, the study provided insight into the impact that mixed message cues, which were represented in this study as exposure to road safety messages followed by exposure to a motor vehicle advertisement, may have upon perceived persuasiveness of both types of messages. By undertaking the first steps in exploring the potential influence that vehicle advertisements may have on the persuasiveness on road safety messages, this study has shown the value of continuing to investigate mixed message cues.

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Appendix A

Motor Vehicle Advertisement

This high performance sports model can achieve 0 to 100 km/h in 6 seconds and exceeds 200 km/h in 11.8 seconds

This vehicle is powered by a turbo V8 engine and reaches a top speed of 290kms/per hour

The Extreme Xx sports model is one of the fastest street legal vehicles permitted on Australian roads

You will be the envy of all your mates if you test drive one today

The road safety messages can accessed from: http://dx.doi.org/10.1016/j.aap.2012.04.018

Appendix B

Semi-Structured Interview Guide

Opening questions:

1. What do you think about current road safety campaigns?
2. What messages do you remember about these campaigns? Why?
3. Did these messages influence your own behaviour? Why/Why not?
4. Do you think that these messages would influence others? Why/Why not?

For each road safety message (i.e., physical gain, physical loss, social gain and social loss):

5. What are your first impressions of this message?
6. How does this message make you feel/think?
7. Do you think that this message would influence your own behaviour?
8. Do you think that this message would influence others?
9. How long would this messages influence your own behaviour?
10. Do you have any other comments or opinions that you would like to share about this message?

After viewing all four road safety messages:

11. Of the four road safety messages, which message(s) would you find most effective?

Vehicle advertisement:

12. What are your first impressions of this advertisement?
13. How does this advertisement make you feel/think?
14. Who do you think this advertisement was designed for?
15. Do you have any other comments or opinions that you would like to share about this advertisement?

Review of contributing factors and interventions for dangerous driving

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Abstract

This paper reviews published research relevant to understanding dangerous driving. A systematic search of relevant databases identified 117 papers that considered driving behaviour, but only 12 that specifically discuss factors that influence dangerous driving, motivations for dangerous driving, and/or interventions to improve road safety in dangerous drivers. The general findings of these studies are discussed, although it is concluded that the use of the term 'dangerous driving' by researchers is typically restricted to the driving behaviour of younger and/or novice drivers. As such a larger body of literature relevant to the topic will not be identified by searches that are restricted to the use of specific terminology. Nonetheless, these searches reveal that the best evidence exists for the implementation of Graduated Driver Licensing programs and the identified studies do highlight a number of key contributing factors that should be addressed in any attempt to reduce dangerous driving.

Keywords

Dangerous driving, Interventions, Systematic review, Alcohol and Drugs, Graduated Driver Licensing

Introduction

In 2004 the World Report on Road Traffic Injury Prevention identified that approximately 1.2 million people worldwide die each year as a direct result of crashes, and up to a further 50 million people are either disabled or injured. Although only a proportion of these crashes are a direct result of dangerous driving [1], road traffic accidents are the eighth leading cause of death in Australia [2].

The personal, social, and economic costs of crashes caused by dangerous driving are immense [3], highlighting the need to identify ways in which traffic related deaths and injuries can be prevented. A pre-requisite for the development of effective intervention, however, is an understanding of those variables that are associated with dangerous driving, as well as knowledge about the features of the most effective interventions. The aim of this paper is, therefore, to systematically identify what is known about those factors that contribute to dangerous driving and to describe the types of interventions that have been shown to be the most effective.

Methodology

A systematic review of the literature was conducted using methods consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [16]. The Academic Search Complete database, one of the leading sources of peer-reviewed research in the Social Sciences and Humanities, was used to identify relevant papers and studies. Seven key terms were used (see Table 1), with each hit being classified into a final pool of studies after the abstract had been reviewed. The term 'dangerous driving' is widely used to refer to intentional risky driving, but has both lay and legal (e.g., the operating of a motor vehicle in a manner which has as one of its inherent qualities the exposure of the public to harm or injury) meanings. Accordingly, other search terms such as 'hoon driving behaviour' and 'hoon attitudes' were also used in an attempt to reflect the currency of this terminology in Australia (e.g., Victoria's Road Safety Amendment [Hoon Driving] Act 2010).

To be retained in the final review, a paper needed to be: (i) peer reviewed; (ii) written in the English language; (iii) full text accessible; (iv) published between 2004 and 2014; and (v) consider factors that influence dangerous driving, motivations for dangerous driving and/or interventions to improve road safety in dangerous drivers. The reference lists of extracted articles were examined to identify relevant articles not identified in the initial searches. A total of 117 published papers met the search criteria, describing a range of different types of study (e.g., review articles, empirical studies) (see Table 1). Each paper was then manually reviewed, independently, by two researchers to establish the relevance of content to the aims of this review prior to inclusion.

Table 1. Search terms used to identify relevant studies for inclusion in the review

Search Number	Key Terms	Total Hits	Selected Hits
1	Dangerous Driving Attitudes	14	3
2	Hoon Driving Attitudes	0	0
3	Hoon Behaviour Attitudes	0	0
4	Dangerous Driving Interventions	10	1
5	Dangerous Driving Programs	19	2
6	Dangerous Driving Laws	74	6
Total		117	12

Results

A total of 12 studies were retained in the analysis. These were grouped into three categories, with four papers relevant to *factors that influence dangerous driving*, three papers relevant to *motivations for dangerous driving*, and four papers relevant to *interventions* (see Table 2). These are described below.

Factors that influence dangerous driving

Four studies investigated factors that influence dangerous driving. The first study by Illiescu and Sarbescu [1] investigated whether age, gender, professional driving and traffic offences differed significantly in relation to dangerous driving behaviour. A total of 953 participants completed the Dula Dangerous Driving Index (DDDI) questionnaire. Dangerous driving was shown to be more common among males, among individuals without

Table 2. Studies identified as relevant to the review aims

Search Number	Source	Selection Criteria Met	Aims
1	O'Brien & Gormley (2013)	Motivations	To compare the inhibitory functioning of young drivers who have been caught speeding and those who have not.
1	Isler, Starkey, & Sheppard (2011).	Intervention	To compare the benefits of higher-order driving skills training and vehicle handling skills training.
1	McCarthy & Peterson (2009)	Factors	To test whether experience with driving, and experience with drinking and driving will effect changes in cognitions.
4	Ho & Gee (2008)	Motivations	To identify the motives that underlie dangerous driving.
5	Simons-Morton et al. (2006)	Intervention	To examine the effectiveness of the checkpoints programme.
5	Dula & Geller (2003)	Definitions	To address the definitional ambiguity of dangerous driving.
6	Iliescu & Sarbescu (2013)	Factors	To examine dangerous driving in relation to a number of relevant factors.
6	Marcotte et al. (2012)	Factors Interventions	To examine differences in self-reported dangerous driving between adolescent binge drinkers and a matched sample of non-binge drinkers.
6	Nelson, Atchley, & Little (2009)	Motivations	To identify patterns of mobile phone use while driving.
6	Harrison (2011)	Motivations	To examine the prevalence of text messaging while driving.
6	Kelly, Darke, & Ross (2004)	Factors	Reviewed literature on drug driving prevalence, effects on driving, risk factors and risk perceptions.
6	Yamamura, E. (2008)	Interventions	To explore the impact of formal and informal deterrence on driving manners.

professional driving experience, and among those with a history of traffic offences. Dangerous driving was not associated with age. It should be noted, however, that this study administered the same questionnaire at different times and in different settings, such as individually or in groups, which may have influenced the validity and reliability of the data.

The next study identified level of alcohol consumption as a factor that contributes to dangerous or risky driving. In order to test the differences between risky behaviour in binge drinkers and non-binge drinkers, Marcotte et al. [5] asked participants about high-risk driving behaviours and driving outcomes. Car crashes and traffic infringements were more commonly reported by younger people who were binge drinkers than those who were not. They were also found to be more likely to engage in speeding, running yellow lights, passing in no-passing lanes and racing cars. However, this study involved a small sample size (n = 38) and as such, these findings require replication with larger samples to confirm their validity.

The third study in this group, by McCarthy and Pederson [6], also examined the association between alcohol and dangerous driving by investigating changes in cognitions about drinking and driving as a result of driving experience and experience with drinking and driving. A total of 266 participants completed a questionnaire measuring drinking and driving behaviour, being a passenger of a drinking driver, drinking and driving attitudes, normative beliefs and perceived negative effects at two points in time, approximately seven months apart. The results supported the hypothesis that drinking and driving behaviour were associated with particular attitudes towards driving; however the authors were not able to determine whether this was a direct result of having experience with driving or having experience with drinking and driving.

The final study identified drug use as an important contributing factor to dangerous driving. Kelly, Darke and Ross [7] conducted a comprehensive review on this issue, with a focus on risk factors and perceptions, effects of drugs on driving performance, and the prevalence of drug driving. Drug use was determined to be an increasing problem in relation to being involved in crashes. They cited evidence that suggests that the prevalence of drug-related car crashes had increased from approximately 20% to 27% over a six year period, with other studies showing the prevalence as being up to 25%. The most common drug detected was cannabis, which has been demonstrated to impair an individual's driving performance by affecting attention, short-term memory, reaction time, decision-making, co-ordination and concentration. When combined with alcohol or other drugs, these impairments become even stronger and more significant.

Motivations for dangerous driving

A total of three studies were identified which investigated motivations underlying dangerous driving. First, Ho and Gee [2] examined the motives that underlie dangerous driving in a sample of 200 young males. Initial exploratory factor analysis of the Motives for Dangerous Driving Scale (MDDS) identified three specific motives for risky driving that were labelled as 'driving fast/risk taking'; 'confidence in one's driving skills'; and 'disrespect for traffic laws'. These factors were supported by confirmatory factor analysis.

Another specific motivation that may contribute towards dangerous driving is the use of a mobile phone. A study by Nelson, Atchley, and Little [8] attempted to establish the patterns of mobile phone use, perceived risk, types of calls and individual motivations. It also aimed to investigate the perceived importance of the call, emotionality of the call, and how often the calls were answered as opposed to initiated. A questionnaire was completed by 372 undergraduate students at Kansas University, all of whom reported at least occasionally talking on the phone while driving, and nearly three quarters of whom (72%) reported that they engaged in text messaging while in control of a vehicle. These findings are consistent with those reported by Harrison [9] who found that 91% of people had engaged in sending a text messaging while driving. Participants also reported that they were less likely to answer a phone call if they felt that the situation was dangerous, unless they believed that the call was of a high level of importance (in which case they would take the risk and answer the call). What the authors referred to as 'subjective norms' were also identified as a significant predictor of mobile phone use, with respondents reporting that they were more likely to talk on the phone and drive if the passengers in their car also believed that this was acceptable behaviour.

Interventions

A total of four studies were identified which investigated current interventions targeting dangerous driving. The effectiveness of formal and informal deterrents on crashes was investigated in a study by Yamamura [10]. Yamamura focused on the effects of the formal and informal deterrents on attention/inattention and dangerous driving, concluding that formal deterrents do not affect dangerous driving but do increase the level of attention that the driver pays. In comparison, informal deterrents were not shown to affect attention levels but were found to reduce the levels of dangerous driving behaviour. Although this study provides some examples of deterrents, it does not provide any specific definitions of 'formal' and 'informal' deterrents, which may lead to different interpretations by different readers.

One intervention that has been widely implemented is the Graduated Driver Licensing program. This approach involves three stages for new drivers to go through: a period of supervised learning; a period of driving under supervision in high-risk conditions; and then obtaining an unrestricted licence [5]. Since the implementation of this program Californian crash rates have reduced to levels that are approximately 30% lower than other states. This program thus appears to be an effective intervention strategy in reducing crashes for young drivers, however it is recommended that additional interventions are provided for those who are prone to binge drinking [5].

A different intervention that requires a large amount of parental cooperation is the Checkpoints Program that was implemented in Connecticut, USA. This intervention is designed to increase the limits that parents place on teenagers in relation to high-risk conditions. It involves a parent-teen driving agreement that encourages parents to limit their child's exposure to 'high-risk' situations, such as having teenage passengers in the car. As the young driver demonstrates that he or she is behaving in a responsible manner and gains driving experience, these restrictions are slowly removed. Simons-Morton et al. [11] reported the results of a randomised control trial involving 3,743 teenagers who had recently obtained their licenses. Participants were randomised either to the intervention group, receiving newsletters, a video, and Checkpoint materials or to the control group, who received standard driver safety information. After three, six and twelve months, both parents and teenagers were required to participate in a phone survey. The results indicated that this program did lead to modest positive improvements in driving behaviour but that these improvements were unlikely to significantly reduce the number of crashes that occur. It is, however, possible that the passive mailing of program materials may not have been powerful enough to motivate parents and teenagers as much as might be required in order to have a significant impact on crashes. Secondly, all data collected was subjective, either from the parents or the teenagers' perspective, and therefore the program may not have been followed as closely as was intended. Simons-Morton et al. did, however, suggest that combining this program with Graduated Driving Licensing may increase its overall effectiveness [11].

Human factors play a role in the majority of crashes, which makes using education and training to improve driver behaviour extremely important. A study by Isler, Starkey and Sheppard [12] involving thirty-six young New Zealand drivers sought to determine whether on-road driving performance, hazard perception, attitudes towards risky driving and driver confidence were significantly affected as a result of either higher-order driving skills training or vehicle handling skills training. Participants were randomly split into either one of the forms of training or a control group that received no training. In order to determine the effects of the training, a detailed driving assessment was conducted both before receiving the training and after its completion, as well as each participant completing a self-report questionnaire and hazard perception test. Results indicated that individuals who received higher-order driving skills training displayed significant improvement in hazard perception and the composite driving measure, safer attitudes towards dangerous overtaking and close following, and a reduction in driver-related confidence. In comparison, those who completed the vehicle handling skills training did not show any improvement in attitudes to risky driving, hazard perception or driver confidence. However, improvements were displayed in the composite driving score, on-road direction control and choice of speed.

Discussion

This review sought to identify what is known about those factors that contribute to dangerous driving, as well as what is known about effective intervention. Factors identified in the published literature that appear to contribute towards dangerous driving behaviour are gender, level of professional driving experience, traffic offence history, alcohol consumption, and drug use. Four different antecedents for dangerous driving were identified: driving fast/risk-taking, confidence in driving ability, disrespect for traffic laws, and mobile phone use. Finally, of the four studies that evaluated interventions to prevent dangerous driving, Graduated Driver Licensing led to a reduction in crash rates of approximately 30%, whereas other programs (e.g., Checkpoints, higher-order driving skills training, and vehicle handling skills training) produced less positive effects. It is not surprising then that the Graduated Driver Licensing is regarded as one of the most effective strategies to improve road safety [14].

The searches identified only a small number of papers that were relevant to the aims of this review. The studies that were identified varied in their methodological quality and involved different designs, sample sizes, and measures making it impossible to synthesise the results or make clear statements about the effect sizes associated with different interventions. Clearly, more extensive and systematic research is required before more sophisticated questions about, for example, the accumulative effects of interventions that focus on licensing and those that focus on changing driver attitudes or skills, can be answered. Nonetheless, this review does suggest that effective intervention strategies should be aimed at male drivers, irrespective of age, who do not have professional driving experience. It also draws attention to the significant percentage of dangerous drivers who are prone to binge drinking and/or cannabis use and these factors are likely to be important to the development of the most effective intervention strategies and deterrents. The key areas that might be usefully targeted in psycho-educational programs are driver risk-taking, over-confidence in driving skill, disrespect for traffic laws, and the use of mobile phones.

It is quite possible, however, that these conclusions are a function of the specific search terms and the particular search engines/databases that were utilised and that some relevant studies were not identified. For example, the Australian Road Safety Research, Policing and Education Conference and the ACRS conference have published relevant papers which were not identified in these searches (see Appendix). Furthermore, the search terms used may have limited the number of positive hits. It was surprising, for example, that no papers related to 'Hoon Driving Attitudes' and 'Hoon Behaviour Attitudes' were identified, and yet there is a small body of published work directly relevant to this area [13]. It would further appear that the term 'dangerous driving' is commonly used in the published research to refer to the driving behaviour of younger and/or novice drivers and, as such, it is misleading to suggest that that the literature identified in these searches can be

applied beyond this group. In other words, this paper only reports literature that specifies the content as "dangerous driving" and does not identify the larger body of research that might be relevant to understanding driving behaviour more generally. For example, Dula and Geller [4] suggest that there are three classes of dangerous driving: negative emotions while driving; intentional acts of physical and/or psychological aggression towards other road users; and risk-taking behaviours, which they define as dangerous behaviours performed whilst in control of a vehicle without the intention of self-harm or the harm of others. These suggestions, along with the conclusions of this review require further testing.

In conclusion, systematic reviews use transparent procedures to find, evaluate and synthesise the results of relevant research in a way that makes research knowledge more readily accessible [15]. The resulting information is likely to have particular value for policy makers who are interested in understanding what the term evidence-based intervention might mean in this context. The results of these searches suggest two things. Firstly, the need for researchers to use consistent terminology when investigating dangerous driving. Secondly, and perhaps most importantly, the need for the further evaluation of those interventions which are identified as 'promising', such that a stronger and more robust evidence base supporting their implementation can emerge.

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A GPS-based examination of the mobility and exposure to risk of older drivers from rural and urban areas

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Abstract

This study examines whether older rural drivers are restricted in their driving mobility and are exposed to more risk when driving than older urban drivers. Participants (aged ≥ 75 years) from rural (n = 28) and urban (n = 28) areas of South Australia were monitored using GPS devices and telephone-based travel diaries. The rural and urban participants did not differ in the number of trips that they made for discretionary or non-discretionary activities. However, while rural participants were exposed to fewer intersections (potential conflict points) in their driving than urban older drivers, they drove further and for longer periods on roads with speed limits of 100 km/h or higher, and at GPS-measured speeds of 100 km/h or faster. Therefore, they are not less mobile but have a higher exposure to road conditions that are more likely to lead to serious and fatal injuries in a crash.

Keywords

Driving mobility, GPS, Older drivers, Road safety, Rural areas, Urban areas

Introduction

Driving enables older adults to remain mobile, which is important for their independence and lifestyle [1-3]. A loss of mobility through driving cessation can lead to depression [4, 5], a reduced network of friends [6], and an increased risk of mortality over a three-year period [7]. While mobility is desirable, it has also been found that older drivers have a higher crash rate per distance driven and an increased risk of being seriously or fatally injured [8-12]. It is thought that this increased risk of injury results from greater frailty, such that older people have a lower tolerance to physical trauma than younger persons [13, 14]. Consequently, the focus of recent research has been on maintaining an optimal level of mobility for older drivers, while also reducing their exposure to risk when on the road [15-17].

Older drivers who live in rural or remote areas are of particular interest because the nature of their driving environments may both restrict their mobility and increase their risk on the road. Firstly, in terms of mobility, the longer distances that need to be driven in these areas may reduce the ease with which drivers are able to reach their destinations, which may make them reluctant to make any more trips than are absolutely necessary. Hough, Cao and Handy [18] examined the travel patterns of elderly women in rural areas of North Dakota, USA, and found they tended to make fewer trips than older women living in small urban areas. However, there may be more to a person's mobility than just the number of outings they undertake. Nordbakke [19] defines mobility as "the ability to choose where and when to travel and which activities to participate in outside the home in everyday life" (p.166). Mobility may be restricted for rural residents because they may have to prioritise their driving and neglect discretionary activities (e.g., social activities). Consistent with this, Hough et al. [18] found that rural older women travel less often than older women from small urban areas particularly for certain activities, such as going to a restaurant, friend's house, store, hair salon, or place to exercise. Thus, older rural drivers may do more driving because of the distances they need to travel, but their mobility may be restricted, which may affect their quality of life.

In terms of risk, the high crash rate per distance driven of older drivers may result from the fact that they travel smaller distances, on average, than younger drivers [8, 11, 13] and may therefore undertake most of their driving on local roads with more potential crash points (e.g., intersections) [20-22]. In contrast, drivers who travel large distances may do much of their driving on high-speed freeways, where there are fewer potential conflict points and crashes are rare per unit-distance [20-22]. An increased crash rate per distance driven has been shown to be the case for drivers who travel fewer kilometres, regardless of their age, and is termed the "low mileage bias" [20-22]. Low mileage bias has implications for understanding the safety of older rural drivers because they may travel longer distances than older urban drivers and undertake more driving on high-speed rural freeways, which would be expected to reduce their crash rate per kilometre driven. However, when Hanson and Hildebrand [23] measured the exposure of older rural drivers to rural and urban roads, using both Global Positioning Systems (GPS) and self-report methods, they found that the proportion of travel on urban streets increased with self-reported mileage and decreased with age. This study also provided crash data, which indicated that rural drivers aged 81 and over had a higher crash rate per kilometre driven than their urban counterparts. They concluded that low mileage bias may not

exist for older drivers in the rural context. In their analyses, Hanson and Hildebrand did not examine the exposure of older rural drivers to potential conflict points (intersections) compared to older urban drivers. Such an examination could be important, given the reason proposed by Janke [21] for a reduction in crashes per distance driven for high mileage drivers was that they frequently use high-speed freeways with relatively few conflict points.

Other research has compared the rates of serious and fatal injuries in older drivers (≥ 75 years) and found that rural drivers are more than twice as likely to be seriously or fatally injured than urban drivers when involved in a crash [12]. Subsequent research by Thompson, Baldock, Mathias, and Wundersitz [24] established that certain environmental variables, which were more likely to be present in the crashes of older rural drivers, increased the chances that the driver would be seriously or fatally injured. The greatest risk of a serious or fatal injury to older drivers was having a crash on a road with a speed limit of 100 km/h or greater. That rural drivers were more likely to be involved in crashes on these high-speed roads probably reflects the greater exposure of this group to these roads. While Hanson and Hildebrand [23] examined the exposure of older rural drivers to high-speed roads in relation to the risk of crash involvement, they did not examine their exposure to these roads in terms of their increased risk of serious or fatal injury in the event of a crash. They also did not directly compare the exposure of older rural drivers to these roads with that of older urban drivers.

The aim of the present study was to examine whether older rural drivers are more restricted in their everyday driving mobility and whether they have a higher level of exposure to risk while driving, compared to older urban drivers. The driving exposure and travel patterns of both groups were monitored for a period of one week using GPS data loggers and travel diaries. The groups were compared in terms of the amount they drove over a one-week period, the activities they undertook through their driving, and their exposure to both intersections (potential conflict points) and high-speed driving conditions.

It was hypothesised that older rural drivers would drive longer distances than older urban drivers, but would be more restricted in their everyday driving mobility, making fewer trips and undertaking fewer discretionary activities. It was also hypothesised that older rural drivers would have a lower exposure to intersections (total intersections, intersections per distance, per time), but a higher exposure to high-speed driving environments, driving further and for longer periods on roads with speed limits of 100 km/h or higher, and at GPS-measured speeds of 100 km/h or faster.

Method

Participants

Participants were recruited from groups of older adults who attended road safety presentations given by the South Australian Royal Automobile Association, which is an independent automobile club (of approximately 560,000 members). The presentations, entitled "Years Ahead", were held at churches and senior citizens' organisations in rural and urban areas of South Australia. One of the researchers (JPT) spoke at these presentations and invited attendees to participate in the research.

Participants had to be aged 75 years or older to be defined as an "older driver". This age was chosen on the basis of a parallel study [12], which found that drivers of this age were significantly more likely to be seriously or fatally injured when involved in a crash than drivers below this age. They were also required to hold a driver's licence for a car (class C licence, entitling a person to drive non-commercial motor vehicles not exceeding 4,500kg), to have driven at least once in the previous month, and speak fluent English.

The samples consisted of 28 participants from rural (10 females, 18 males) and 28 participants from urban (14 females, 14 males) areas of South Australia. Rural and urban participants were differentiated by a classification of South Australian residential postcodes, used by Kloeden [25], whereby urban areas (postcode 5000 to 5199) were defined as the capital city, Adelaide, and regions within a 5 to 20 kilometre radius. Rural areas (postcode 5200 to 5999) were defined as those regions outside of the urban area. A distance limit of within a two-hour drive from the city (a radius of approximately 100 km) was necessary, as the researcher was unable to routinely travel larger distances to recruit participants and collect data.

Participants ranged in age from 75 to 90. Rural participants had a mean age of 79.9 years (SD = 3.8) and urban participants 80.6 (SD = 3.6). According to licensing data from the South Australian Department of Planning, Transport and Infrastructure, 60,602 individuals aged 75 and over had a class C driver's licence in South Australia in 2009. Eighty-three per cent were in the 75-84 age group and 17% in the 85 and over group, compared to 84% and 16% for the current sample. Therefore, the age composition of the sample closely approximated the broader population.

Materials

On-road driving was recorded using the 747ProS GPS Trip Recorder (hereafter referred to as Trip Recorder), manufactured by TranSystem Inc. (Hsinchu, Taiwan). For this study, it was set to record location and time data every second. Depending on the strength of the satellite reception (which can be affected by tall buildings, inclement weather, tunnels, etc.), the accuracy of the information that the Trip Recorder provides is within three metres for location and to the nearest second for time. This level of accuracy is consistent with other GPS data loggers [26]. It can be attached to the vehicle's AC power and synchronised to operate with the vehicle's ignition. Thus, it only records data when the ignition is on. This groups the data into separate 'trips' (i.e., a section of driving in which the vehicle was started, driven and then stopped at a destination) because it starts recording when the vehicle is started and driven, and stops when the vehicle is turned off.

A computer program was developed by the researchers to analyse the data from the Trip Recorder, which provided information on each separate trip: date and time; distance (kilometres) and duration (minutes); the average, minimum and maximum speeds (km/hour); and total kilometres and minutes over the combined trips. The program also allowed the user to view each trip on a map, which displayed the route taken and the travelling speed throughout the trip.

As the GPS could not record trip purpose or identify the driver, additional information was obtained through a telephone-based 'Travel Diary'. This involved the researcher telephoning the participant on a daily basis during the one-week data collection period to record the details of all of the driving that occurred in the vehicle(s) in which a Trip Recorder had been installed. Information was collected for each separate trip, including the date, the driver (for vehicles driven by more than one person, so that only data for the participating driver was analysed), start location, destination (where the trip ended), purpose (e.g., shopping), and the approximate start and end times.

Procedure

Data collection

A Trip Recorder was installed in each participant's vehicle. If they drove multiple vehicles, a Trip Recorder was placed in each. The researcher (JPT) telephoned participants daily to record the Travel Diary data, and returned at the completion of the seven day period to remove the Trip Recorder and record the final Travel Diary information. All data were collected between June 2011 and June 2012.

Data preparation

The GPS data for each participant were linked to the information from the Travel Diary in order to determine the driver and purpose of each trip. All trips made by non-participating drivers were excluded. Once a trip was linked to a specific purpose, it was classified as one of ten categories of activity in order to undertake a comparison between the rural and urban participants in terms of their access to specific categories of activities (an index of driver mobility). The ten categories were: 'leisure activities' (e.g., having a meal out), 'social activities' (e.g., visiting family/friends), 'community activities' (e.g., church), 'shopping', 'medical/health care activities' (e.g., doctor appointment or shopping at chemist, if the trip was for the driver and not for family or friends), 'other errands' (e.g., getting petrol), 'errands for other people' (e.g., transporting family/friends, including visits to the doctor), 'return home', 'move car' (i.e., a short distance), and 'unknown' (i.e., activity not identified). In addition, trips were grouped according to whether they were 'discretionary' (leisure, social and community activities) or 'non-discretionary' (shopping, medical/health care activities, other errands, errands for other people). Trips categorised as 'return home', 'move car' and 'unknown' were excluded from this latter classification.

Where two purposes were given for a trip (e.g., travel to a shopping centre for both shopping and lunch with friends), both were counted equally and treated as separate activities. Thus, the total number of activities over the week could be greater than the number of trips. In addition, where participants stopped at a destination for an activity, but did not turn their car off before proceeding to another destination, this would result in two activities for one trip.

Each trip that a participant made was viewed on the map program in order to count the number of intersections that they drove through. These intersections were those where the driver had to actively respond or attend to the driving environment. These included: signalised intersections, roundabouts, intersections where they turned from one road into another, intersections where they were required to give-way or stop, and railway crossings. Instances where they turned into a car park or driveway were not included. Information about an intersection (e.g. traffic lights, roundabouts) was provided on the map program, but some information (e.g. give-way/stop signs) could only be identified using 'Street View' in the Google Maps internet site (http://maps.google.com/), which provides a 360-degree street-level view of most roads. The total number of intersections for each participant was divided by both the total distance and total time they drove over the week in order to calculate the number of intersections they drove through per kilometre and minute driven.

Street View was used to identify the sections of a participant's trips that were on roads with a speed limit of 100 km/h or higher. The researcher would identify the driving route in the map display and examine the street-level images of the road in Street View to determine where speed limits started and ended, as indicated by street signage.

Data analysis

Independent samples *t*, Mann-Whitney *U* and chi-square tests were used for the comparisons between the rural and urban participants in terms of demographics, mobility and exposure variables. Two-tailed tests were conducted, using an alpha of .05. Cohen's *d* effect sizes were calculated to evaluate the magnitude of the group differences, with $d = .2$, .5 and .8 equating to small, medium and large effect sizes, respectively [27].

Results

Demographic comparison of rural and urban drivers

The rural and urban samples were firstly compared in order to determine whether they were demographically comparable. No significant differences were found between the groups in terms of their age, $t(54) = .73$, $p = .470$, years of schooling, $t(54) = 1.39$, $p = .170$, or gender composition, $\chi^2(1, N = 56) = 1.17$, $p = .280$, indicating that they were well-matched.

Table 1. Comparisons of distance driven, time spent driving and number of trips over one week of driving between rural and urban participants

	Rural Mean (SD)	Urban Mean (SD)	*t*	*p*	Cohen's *d*[a]
Distance driven (km)	165.6 (123.8)	94.8 (76.9)	2.57	.014*	.71
Time spent driving (mins)	233.7 (149.9)	209.0 (135.7)	.65	.521	-
Number of trips	23.7 (11.9)	20.8 (10.9)	.98	.334	-

[a] Cohen's *d* effect sizes were only calculated for statistically significant differences.

* $p < .05$.

Driving mobility

The rural and urban participants were compared in terms of the distances driven, time spent driving and number of trips they made over the one-week period. In Table 1, it can be seen that the mean distance (kilometres) driven by rural participants was significantly higher than the mean for urban participants and that the difference between these means was medium-to-large in size. However, there were no significant differences between them in terms of the mean time (minutes) they spent driving or the mean number of trips they made. Thus, older rural drivers drove further over the one-week period than older urban drivers, but spent a similar amount of time driving and made a similar number of trips.

The total activities of the rural and urban participants over the week, as well as the proportions that were grouped into each of the 10 categories of activity, are displayed in Table 2. A chi-square test revealed a significant association between rural/urban residence and activity-type, $\chi^2(9) = 34.41$, $p < .001$. However, the small Cramer's V statistic of .16 indicates that only 3% of the variation in activity-type was explained by whether the driver lived in a rural or urban area. Both groups undertook a similar number

Table 2. Activities of rural and urban participants by activity type, as well as discretionary/non-discretionary classification

	Rural % (n = 706)	Urban % (n = 632)
Leisure activities	6.9	4.4
Social activities	6.7	11.7
Community activities	9.5	8.9
Shopping	16.9	16.1
Medical/health care activities	3.5	5.9
Other errands	12.3	6.5
Errands for other people	5.0	6.0
Return home	30.5	32.0
Move car	2.1	3.6
Unknown	6.7	4.9
Total	100.0	100.0
	Rural % (n = 429)	Urban % (n = 376)
Discretionary[a]	38.0	42.0
Non-discretionary[b]	62.0	58.0
Total	100.0	100.0

[a] "Discretionary" activities are not essential to everyday life but contribute to quality of life. This category includes leisure, social and community activities.

[b] "Non-discretionary" activities are essential to everyday life. This category includes shopping, medical/health care activities, other errands and errands for other people.

Table 3. Comparisons between rural and urban participants in their exposure to intersections through one week of driving

	Rural Mean (SD)	Urban Mean (SD)	*t*	*p*	Cohen's *d*[a]
Total intersections	128.7 (83.8)	166.0 (113.3)	1.40	.168	-
Intersections per km driven	1.1 (0.8)	1.9 (0.5)	4.43	< .001*	1.21
Intersections per min driven	0.6 (0.2)	0.8 (0.2)	4.73	< .001*	1.27

[a] Cohen's *d* effect sizes were only calculated for statistically significant differences.

* $p < .05$.

of activities in the categories of: community, shopping, errands for other people, return home, move car and unknown activities (see Table 2). Small differences were notable in leisure activities and other errands, with rural participants undertaking more activities of this type. There were also small differences in social and medical/health care activities, with rural participants undertaking fewer activities of this type.

The total number of activities (excluding returning home, moving car and unknown activities), as well as the proportions that were discretionary and non-discretionary, for rural and urban participants are also displayed in Table 2. The association between rural/urban residence and discretionary/non-discretionary activities was not significant, $\chi^2(1) = 1.36$, $p = .244$. Thus, the groups undertook a similar amount of discretionary and non-discretionary activities.

Exposure to risk

The groups were then compared in terms of the number of intersections they drove through. As seen in Table 3, the mean total number of intersections was lower for rural than urban participants, but this difference was not statistically significant. However, the means for rural participants in terms of intersections per kilometre and per minute driven were both significantly lower than those for urban participants and the differences between both sets of means were large in size. Thus, older rural drivers had a lower level of exposure to intersections (i.e. potential conflict points) on a per distance and time driven basis.

Next, the groups were compared in terms of the amount of driving done on roads with a speed limit of 100 km/h or higher. Table 4 shows that the mean distance travelled on such sections of road was higher for rural than urban participants. A non-parametric Mann-Whitney *U* test was used to test the significance of this difference because the

Table 4. Comparisons between rural and urban participants in their exposure to high-speed driving environments through one week of driving

	Rural	Urban	*U*	*p*	*z*
Distance (km) driven on roads with a speed limit of 100 km/h or higher					
Mean (SD)	79.8 (89.0)	3.5 (12.6)			
Median	64.9	0.0	614.00	< .001*	4.08
Time (mins) spent driving on roads with a speed limit of 100 km/h or higher					
Mean (SD)	54.7 (61.2)	2.4 (8.4)			
Median	43.9	0.0	614.00	< .001*	4.08
Distance (km) driven at speeds of 100 km/h or faster					
Mean (SD)	21.0 (40.3)	1.0 (5.2)			
Median	1.6	0.0	614.00	< .001*	4.18
Time (mins) spent driving at speeds of 100 km/h or faster					
Mean (SD)	11.9 (22.6)	0.6 (3.0)			
Median	0.9	0.0	614.00	< .001*	4.18

* $p < .05$.

data were non-normally distributed and included numerous zero values (e.g., 82% of urban participants did not travel on roads with these speed limits during the study period). This test indicated that the median distance driven on these sections of road by rural participants was significantly higher than that of the urban participants (see Table 4). In terms of time spent driving on such sections of road, the mean for rural participants was higher than that of the urban participants. Again, a Mann-Whitney *U* test revealed that rural participants had a significantly higher median time than urban participants.

Finally, the rural and urban drivers were compared in terms of the distance and time that they drove at speeds of 100 km/h or faster. Table 4 shows that the mean and median distance for rural participants was higher than for the urban participants, which was supported by a significant Mann-Whitney *U* test. The mean and median time that rural participants drove at speeds of 100 km/h or faster was also statistically significantly higher than for the urban participants.

Discussion

This study was designed to determine whether older rural drivers are more restricted in their everyday driving mobility, and whether they have a higher level of exposure to risk while driving, than older urban drivers. To this end, the driving exposure and travel patterns of older drivers (aged ≥ 75) from rural and urban areas of South Australia were monitored for one week using GPS data loggers and telephone-based Travel Diaries. Consistent with our predictions, older rural drivers drove further than their urban counterparts in terms of the total distance travelled per week. It was also expected that, as a result of the distances they have to travel, older rural drivers would make fewer trips than older urban drivers. However, the number of trips did not differ, suggesting that older rural drivers are not restricted in their driving mobility.

It was also thought that older rural drivers might prioritise their driving and neglect certain discretionary activities (e.g., social activities). While they did differ from older urban drivers in the extent to which they undertook certain types of activities, these differences were small. Furthermore, they did not differ in the number of activities that were deemed to be discretionary or non-discretionary, further suggesting that older rural drivers are not restricted in their driving mobility. This is a positive finding, given the abundance of research that highlights how important driving mobility is to the health and well-being of older adults [1, 2, 5-7].

Interestingly, despite travelling greater distances than their urban counterparts, rural drivers did not differ in the amount of time that they spent driving. This may be explained by the finding that they undertook a larger amount of driving at high speeds than urban drivers and so covered greater distances in the same amount of time. It may also be explained by there being fewer intersections on rural roads and less traffic congestion, which would reduce their travel times.

While it was predicted that the exposure of older rural drivers to intersections would be lower than that of older urban drivers, the two groups drove through a similar total number of intersections. However, this was likely to be due to the greater distances the rural participants drove over the week. Indeed, they were exposed to fewer intersections on a per kilometre driven basis. Older rural drivers were also found to travel through fewer intersections per minute driven. The findings support Janke's [21] suggestion that higher mileage drivers who travel on high-speed freeways encounter fewer intersections. Older rural drivers are exposed to less risk in terms of potential conflict points per distance and time driven than older urban drivers because of the roads they travel on. It would be expected, therefore, that this would reduce their per distance driven crash rate. However, Hanson and Hildebrand [23] found that rural drivers aged 81 and over had a higher crash rate per kilometre driven than their urban counterparts. While it may be the case that older rural drivers, despite their lower exposure to intersections per distance and time driven, are involved in more crashes than older urban drivers, other research by Thompson et al. [12] has shown that they are involved in fewer total crashes, as well as crashes per head of population and per licensed driver. Consequently, further research in this area may be required.

The exposure of older rural drivers to high-speed driving environments was clearly greater than that for older urban drivers. Older rural drivers travelled for longer distances and for longer time periods than older urban drivers on roads with a speed limit of 100 km/h or higher and at GPS-measured speeds of 100 km/h or faster. Previous research has suggested that high-speed roads [24] and high-speed travel [28-30] increase the likelihood of serious and fatal injury in a crash situation and this is likely to be exacerbated for older persons, given their frailty and susceptibility to increased injury severity [13, 14].

Future research should attempt to identify ways to reduce this exposure for older rural drivers, possibly through drivers avoiding areas with speed limits of 100 km/h or higher as much as possible. However, for many, this may not be possible, as it may be the only way they can reach their destinations. A second option would be to reduce the speed limit in these areas, in particular from 110 to 100 km/h. Long, Kloeden, Hutchinson, and McLean [31] have previously shown that a reduction in the 110 km/h speed limit to 100 km/h on specific rural roads in South Australia reduced both the average travelling speed and the number of crashes in which there were casualties at these sites. Reductions in speed limits are likely to benefit the safety of drivers of all ages. A third option would be to encourage older rural drivers to purchase the newest vehicles they can afford when they are in the market, as newer vehicles provide superior protection from serious or fatal injury in the event of a crash [32-34]. A fourth option would be to increase public transportation services (e.g. buses) or subsidise private services (e.g. taxis) in rural areas, where the availability of these alternative options is often limited [35], and encourage older adults to increase their usage of these services. However, the cost of increasing

these services may be prohibitive in small communities and remote areas. Alternatively, rural councils, as well as churches and senior citizens clubs, could be encouraged to increase their provision of community-run transportation services (e.g. community buses or volunteer driver systems).

Study limitations and future directions

There are a number of limitations that should be acknowledged. Firstly, the rural participants were recruited from areas relatively close to the capital city (i.e., within approximately two hours driving distance), which meant that older drivers from remote rural locations were not included. The proximity of the rural participants to the capital city, as well as the fact that many lived in retirement villages, large towns and regional centres, may mean that they had access to necessary services and encountered traffic conditions not too dissimilar to the fringe areas of Adelaide. Thus, it is likely that they had better access to services and more opportunities to socialise than individuals from remote locations. People residing in remote areas are likely to drive further to reach their destinations and, consequently, may have an even higher level of exposure to high-speed roads. It is also likely that their mobility may be more restricted if they have to drive further distances. Therefore, the differences between the rural and urban participants (number of trips and activities) may have been larger if remote drivers were included. Older drivers from remote areas should be recruited, if possible, in any future research on this topic.

Another limitation was that participants were recruited from senior citizens clubs and churches. These attendees, particularly those willing to volunteer for the study, may be healthier and more active than other adults of the same age. Indeed, that they were able to travel from their homes to these organisations suggests they are mobile. Consequently, these rural participants may not have been deterred by driving longer distances, which may explain why they were not restricted in their number of trips or activities. Future research should assess the health of the sample, and endeavour to include participants who vary in their health and mobility. It should also be acknowledged that participants who are concerned enough about their driving, and road safety in general, to attend a driving safety presentation may not be representative of all older drivers. Indeed, it might have been anticipated that they would attempt to reduce their travelling speed while they were being monitored by the GPS logger. However, any such adjustments would have been equivalent across the rural and urban groups and the difference between them in terms of the amount they drove at GPS-measured speeds of 100 km/h or faster was large. Therefore, it is unlikely that such sample bias had any considerable effects on the overall outcomes of the study.

It is also possible that the participants altered the amount that they drove, their speed and/or their activities because their driving was being monitored. In particular, the placement of the Trip Recorder on the dashboards of their vehicles may have acted as a visible reminder of the study. However, initial pilot testing of the devices used in the present study found that the participants reported that the devices were barely noticeable and did not affect their driving behaviour [36]. Research by Blanchard, Myers, and Porter [37], which also used GPS devices to monitor the driving of older adults, produced similar findings.

In addition, it was only possible to monitor one week of driving for each participant. Although data based on uncharacteristic weeks (e.g., where they went on a driving holiday or became unwell) were excluded, it is still possible that the week may have been atypical. Future research could monitor driving for a longer period to address this issue. This would, however, increase the already large amount of data provided by the GPS loggers, as well as the time required to analyse it. For present purposes, it was thought that an atypical week was equally likely to occur in either group, in which case any effects on the measurements of routine driving exposure and travel patterns are likely to be evenly distributed across groups.

It should also be noted that the data were collected over a 12-month period and so there may have been seasonal effects on travel behaviour. However, the rural and urban data were collected concurrently and, therefore, any such seasonal effects are also likely to be equal across groups.

Conclusion

Recent research by Marottoli and Coughlin [16] highlighted the importance of balancing the safety of older drivers while they are on the road with the competing need to maintain their mobility for as long as possible in order to optimise their quality of life. The present research indicates that this balance is particularly important for older drivers who live in rural areas. A greater proportion of their travel is undertaken on high-speed roads than is the case for older urban drivers, which increases their risk of serious or fatal injury in the event of a crash. Possible ways to deal with this increased risk include reducing speed limits in rural areas (e.g., 110 to 100 km/h) and encouraging older rural drivers to drive newer and safer vehicles, which should lower the risk of injury without affecting mobility.

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Effect of mobile phone use and aggression on speed selection by young drivers: a driving simulator study

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Abstract

Aggressive driving has been associated with engagement in other risky driving behaviours, such as speeding; while drivers using their mobile phones have an increased crash risk, despite the tendency to reduce their speed. Research has amassed separately for mobile phone use and aggressive driving among younger drivers, however little is known about the extent to which these behaviours may function independently and in combination to influence speed selection behaviour. The main aim of the current study was to investigate the effect of driver aggression (measured by the Driving Anger Expression Inventory) and mobile phone use on speed selection by young drivers. The CARRS-Q advanced driving simulator was used to test the speed selection of drivers aged 18 to 26 years (N = 32) in a suburban (60kph zone) driving context. A 2 (level of driving anger expression: low, high) X 3 (mobile phone use condition: baseline, hands-free, hand-held) mixed factorial ANOVA was conducted with speed selection as the dependent variable. Results revealed a significant main effect for mobile phone use condition such that speed selection was lowest for the hand-held condition and highest for the baseline condition. Speed selection, however, was not significantly different across the levels of driving anger expression; nor was there a significant interaction effect between the mobile phone use and driving anger expression. As young drivers are over-represented in road crash statistics, future research should further investigate the combined impact of driver aggression and mobile phone use on speed selection.

Introduction

Mobile phone use while driving

Mobile phone use while driving is a risky behaviour as attention is diverted away from the road and the primary task of driving. While it is broadly acknowledged that crash risk is increased from mobile phone use while driving, quantifying the exact increase in risk has proven challenging, mainly due to methodological limitations within studies (e.g., unreliable data collection methods) [15]. Recent publications, however, examining previous studies and accounting for their limitations, have suggested the increase in crash risk may be between one and threefold [15, 33]. Despite this increased risk, 98% of young Australians aged 15 to 24 years have a mobile phone, and 69% report using it while driving [25].

Multiple Resource Theory [31] purports that humans have several different pools of resources (e.g., input, output and processing modalities) that are finite and can be accessed simultaneously. When a secondary activity requires resources from the same pool as the primary activity, depending on the level of task complexity, they will compete for these resources and subsequent performance decrements can arise [31]. As driving is a high demand task, when the distracting activity is of a similarly high demand and uses the same resources as driving, performance is likely to be compromised and subsequent crash risk is increased [19]. For these reasons, mobile phone use while driving is a risky behaviour as it requires the same resources that are also necessary for safe driving (e.g., cognitive and physical resources).

Studies (including simulator studies) have consistently found that drivers on their mobile phones tend to reduce their speed [15, 16, 32]. Consistent with Multiple Resource Theory, this reduction in speed may occur in order to compensate for one's divided attention and increased mental workload; thereby maintaining a constant level of risk perception [21, 29].

The relative degree of distraction incurred by mobile phones in hand-held and hands-free modes has also been of interest to researchers. Many countries legislate against the use of mobile phones while driving; however this legislation often only concerns phones in the hand-held mode (e.g., Australia, France) [29]. Despite some studies finding no difference in interference to the driving task between hand-held and hands-free modes, many studies have found the tendency for the hand-held mode to interfere more [30]. Specifically, studies have shown that drivers tend to slow down more while talking on a mobile phone in hand-held mode compared to a hands-free mode; possibly because talking on a mobile phone in hand-held mode involves physical as well as cognitive distraction, whereas the hands-free mode involves only cognitive distraction [29, 30].

Aggressive driving

Aggressive driving can generally be defined as a behaviour that is intended to have a negative impact (either psychological or physical) on another driver, for example, tail-gating, horn-honking, and obscene gestures [20]. The prevalence of aggressive driving was highlighted in a recent Australian survey of 3,740 drivers aged 18 years and over. Half of the participants admitted to yelling or swearing at another motorist, 38% admitted to giving an obscene gesture, and 18% admitted to tailgating [1].

Deffenbacher, Oetting, and Lynch [10] developed the Driving Anger Scale (DAS) to measure trait driving anger. However, it was later acknowledged that, despite feeling the same level of aggression, drivers may express their aggression quite differently thereby having a differential impact on crash risk. For example, a driver who mumbles something to themself is unlikely to negatively affect other road-users. However, a driver who tries to run another car off the road places themselves, their passengers, and the other car occupants at a much higher crash risk [8]. To encompass and acknowledge these differential risk factors, the Driving Anger Expression Inventory [9] was developed. (See materials section for a more detailed description and example items from the DAX). This inventory measures driving anger expression, defined as a situation-specific (i.e., driving) form of trait anger [10]. The DAS and the DAX are positively correlated in that drivers who score high on the DAS are also likely to score high on the DAX. That is, those with high driving anger also have a high level of driving anger expression and engage in more aggressive driving behaviours [7, 11].

Aggressive driving is commonly associated with other risky driving behaviours, such as speeding, erratic driving, and failure to obey traffic signs [3]. In a review of the published scientific literature, the AAA Foundation for Traffic Safety attempted to quantify the contribution of aggressive driver actions to fatal crashes and reported that 56% of fatal crashes in the United States from 2003 to 2007 involved at least one driver action that is typically associated with driver aggression. The most common action, reported in one third of these fatalities, was speeding [3]. In addition, simulator studies have found that those with high driving anger, as measured by the DAS [10] tend to select higher speeds for driving situations, such as speed departing from an open gate, and driving faster and more erratically on open road simulations [7, 27].

Young drivers

Young drivers aged 17 to 25 years old are represented in over 20% of deaths in road crash fatalities in Australia [12] yet constitute only 12.4% of the population [4]. Despite this over-representation in road crash statistics, younger drivers aged 18 to 24 years are more likely to use a mobile phone while driving [2]. As they are more likely to use their mobile phones and they lack driving experience, young drivers represent a particularly vulnerable group as their attentional resources are more heavily compromised and their resulting crash risk is increased. Indeed, Neyens and Boyle [23] analysed data on teenaged drivers from the US National crash database and found that teenaged drivers and their passengers were most likely to be severely injured when distracted by a mobile phone. Haque, Washington, Ohlhauser, and Boyle's simulator study [17] found the risk of yellow-light running while using a mobile phone was greatest for drivers aged 16 to 25 years. Additionally, a recent simulator study investigating reaction times of young drivers found 50% longer reaction times to detect an event that originated in the driver's peripheral vision, such as a pedestrian entering a zebra crossing, when using a mobile phone compared to when they were not [16].

In addition to young drivers' risky use of mobile phones, research typically shows younger drivers are often involved in aggressive driving incidents or self-reported aggressive driving behaviours which may also contribute to their over representation in the road crash statistics [20, 24]. A recent Australian survey found that 31% of young drivers aged 18 to 24 years admitted to tailgating other vehicles, representing the group most likely to engage in this behaviour. In addition, 50% admitted to having yelled or sworn at another driver, and 43% have gestured rudely at another driver [2]. Similar to their older counterparts, aggressive young drivers are more likely to engage in risky behaviours such as speeding than non-aggressive young drivers [12]. However younger drivers may be at even greater risk when they speed as they lack driving experience and do not always correctly evaluate a given situation [12].

The current study

As aggressive driving is commonly associated with engagement in other risky driving behaviours such as speeding [3], it is possible that aggressive drivers are more likely to engage in mobile phone use as it, too, represents a risky driving behaviour. Indeed, Chen [6] carried out a survey study and found that aggressive drivers were more likely than non-aggressive drivers to use their mobile phone while driving. Despite this result, little is known about the extent to which aggressive driving and mobile phone use may function independently and in combination to influence speed selection behaviour. Although not specifically targeting young drivers, a study that has investigated the combined effect of aggression and mobile phone use in on-road driving performance found that, when approaching traffic signals at intersections, the aggressive drivers tended to drive faster than non-aggressive drivers regardless of whether they were using a mobile phone or not [21].

In order to address this gap in the literature, the current simulator study explored the impact of driving anger expression (categorised as low and high, measured by the Total Aggressive Expressive Index from the DAX [9]) and mobile phone use condition (baseline, hands-free, and hand-held) on speed selection by young drivers aged 18 to 26 years. The overarching, exploratory aim of the current study, therefore, was to investigate whether average speed selection for each of the mobile phone conditions was different for young drivers scoring low or high in driving anger expression. The current study also investigated mean

deviation from the speed limit as a dependent variable; a closely related concept to speed selection. The specific hypotheses were as follows:

H1: It was predicted that speed selection for each of the mobile phone conditions will be different for drivers with low and high driving anger expression. That is, there will be a significant interaction effect.

H2: In support of previous literature[12], it was hypothesised that young drivers high in driving anger expression would drive at a higher speed across each of the mobile phone conditions than young drivers low in driving anger expression. That is, there will be a significant main effect for driving anger expression.

H3: In support of previous literature [29, 30], it was predicted that all drivers would have the highest speed selection for the baseline condition (where no additional attentional resources are required) and select the lowest speed for the hand-held mode (where additional physical and cognitive resources are required). That is, there will be a significant main effect for mobile phone use condition.

Methodology

Participants

Participants (N = 32, 16 males, 16 females) were recruited by flyers distributed through university student email addresses, university Facebook portals, and by posting in a few university locations (e.g., library, refectory). All participants were aged between 18 and 26 years (M = 21.5, SD = 2.0); held either a provisional (n = 11) or open (n = 21) Queensland driver's licence; did not have a history of motion sickness; and were not pregnant. The average driving experience was 4.20 (SD = 1.89) years. Current amount of driving and mobile phone usage while driving are reported in Table 1.

Driving Simulator

The CARRS-Q Advanced Driving Simulator located at the Queensland University of Technology (QUT) was used for this study. This high fidelity simulator consists of a complete car with working controls and instruments surrounded by three front-view projectors providing 180-degree high resolution field view to drivers. LCD monitors replaced the car's wing mirrors and rear view mirror to simulate rear view mirror images. Road images and interactive traffic were continuously updated on front-view projectors, wing mirrors and the rear view mirror at 60 Hz to provide a photorealistic virtual environment. The car used in this experiment was a complete Holden Commodore vehicle with an automatic transmission. Driving performances data such as position, speed, acceleration and braking were recorded at rates up to 20 Hz.

The simulator driving route for the current study was approximately 7km long and included a detailed simulation of a suburban route of approximately 5km with various 'normal' traffic events such as following lead cars, free flow with no other cars in sight and free flow along curve with opposing traffic. The speed limit for the selected segments in this study was 60 kph. Three route starting points were designed to reduce learning effects and allow driving under the three different phone conditions. All three routes had the same geometry and road layout but the locations of traffic events were randomised across the routes. The driving conditions were counterbalanced across participants to control for carry-over effects. Participants were instructed to drive as they normally would, to obey the posted speed limits, and to follow the directional signs towards the airport, that is, participants had a navigational task.

Procedure

After ethics approval was received and informed consent was obtained, participants completed a self-report questionnaire that included driver demographics, driving history, general mobile phone usage history, usage of mobile phones while driving, and driver behaviour related to aggressiveness (i.e., the DAX [9]). For experimental drives in the hands-free and hand-held phone conditions, the experimenter called the participant before the start of the drive and there was a single continuous call until the end of the drive. The participants talked through a Bluetooth headset in the hands-free condition, and were required to hold the phone to their ear for the duration of

Table 1. Reported distance driven and frequency and type of mobile phone use while driving

	km	% of participants
Distance driven in a typical year	< 10,000	44
	10,000 – 20,000	47
	> 20,000	9
Frequency of mobile phone use (including talking and texting) while driving	At least once per day	34
	1 – 2 times per week	47
	1 – 2 times per month	19
Type of mobile phone used while driving	Hands-free	22
	Hand-held	78

the conversation in the hand-held condition. The phone conversation dialogues used in both phone conditions was cognitive in nature and modified from Burns, Parkes, Burton, Smith, and Burkes' 2002 study on the impact of mobile phone use while driving [5]. The dialogues required the participant to provide an appropriate response after hearing a complete question (e.g., 'Jack left a dinner in his microwave for Jim to heat up when he returned home. Who was the dinner for?'), solve a verbal puzzle (e.g., 'Felix is darker than Alex. Who is lighter of the two?'), or solve a simple arithmetic problem (e.g., 'If three wine bottles cost 93 dollars, what is the cost of one wine bottle?'). These types of questions required simultaneous storage and processing of information, and thus distracted drivers by increasing their cognitive load.

When a participant reached the route starting point, after a closed loop drive the scenario automatically ended. Participants took brief breaks while remaining in the vehicle between each experimental drive while the scenarios were loaded onto the simulator display system. All data not collected in the simulator were self-report. Participants were reimbursed for their time upon completion of the study.

Measures

Driving Anger Expression Inventory (DAX)

The DAX [9] is a validated measure [18, 26] of how drivers express their anger in the driving context. The DAX breaks down into two general dimensions, a 34-item hostile/aggressive expression dimension (comprising three subscales) and a 15 item adaptive/constructive expression dimension (comprising one subscale). Items in each scale are rated on a 4-point likert scale (1 = *almost never*, 4 = *almost always*). The hostile/aggressive expression dimension correlates positively with measures of driving-related anger, aggression, and risky behaviour [9, 7]. The three subscales comprising this dimension are:

1. Verbal Aggressive Expression (12 items) assesses verbal means of anger expression (e.g., "I make negative comments about the other driver") and formed a reliable subscale in the current study (Cronbach's $\alpha = .88$);

2. Physical Aggressive Expression (11 items) assesses the physical forms of expressing anger (e.g., "I try to get out of the car and tell the other driver off"). The reliability of the subscale in the current study was Cronbach's $\alpha = .57$;

3. Use the Vehicle to Express Anger (11 items) assesses the way drivers use their vehicles to express anger (e.g., "I try to cut in front of the other driver") and formed a reliable subscale in the current study (Cronbach's $\alpha = .89$).

When added together, these three subscales form the Total Aggressive Expression Index. This Index formed a reliable scale in the current study (Cronbach's $\alpha = .89$). For the purpose of this study, and consistent with the previously acknowledged definition of driver aggression as causing another driver harm, the fourth subscale measuring Adaptive/Constructive Aggression (e.g., "I try to think of positive solutions to deal with the situation") was not included in the analysis.

Note that while it is acknowledged that the reliability of the Physical Aggressive Expression subscale is low, it was retained to maintain the factor structure of the Total Aggressive Expression Index in the DAX. In addition, with the relatively small sample size ($N = 32$) it was beyond the scope of the present study to carry out a factor analysis.

Results

A 2 X 3 mixed factorial ANOVA was conducted to assess the impact of level of driving anger expression (low, high) and mobile phone use condition (baseline, hands-free, hand-held) for both speed selection and deviation from the speed limit. For the purpose of the current study, participants were divided into low and high levels of driving anger expression determined by a median split on the Total Aggressive Expressive Index to generate a dichotomous categorical variable. Young drivers were categorised as having a high level of driving anger expression if they scored over 56 ($n = 16$) and a low level of driving anger expression if they scored below 56 ($n = 16$).

Results showed that, for mean speed selection as the dependent variable, there was no significant interaction between level of driving anger expression and mobile phone use condition, Wilks' Lambda = .92, $F(2,29) = 1.27$, $p = .30$, $\eta^2 = .08$. This result indicated that the speed selected in each phone use condition did not differ between drivers with low and high levels of anger expression. There was, however, a significant main effect for mobile phone use condition, Wilks' Lambda = .47, $F(2, 29) = 16.65$, $p < .001$, $\eta^2 = .54$. Inspection of the mean speed selections showed that young drivers with both low and high levels of anger expression used the highest average speed for the baseline condition and the lowest for the hand-held condition (see Table 2). The main effect for level of driving anger expression was not significant, $F(1, 30) = .43$, $p = .52$, $\eta^2 = .01$, indicating that there were no significant differences between speed selection for drivers with low and high levels of anger expression.

For mean deviation from the speed limit as the dependent variable, results showed a similar pattern to speed selection. Deviation from the speed limit was calculated as 60kmph minus average speed selected for each phone use condition for low and high driving anger expression. There was no significant interaction between level of driving anger expression and mobile phone condition, Wilks' Lambda = .92, $F(2, 29) = 1.34$, $p = .30$, $\eta^2 = .08$ indicating that the deviation from the speed limit in each phone use condition did not differ between drivers with low and high levels of anger expression. There was a significant main effect for mobile phone use condition, however, Wilks' Lambda = .45, $F(2, 29) = 17.84$, $p < .001$, $\eta^2 = .55$. Inspection of the mean deviations from the speed limit indicated that young drivers with both low and high levels of anger expression

Table 2. Mean speed selection and mean deviation from speed limit for low aggression drivers for each of the mobile phone conditions

Mobile phone use condition	Level of driving anger expression	Mean speed selection (kmph) (SD)	Mean deviation from speed limit (kmph) (SD)
Baseline	Low	56.39 (3.04)	3.61 (3.04)
	High	56.83 (1.79)	3.17 (1.79)
	High and low	56.61(2.46)	3.40 (2.46)
Hands-free	Low	54.34 (3.99)	5.50 (3.44)
	High	53.38 (3.88)	6.36 (3.74)
	High and low	53.86 (3.90)	5.90 (3.56)
Hand-held	Low	53.98 (4.70)	6.03 (4.69)
	High	52.44 (3.78)	7.56 (3.78)
	High and low	53.21 (4.27)	6.80 (4.26)

Note: The higher the score on mean deviation from the speed limit indicates a lower speed selection.

had the greatest deviation from the mean in the hand-held condition and the lowest deviation for the baseline condition (see Table 2). The main effect for level of driving anger expression was not significant, $F(1, 30) = .40$, $p = .53$, $\eta^2 = .01$, indicating that there were no significant differences between mean deviation from speed limit for drivers with low and high levels of anger expression.

Discussion

The main aim of this study was to provide an initial investigation into whether mean speed selection for each of the mobile phone conditions (i.e., baseline, hands-free, and hand-held) was different for drivers with low and high anger expression. Our exploratory hypothesis was not supported as no significant interaction effect was found for this combination of factors. This suggests that the combined effect of level of driving anger expression and mobile phone use condition does not result in significantly different speed selections.

A significant difference was found, however, for mean speed selection for mobile phone use condition such that drivers, regardless of their level of driving anger expression, selected the highest speed for the baseline condition and the lowest speed for the hand-held condition. This result was predicted and supports previous studies in which drivers reduced their speed more when using a mobile phone in hand-held mode than in hands-free mode[29, 30]. While the use of both hand-held and hands-free modes presents a cognitive distraction, the hand-held mode is riskier as it also presents a physical distraction. Drivers may reduce their speed in order to maintain a constant level of risk perception and attempt to compensate for divided attention and increased mental workload [21, 29, 30]. Despite being illegal in Australia, in the current study, 78% of the young drivers reported typically using a hand-held (rather than hands-free) mobile phone while driving. This finding represents a challenge for law enforcement and public education. While selecting a lower speed may decrease crash risk [15], the public could be made aware that attention being diverted from the primary task of driving probably outweighs the small reduction in risk that results from selecting a lower speed.

The current study found no significant difference for speed selection between levels of driving anger expression, regardless of phone use condition. This finding does not support our hypothesis or previous literature, the latter of which has shown that high aggressive young drivers select higher speeds than low aggressive young drivers [12]. It is possible, however, that as young driver aggression may increase speed selection and mobile phone use while driving typically results in reduced speed selection [29, 30], in the current study, they may have functioned to cancel each other out and the net effect was negligible. Indeed, a recent review of simulator studies showed that the increase in reaction time combined with the reduction in speed selection (two behaviours often associated with mobile phone use while driving) sometimes had the effect of cancelling each other out, so the overall impact on crash risk appeared quite minor [15]. As mean speed selection and mean deviation from the speed limit are closely related measures, the discussion can also refer to mean deviation from the speed limit.

The main strength of the current study is that it is, to our knowledge, the first to investigate the combined influence of mobile phone use and level of driving anger expression on speed selection among a sample of young drivers. However there are also limitations. While it is acknowledged that the internal reliability of the Physical Aggressive Expression subscale was low (Cronbach's $\alpha = .57$), it was retained in order to maintain the factor structure of the Total Aggressive Expression Index in the DAX. The study's sample size was relatively small ($N = 32$) and comprised university students who may not be representative of the population of young drivers. Future

studies should continue to investigate this combination of variables and address these limitations by recruiting a larger sample size from the broader community of young drivers.

Conclusion

Driver aggression and mobile phone use are both prevalent and risky behaviours among young drivers, who are already over-represented in road crash statistics. The current simulator study investigated the impact of level of driving anger expression and mobile phone use condition on speed selection by young drivers aged 18 to 26 years. While no significant interaction effect was found between these two variables, results showed that mobile phone use (regardless of level of driving anger expression) had a significant effect on speed selection among the young drivers in the current study. Future studies should further investigate this risky combination of variables and their impact on young driver behaviour and subsequent crash risk.

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Contributed Articles

Australia's Naturalistic Driving Study

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The Australian Naturalist Driving Study (ANDS) is being carried out by a Transport and Road Safety (TARS) team led by Professors Raphael Grzebieta and Ann Williamson. Drivers will be observed within and around their vehicles using the so-called Naturalistic Driving Study research method. The ANDS team will be instrumenting around 400 cars in Sydney and Melbourne to continuously record data from within and outside the vehicles on driver and road user behaviour, in normal and safety-critical situations. They will then analyse this data to develop new and novel countermeasures for reducing road deaths and serious injuries on Australian roads. This is the first study of this magnitude and sophistication being carried out in Australia.

Researchers

The team comprises researches from a number of areas including: co-Chief Investigators Associate Professor Teresa Senserrick from TARS; Professors Narelle Haworth and Andry Rakatonirainy from CARRSQ in Brisbane; and Professor Stevenson, Associate Professor Judith Charlton and Doctor Kristie Young from MUARC in Melbourne; and Doctor Jeremy Woolley from CASR in Adelaide.

After successfully securing around $3 million funding from the Australian Research Council and Partner Organisations, an Integrated Facility is being built and an extensive research project has been planned to carry out this ground breaking research to observe Australian drivers in New South Wales and Victoria. The Partner Investigators joining the team are Ben Barnes and John Wall from the New South Wales Centre for Road Safety (Transport for New South Wales); Samantha Cockfield from the Transport Accident Commission in Victoria; Antonietta Cavallo and David Healy from VicRoads; and Jack Haley from NRMA Limited in New South Wales. Other Partner Organisations and people involved are Iain Cameron from the Office of Road Safety from Main Roads Western Australia and Ben Tufnell from the Motor Accidents Commission of SA. The ANDS team will be partnering with the Virginia Tech Transportation Institute in the USA who will be assisting with the installation of the vehicle instrumentation and data capture.

The Integrated Facility will help underpin all future road safety research and become an essential pillar for the entire Australian road safety research community and regulatory authorities. The team of Chief Investigators and Partner Investigators assembled to manage and utilise this Integrated Facility includes the most eminent group of researchers, practitioners and regulators in road safety in Australia and internationally. It is expected that road safety policies and trauma mitigation strategies resulting from research outcomes using the facility, will likely yield fatality and serious injury reductions in the order of around 20-30% over the next decade; saving many hundreds of lives as well as eliminating many thousands of life-threatening serious injuries.

Australia's past success in road safety has been due, in large part, to the development of road safety strategies with prioritised interventions with a very strong evidence base. To date, this evidence base has been derived primarily from crash data collected by police, in-depth crash investigations, Coroners' and hospital data and from data from surveys on driver exposures to risk. However, these data sources are limited in the depth and quality of information they provide about driver and road user behaviour, which are major contributing factors in most collisions. Such data can often only be inferred, if at all, from available evidence after a crash or from surveys with confounding unknown self-reported biases. Existing data collection methods in road safety in Australia rely on the limited post-crash accuracy and biases of driver and witness recall of events and on retrospective physical evidence from crash scenes - with little or no pre-crash information about other vehicles and road users involved.

The Naturalistic Driving Study (NDS) is a relatively new research method that has the potential to overcome many of these limitations. In a NDS, volunteer participants drive an instrumented vehicle (usually their own) for 6 to 12 months, or more, fitted with an unobtrusive Data Acquisition System (DAS) which continuously records their driving behaviour (e.g. where they are looking), the behaviour of their vehicle (e.g. speed, lane position) and the behaviour of other road users with whom they interact (e.g. other drivers, motorcyclists, cyclists and pedestrians) - in normal and safety-critical situations. Each DAS, depending on its capabilities, incorporates multiple sensors (video cameras, GPS, radar, accelerometers, etc.) – to provide a complete, second-by-second, picture of driver, vehicle and road user behaviour in all driving situations.

The importance of the NDS paradigm in overcoming the limitations of traditional methods of data collection and analysis in road safety is now well recognised by the international research community. The United States, for example, has undertaken several large-scale NDS projects. The first was the seminal "100-car naturalistic driving study", which explored factors leading to rear-end crashes, and the most recent (currently underway) is the United States Strategic Highway Research Program Phase 2 ("SHRP 2") NDS, which deployed around 3000 vehicles to explore and analyse a much wider range of road safety problems. Recently, Japan, Europe (the EC-funded UDRIVE project), Canada and China have followed suit in ramping up their first large-scale NDS projects. To date, no large-scale studies of this kind and complexity have been undertaken in Australia.

So far around 40 studies utilising the NDS approach have been undertaken worldwide. Most have been small-scale studies. Several research issues have been examined, including factors leading to rear-end crashes; skill development in young drivers; skill loss in older drivers; young novice driver crash and incident types; distraction and inattention; fatigue; behaviour of drivers with dementia; interactions between light and heavy vehicle drivers; use of recorded data as feedback to improve driver safety [2]; understanding driver interactions with new vehicle safety technologies; and lane changing behaviour.

While previous NDS projects have yielded some valuable insights into driver and road user behaviour in general, their applicability to the Australian context is questionable for several reasons. First, besides driving on the right side of the road, they have not yet explored many of the high priority, and intractable, road safety problems identified in the Australian National Road Safety Strategy. Speed choice and vulnerable road user interactions, in different situations, and in urban versus regional areas, are good examples. Second, it is not clear how well the findings translate to Australian conditions. Differences in cultural and societal norms, road laws, enforcement strategies, vehicle fleets, road environments, distances travelled, environmental conditions and mix of road users may threaten the transferability of data across countries. Finally, much data from NDS projects undertaken overseas (especially video data) are not accessible to Australian researchers for analysis, for ethical, commercial and other reasons.

The Australian NDS, even on its own, will provide a massive "living" database of information that can be interrogated for many years to improve countermeasure development and enhance Australia's road safety performance. Further information concerning the study can be obtained from the ACRS Conference Database [1]. The ANDS team will be calling for volunteer drivers to sign up to the study sometime in April 2015. To make an enquiry or to register an interest in the study, contact Professor R Grzebieta on r.grzebieta@unsw.edu.au.

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"Ride to Live" – the research behind the campaign

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The "Ride to Live" campaign is the first integrated motorcycle education campaign in New South Wales. It targets both riders and drivers through television, radio, digital and outdoor advertising. The campaign aims to highlight scenarios which put motorcyclists at risk, and encourage riders to make safe decisions in order to manage their risks on the road. It also targets drivers, highlighting that the actions drivers take have potential consequences for motorcyclists.

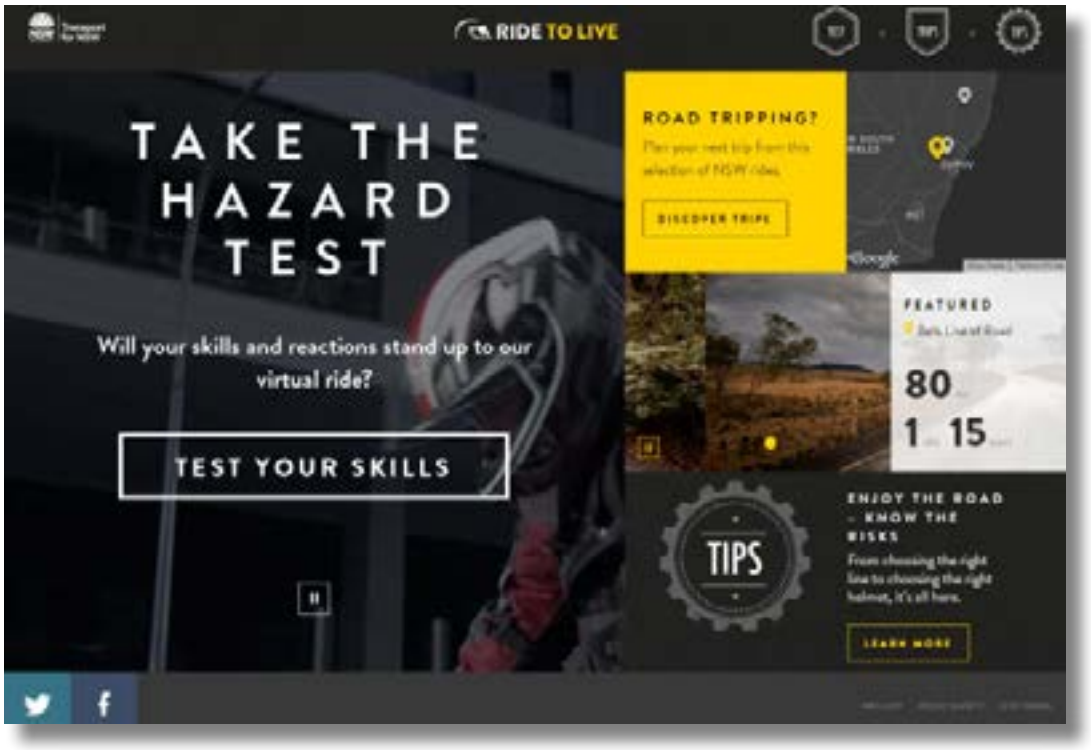
An analysis of New South Wales crash data revealed distinct crash patterns for commuter and recreational motorcycle riders. Commuter riders are more commonly involved in crashes with other vehicles, particularly at intersections or in rear-end and lane change collisions. Recreational riders have a higher incidence of single vehicle crashes due to loss of control on both straight and curved roads. The crash profile for each group informed the scenarios that were depicted in each of the campaign executions.

In 2012, quantitative research was undertaken to gain an in-depth understanding of the knowledge, attitudes and self-reported behaviours of New South Wales riders and drivers in relation to motorcycle safety. This consisted of an online survey of three groups:

- a representative sample of n=948 motorcycle riders based on New South Wales licensing data;
- an open sample of n=1036 motorcycle riders sourced from a link placed on New South Wales motorcycle club and association websites; and
- a representative sample of n=997 drivers based on New South Wales licensing data.

The additional open sample helped ensure that the attitudes and behaviours of the active motorcycle riding population were captured, as motorcycle licensing data is considered a poor measure of underlying exposure levels for motorcyclists. Detailed findings of the 2012 research were presented at the 2013 National Road Safety Forum in Tasmania [1].

Results from the research indicated that visibility and inattention are key issues for riders and drivers. Drivers reported being concerned about the visibility and riding behaviour of motorcyclists, while riders reported equal concern about their own visibility. Common to both road user groups was a shared sense of responsibility for the safety of motorcycle riders.



The research also highlighted key differences between the open and representative rider sample. The open sample was more likely to ride more frequently, report being involved in a crash or close call, and blame the other road user for the crash or close call. This group also had a much lower perception of risk, and were more focussed on rider skills and the role of other motorists in crashes.

Based on the insights gained from the research, the campaign was subsequently designed around highlighting everyday hazards that riders face on the road and illustrating the consequences of different choices riders can make in response to each scenario. The campaign aims to challenge riders to better manage their risks by anticipating hazards and preparing early through good lane positioning, buffering and setting up brakes without being too prescriptive and authoritative.

Campaign executions include 30 second and 15 second advertisements featuring metropolitan and rural locations to target the specific crash types and risk management strategies for commuter and recreational riders. There is also a driver execution, which challenges drivers to think about how closely they look for motorcyclists and reminds drivers to check blind spots and look out for motorcyclists at all times.

The television campaign is also supported with a website, which includes online hazard tests based on key crash types, safety tips, and a trip planner of popular recreational riding routes in New South Wales featuring hazard information, recent crashes, weather, traffic and places to stop. The online hub can be found at http://ridetolive.nsw.gov.au.

The results of the crash data analysis and quantitative research were instrumental in the development of the new campaign, and were considered at every stage to ensure the campaign messages were relevant and credible to riders, and effectively addressed their unique road safety challenges. This was achieved through a strong collaborative approach between teams within Transport for New South Wales and key motorcycle stakeholders including the Motorcycle Alliance and Motorcycle Council of New South Wales.

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Driver Behaviour

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This article begins with a bold, and some would say, cynical statement. For years now governments and vehicle manufacturers have spent hundreds of billions of dollars, uncountable hours and very high expertise designing safer roads, safer vehicles, safer road sides, implementing systems and improved regulations, in a bid to continue to reduce the numbers of people killed and injured and damage done on the road. Then they put people in charge of vehicles.

Without people in control of vehicles the number of incidents on the road would be next to zero. The human being is the only part of operating a vehicle, or the roads, roadsides, etc. that cannot be engineered or designed to be next to perfect, and in truth fails at the task of driving so often.

Some would say "what about weather, falling trees, animals and so on?" Well, engineering can provide solutions to these 'external' factors with improved roads, roadsides and vehicle responsiveness. To give you an example, consider the technology available in newer Volvos. It keeps the car within the lane; ensures there is sufficient space kept in front of the vehicle to be able to stop; scans the road ahead and if it detects anything coming out in front brakes immediately. It has ESC, ABS, EBD etc. And these are only the active safety devices. It then has additional passive devices in case a crash actually occurs - such as airbags.

According to Transport for NSW [1], 295 deaths and 7,111 casualties in New South Wales in 2012 were caused just by the human factors of speeding, alcohol, fatigue and not wearing restraints. The total number of deaths in New South Wales in 2012 was 368 and injuries 22,902. If you add failing to give way, tailgating, dangerous driving, etc., the percentage of deaths, injuries and crashes caused by humans is even higher.

So while ever there are moving vehicles there is a possibility of an incident and evidence suggests that humans are the single biggest cause of incidents on the road. There are many reasons for this, the first being that

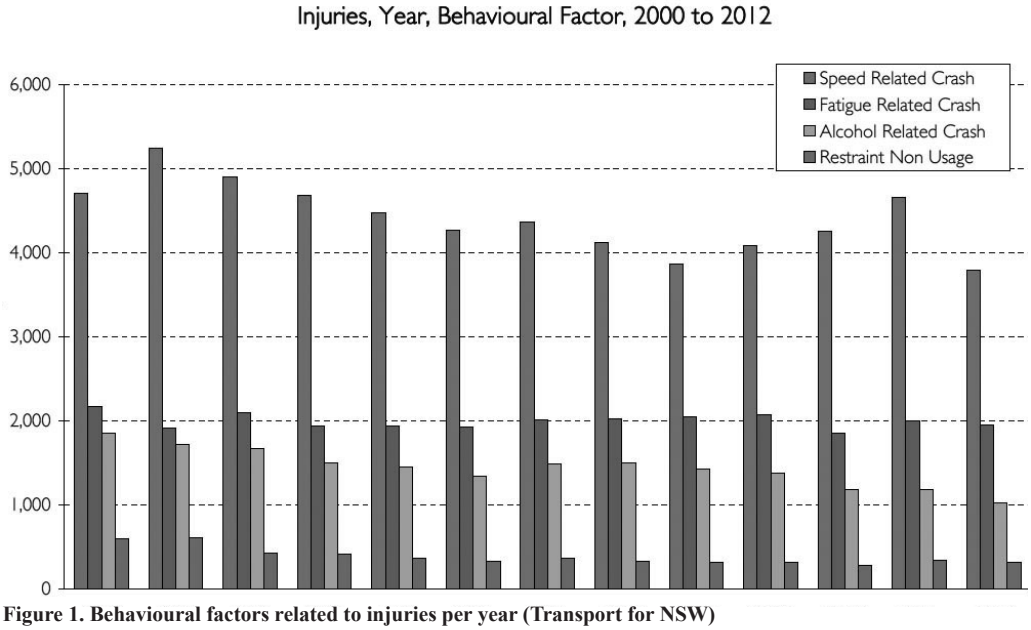

Figure 1. Behavioural factors related to injuries per year (Transport for NSW)

even with maximum effort and concentration humans cannot be perfect. On top of that, human beings are programmed to take risks. In order to live their lives humans must take risks. It is present in everything humans do, so they become used to it, even immune and unaware of it, until the consequence or likelihood of a risk reaches a level where the conscious mind steps in and says, "Think about it!" This point where individuals start to think about what they are doing is different for everyone and is expressed in the statement that "some people are more risk averse than others".

A revealing exercise

Dropping the statistics for a moment, the simple exercise below adds weight to the arguments discussed so far. The table below can be filled out with a range of factors that can be considered to contribute to crashes on the road. This may include incidents that drivers or passengers have either experienced or that they know about. Some examples have been provided, but this is just a sample of the many factors which an individual may be aware of.

Human Error	Vehicle	Environment
Speeding	Faulty brakes	Wet weather
Fatigue	Bald tyres	Fog
Alcohol	Lights not working properly	Animals

Human error is often the most common factor. But when the list in the vehicle and environment columns is analysed to identify factors which could also be eliminated or mitigated by a change in driver behaviour (such as car maintenance, slowing down, etc.), these can then be moved into the human factors column. The list of human factors are then by far the most common issues. Looking at the human factors it is essentially a list of risk taking behaviours.

This is not a scientific exercise; there are no quoted research findings or statistics. The result can be defined by an individual based on their own experience.

Addressing human driving behaviour is arguably the most important road safety factor that needs to be addressed. Vehicle manufacturers are close to largely eliminating the human factor with driverless cars but the future of this technology has not been defined at this stage. Will they only be for local use? Will this cover all driving? What about enthusiasts, motorcycles and so on?

Even with the introduction of these new technologies, it is still important that efforts be made to address the human factor in order to improve road safety outcomes.

Risk-taking behaviour

This is a complex area of human behaviour, which is not possible to discuss fully here. This article only considers risk-taking behaviour in the road environment.

Human beings have a psychological condition called 'Optimism Bias'. In layman's terms this means they believe good things happen to them and bad things happen to others. The extension of this belief is that "I can take risks because nothing bad happens to me, and if for some reason it does it will only be minor."

Extending that belief further, it turns into:

- "I'm a good driver, everyone else is the problem."
- "You have to drive like everyone is out to kill you!"

- "I can't believe how many idiots are on the road"

Yet a further extension to this way of thinking is road user responses after an incident occurs:

- "There was nothing I could do, the car in front stopped too quickly!"
- "The car came out of nowhere; there was nothing I could do!"

If you think about these types of statements they also externalise the responsibility. People do this because it is easy, protects their self-esteem and it is more comfortable to feel you were not in control of events. If you reverse those statements to internalising statements such as "I should" or "I could", the person is accepting responsibility for managing their risk. It means people are taking responsibility for their own actions. However, it is not comfortable to feel that you could have done something but didn't. So people tend to avoid this type of thinking.

Externalising leads road users into a lazy, complacent style of driving. After all if there is nothing I can do, then I don't need to take any specific preventative action.

The two broad types of driving attitude can be described as:

Externalising: Anything that may cause me to crash is not under my control and I can't do anything about it, i.e.: "There was nothing I could do" and;

Internalising: I am able to exert at least some level of control over all factors that may cause me to crash, i.e.: "I can …"

The power of this knowledge is that it allows road users to change from a defeatist/victim style of driving to pro-active driving behaviour that manages risk well. An internalising style of thinking leads to internalising situations prior to incidents happening. Road users naturally move from internalising after incidents occur, to before they occur. They start to think about what they can do as they approach different situations to minimise the risk of being in a crash, even if it wouldn't be their fault.

So Optimism Bias is a normal, and in fact important, part of the human psyche. After all would you even get up in the morning if you thought bad things were going to happen to you? In the driving environment however, it leads to laziness, complacency, risk taking, etc. and is a dangerous way of thinking. In the end it is also based on incorrect assumptions, because every person has had bad things happen to them.

Unintentional vs Intentional risk taking

Risks taken on the road include both unintentional and intentional risks. There are risks that occur without us realising they are about to happen or that we take without realising it, e.g.: becoming fatigued can be very subtle; and there are those that we intentionally take.

We make thousands of decisions while driving. In most cases they are good rational decisions. However, there are times when road users will make a decision to do something that increases their risk, because they feel the reward they hope to get makes it worthwhile. An example of this is overtaking on double unbroken lines. The belief is that the risk of having a head on crash is outweighed by the time that will be saved.

For most drivers, when they are in a position where they are considering their driving behaviour, such as a training course, it is usually easier to address their intentional risk taking, because it is easy for them to identify these risks and do a risk vs consequences analysis. Unintentional risk taking is often harder to identify and conduct an analysis on.

For a safe driver the unintentional risk taking is probably the most important area, whereas for the average driver, addressing intentional risk taking is probably most important to begin with.

Externalising is one factor that leads road users into both intentional and unintentional risk taking. Internalising is how they learn to manage risk and become a safe driver.

What affects road user behaviour?

Again, human beings are complex and flawed. They are in possession of the most powerful problem-solving device in the world - their brains - but the facts are that in their day-to-day lives humans actually make decisions based on how they feel, rather than what they think. How many times have you personally done something that you rationally knew was stupid, dangerous or even illegal? Why did you do it then?

There are both internal and external factors that affect decision-making by road users, including:

- Attitudes to safety
- Attitudes to authority and rules
- Belief systems
- Estimation of one's ability
- State of emotion
- State of impairment
- Medication
- External pressures
- Internal pressures
- Social expectations
- Media

An example of a risk taking decision by a driver is running late. The decision needed is whether to stick to the speed limits and the rules at intersections, or give in

to the pressure of being late and take the risk of speeding, accelerating through an amber light, and so on.

Social impact is another influence on decision making. Many drivers don't believe they can implement safe driving techniques because of the response they will get from peers and other road users. This is commonly expressed in the statement "I speed because everyone else does". Anecdotally from our experience in road safety training it is clear that social acceptance is a major barrier to safer driving.

In modern society another barrier is the perception of many people that they are always in a hurry. Modern society seems to put pressure on people, such as long work hours, needing to drive children to sport and so on. This shows in the driving environment with behaviours such as speeding, tailgating, dangerous overtaking and road rage. The truth is that, despite the fact that these behaviours usually result in very little time saved, generally people are probably not in as much of a hurry as they think. Possibly, people have become conditioned to feeling they're in a hurry and under pressure.

A good question to ask yourself when you feel you need to rush as a driver is "When I get to my destination am I going to run when I get out of the car?" If the answer is no, then you're probably not in that much of a hurry and the very small amount of time you lose by driving safely will make no difference at all.

Males vs Females

A good way to stimulate thinking about the effect of the human being on safe roads is to compare male and female drivers. To do this we do need to generalise but it is valid in such a discussion to demonstrate the point. Below you will see the graph that shows the difference in the number of deaths on the road by gender in 2013 [1].

Figure 2 indicates that in most age brackets male drivers are approximately twice as likely to be killed. There are many reasons for this including factors such as males driving more hours than females, at the most dangerous times of the day and on the most dangerous roads.

However, it can also be argued that for such a large difference there must be some other factors, including driving behaviour. It is generally acknowledged that males take more risks on the road, including speeding, overtaking, tailgating and engaging in hoon driving.

Another point of interest is that this graph has changed dramatically. Since 2005 until 2013 males were always three times more likely than females to be killed in a crash [1]. So what has changed? Possibly the driving behaviour of females is changing and increased risk taking is starting to impact on the numbers? Perhaps males are changing their behaviour?

Of course this graph doesn't include injuries or crashes with no injuries. It is possible that female drivers could be involved in more crashes. However, whether females are involved in more crashes than males or not, both results would indicate that male driver behaviour is more dangerous.

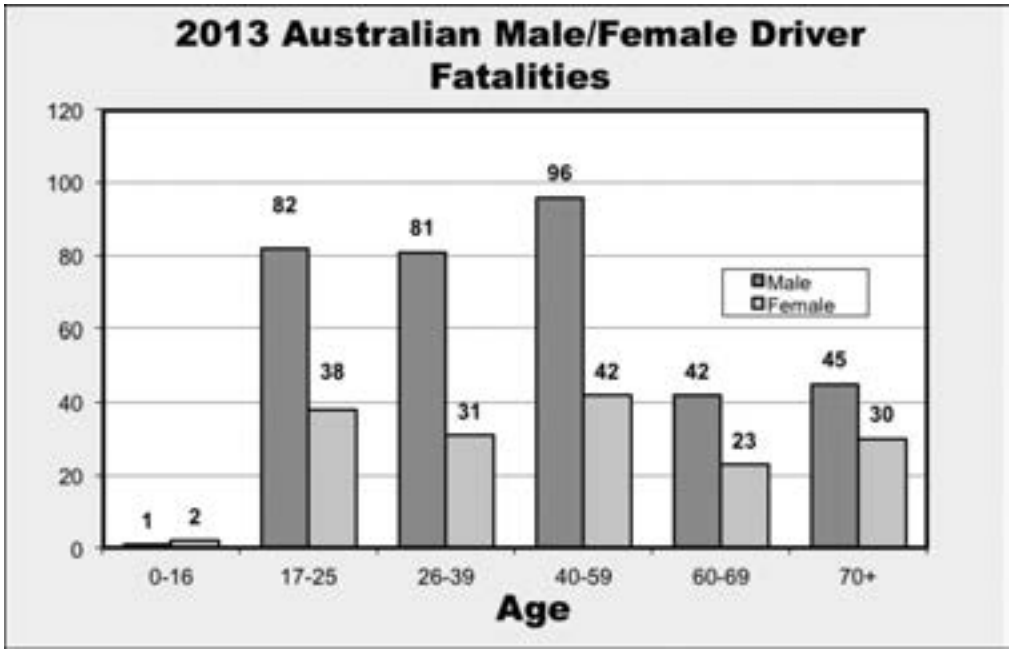

Figure 2. Comparison of Australian male and female driver fatalities.
Source: (Department of Infrastructure and Regional Development)

The ambivalent driver

Human beings will not change their behaviour without a significant reason to do so. That reason needs to be personally meaningful for them and have a strong perceived benefit. Unfortunately, this means there are many road users that will not improve their driving behaviour without being convinced of a significant reason to do so.

Drivers will often change their risk taking behaviour for one of the following reasons:

1. They decide they no longer want to pay fines,
2. They are incurring too many demerit points,
3. They lose their licence,
4. Their lifestyle changes, such as having children in the car,
5. In response to education (advertising or training) increasing their awareness,
6. They are sent to court, or;
7. They receive a prison sentence.

Even then some people will not change their risk taking behaviour at all.

Changing risk taking behaviour

From the list above the most significant motivating factor for a road user to change their behaviour is based on negative outcomes. This is where our police force and the justice system comes into play.

Without doubt, enforcement has a major impact on improving road user behaviour. Part of the risk vs reward decision-making discussed above is the question "Will I get caught?" If drivers were 100% certain they would get caught when they broke the road rules then probably no one would take the risk. When faced with a fixed speed camera, road users generally do not intentionally speed through the speed camera zone simply because the outcome is 100% certain. (There are exceptions such as removing their number plate beforehand).

However, education and training can play a major part in changing driver behaviour. To achieve behaviour change is not easy though and requires a structured training environment and the application of behaviour change theory, which encourages participants to reflect on their own personal motivations and lifestyle.

There are a range of behaviour change theories; this article will consider two of those:

1. Transtheoretical behaviour change theory [5] and
2. The Theory of Reasoned Action (formulated by Icek Ajzen) [5]

The Transtheoretical/Stages of Change Model

This theory states that there are five stages of behaviour change:

1. Pre-contemplation: The individual may or may not be aware that a change is needed.
2. Contemplation: The individual develops motivation to change.
3. Preparation: The individual prepares to make the change in the immediate future.
4. Action:The individual begins to make the change.
5. Maintenance:The individual begins to maintain the change. This stage is reached after approximately six months of demonstrating the new behaviour.

Theory of Reasoned Action

This theory is based on the presumption that people will consider the consequences of a change in behaviour before changing, including the social consequences. They make a decision whether that change in behaviour will have positive or negative consequences.

They will only make the change if they see that the new behaviour will have positive consequences or as a minimum, will not negatively impact upon them socially.

This means that a person's attitude and the social pressure they experience will influence their decision to change.

Self-Efficacy

Self-efficacy is not a behaviour change theory, but is critical for a change to be effective. It describes a person's belief in their ability to perform a task, which is affected by factors such as their prior success at the task or similar tasks; outside factors that affect motivation; and their physiological state.

It is believed that self-efficacy is a good predictor of a person's willingness to make and maintain a change in behaviour.

Self-efficacy is essential for change to happen. Therefore, training developers need to consider how they can empower the learners to feel they have the ability to perform the change.

When developing a training or education program using a behaviour change process, the first step is to increase the feeling of vulnerability - the "it can happen to me if I behave like this" feeling. This is addressing the pre-contemplation stage, making participants think that possibly they need to change their behaviour.

From this point it is important to build the motivation in participants to support the thought that possibly a change is needed.

The next step is to encourage participants to develop a plan to make the change they are considering.

Now is the difficult phase that many programs cannot address, unless it is extensive and conducted over a significant period of time. That is the action and maintenance phases. During a program participants are able to develop their plans and the intention to act but the action and the maintenance of that change is conducted post program. It requires participants to return and undergo further engagement in the process. Therein lies the major challenge to behaviour change programs.

Throughout the process the participant must be encouraged to believe they can make the change (self-efficacy).

Summary

So in summary, the human being is by far the greatest cause of incidents on the road. Changing road user behaviour is often achieved through enforcement and punishment processes, but education and training is an important part of achieving change. Changing behaviour through education and training is not simple but if done well can be effective.

Therefore, education and training in relation to road user behaviour is an important component in the efforts to reduce road incidents. Based on this, there is a strong argument that education and training needs to be implemented on a wider scale as part of the various licence schemes in Australia.

The Author

Stephen Lake (Dip. Training Design and Development) is the CEO of Freebott Pty Limited. Stephen began his career in road safety as a motorcycle instructor for nine years where he taught safe riding techniques. From there Stephen began to work for Freebott Pty Limited where he learnt more about the psychology of road users and the development of behaviour change based programs.

Freebott Pty Limited has been the contracted provider of the Road Ready suite of road safety training programs in the ACT, outside the school and community based environment, for 14 years. The company also delivers programs for road users convicted of drink or drunk driving in both the ACT and New South Wales and is a provider of the Safer Driver Course for learner drivers in New South Wales.

The company developed the current testing tool for Car, Motorcycle and Heavy Vehicle instructors under contract to the ATSB, contributed to the development and trial of the Novice Driver Program and the Sober Driver Program.

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Creating a driver safety culture in the not for profit sector: the UnitingCare Queensland Road Safety Program

By Mark Stephens

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The motivation - vehicle crash and infringement history

Since 2008 UnitingCare Queensland (UCQ) has been providing a coordinated driver education program in road safety. The catalyst for embarking on this program, which was about influencing driver behaviours, was the increasing number of at fault crashes and traffic violations. In fairness to our drivers the environment they operate in and the increased exposure of traffic monitoring equipment are key factors in the increased risks. UCQ has a long history as a

leading provider of community, residential care and health services across Queensland through its service groups Blue Care, Uniting Care Community / Lifeline and Uniting Care Health. The delivery of these services is supported by a fleet of over 2,400 vehicles that travel in excess of 45 million kilometres each year.

The program for Blue Care has now been expanded to all UCQ service groups delivered by the Fleet Operations Unit of UCQ. The initial program was developed to educate staff on the importance of road safety and sharing the road with other road users. The key message delivered through all mediums was and remains that people depend on them when they are driving - and not just other road users, but also their families, partners and friends that want them to arrive home safely after every shift.

A number of significant issues have highlighted the importance of fleet vehicle and road safety as imperative for modern-day fleets. Driven by legislated changes in Europe, Australia has recognised that 'duty of care' compliance encompasses all aspects of working life and should include every part of fleet operations from the purchase and operation of fleet vehicles to staff training in their 'duty of care' to other road users and pedestrians.

Executive and management support

The success of the initiatives of the Fleet Operations Unit could not have been achieved without the support of the executive of the service groups as well as the UCQ executive team and board. The ongoing support has been just as important, as the Fleet Operations Unit introduces new resources and tools to compliment the program and maintain the focus on road safety. Any rollback of this vital program would see the eventual erosion of the road safety culture.

Partnerships and the development of the Driver Safety Campaign

A road and vehicle safety program was designed and delivered in consultation with internal stakeholders and peak bodies. This ensured acceptance by staff and the embedding in organisational culture from the top level of management to the drivers at the coalface. Both CARRSQ and the RACQ have had long relationships with UCQ and were obvious partners to designing, developing and in implementing the program. CARRSQ's involvement started as a research program with Australian Research Council funding in 2006. This research program contributed to the first interventions, with CARRSQ providing technical assistance in the development of slogans and the review of resources during the development phase of the program.

The RACQ has for many years provided road side assistance to UCQ. Currently, UCQ uses a number of the RACQ services to develop and review road safety and the operation of fleet vehicles. The RACQ road safety education unit has been pivotal in providing the technical support to develop internal education resources and in delivering the education sessions.

With the assistance of RACQ and CARRSQ the Blue Care marketing team's graphic designers developed a range of posters aimed at protecting the driver and also reminding them of their responsibilities to their families and the public. These posters were designed from the driver view of the road, reinforcing that as drivers, people are depending on them. Other communication and dissemination strategies included stickers and driver safety handbooks, brochures, newsletter contributions, e-mail reminders, fleet safety as an integral component of zero harm at work, and constant reminders in electronic communications.

UCQ has furthered its commitment to road safety through its membership and direct involvement with the National Road Safety Partnership Program (NRSPP) as an inaugural member of the steering committee and by its continuing involvement in promoting road safety. The NRSPP made up of leading companies and organisations is committed to promoting road safety across fleets in Australia and New Zealand.

Challenges and road blocks

Sadly the main challenge to the success of this program was not gaining acceptance of the executive or managers but more so the cost of the program. The NFP sector is reliant on government funding and client contributions, which can result in a tightening of available funds for this type of program. Early in the development of the program we realised that our greatest roadblock was going to be the cost of training and resources and that if a manager had to pay for the training out of their budgets then this type of training could take a lower priority. This funding issue was addressed by the creation of a fleet safety training budget.

The other major challenge has been getting access to the drivers to run the education sessions. Follow-up sessions and individual sessions were often required to ensure the road safety training and message was delivered to all staff.

Responsibilities of the modern fleet manager

In the ever-changing corporate environment the modern fleet manager's responsibilities have now become critical for the directors or owners of any company or organisation operating vehicles as part of their business. With a raft of new laws and regulations either in place, or pending, company directors should be mindful of their obligations in regard to the safety of their drivers. This means that:

- Gone are the days of treating the company vehicles as just a medium to get the employee to the next job or sale opportunity;
- Gone are the days of using the excuse that if a person has a license then they are competent to operate the vehicle;
- Gone are the days of ignoring speeding infringements or allowing the infringement to be hidden as a corporate fine;
- Gone are the days of ignoring the accident in a company vehicle and treating it as just an insurance cost;
- Gone are the days of handing the driver a set of keys without carrying out due diligence on their driving history or level of competence to operate the vehicle and;
- Gone are the days of selecting vehicles based on what the driver wants.

Sadly there are fleet managers in both the profit and not-for-profit sectors that continue to be hobbled by directors who believe that the costs of operating fleet vehicles can be passed onto the customer. Instead, they should be looking at their legal, moral and social responsibilities as an opportunity to not only make money out of fleet operations, but also additionally address their duty of care to their employees and their social responsibilities.

Using these new responsibilities to change the shape of the fleet and educate drivers will not only add value to the fleet but just as importantly, reduce the operating cost of the fleet.

Outcomes

While UCQ has achieved overall reductions in "at fault" crashes, fail to give way, and reversing crashes, the significant achievement is that road safety as a culture is now firmly embedded. With a fleet of over 2,400 vehicles that now includes vehicles across the Northern Territory the risk of drivers making a mistake will never be fully mitigated. Our responsibility is to continue to promote Road Safety to our drivers and all our staff - not just through existing resources but through constant reinvention, risk analysis and interventions.

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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 or as contributed articles. Articles are now invited for issues in 2015.

When preparing articles for submission, authors are asked to download and follow the ACRS Instructions for authors, available at http://acrs.org.au/publications/journals/author-guidelines.

Please contact the Managing Editor for further information, and for publication dates and deadlines.

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.

The next issues of the Journal will include a range of topics across sectors, including features on safe roads and infrastructure; and road injury and trauma. Articles are invited on these themes or other road safety issues to be published in 2015.

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ACRS provides researchers and academics, with a forum for discussion, advocacy and collaboration across disciplines, agencies and on an international scale.

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