Vol 24 No 2, 2013

Journal of the Australasian College of Road Safety

Formerly RoadWise – Australia's First Road Safety Journal

Special Issue - 2nd Anniversary of UN Decade of Action


I wish I wasn't in this ad.
I wish I hadn't put my family through this.
I wish I had both legs.
I wish I wasn't in pain all day. And night.
I wish I could sleep.
I wish I wasn't going to end up in a wheelchair.
I wish I hadn't been going so fast.
James Archer, speed crash survivor, May 1996.
Two months in hospital, three months in
physical rehab, a lifetime of pain.
We wish we didn't
have to show these ads.
Don't rush.
An initiative of your local council as part of the Local Government Road Safety Program.
NSW
GOVERNMENT
AMA

The 2013 Australasian College of Road Safety Conference will be held in Adelaide at the National Wine Centre of Australia on **Thursday & Friday, 7–8 November 2013** with a welcome reception on the evening of Wednesday 6 November.

The Conference provides a valuable opportunity for participants to hear about the latest developments in road safety and have discussions with leading researchers, senior policy makers and experienced practitioners. Emphasis is placed on networking, information sharing and the translation of road safety research and policy into practice.

In addition to general papers on various road safety topics, this year's conference will contain a special stream on **what influences the public perception of road safety problems and the issues that need to be discussed** if we are to make significant progress in reducing road trauma over the next decade.

Who should attend

The primary aim of the ACRS Conference is to provide a rich environment to encourage best possible outcomes to save lives and reduce injuries on our roads

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This conference is a must for anyone involved in road safety across all areas of the road safety profession.

This includes:

- Journalists, editors and public relations
- Media and communication experts
- Researchers and academics
- Federal, state and local government employees
- Policy makers
- Law enforcers and legislators
- Health professionals
- Engineers
- Psychologists
- Students in the road safety disciplines
- Consultants
- Private sector organisations
- Educators, teachers and trainers
- Any others with an interest in road safety

Register | Submit an Abstract | Sponsor

http://acrs.org.au/conference

ENTRIES OPEN 1st May 2013

3M–ACRS Diamond Road Safety Award 2013

Keeping people safer through innovative best practice

ENTER & GET RECOGNISED!

Have you or a colleague recently developed a road safety treatment/initiative that stands out beyond traditional activities and delivered improved road safety? You could be the winner! We are looking for entries from **any road safety practitioner** who works within the Australian private or public sector who fits this criteria. Don't miss out on your chance to win and be recognised!

WHO WILL JUDGE ENTRIES

All entries will be judged by an independent committee of industry representatives, established by the ACRS specifically for this award.

DIAMOND AWARD

- An individual Team Leader from the winning project will **RECEIVE a trip** to the **USA** to attend the **44th ATSSA Annual Convention & Traffic Expo Headquarters at San Antonio, Texas USA** between the 21st-25th February, 2014. **You will also visit 3M head office.** This individual will also present on their winning entry and international trip at the following ACRS Road Safety Conference in 2014
- The winning entry will be announced at the **ACRS Road Safety Conference Dinner** on **7th November 2013** where **all eligible members** of the winning project will be presented with the 3M-ACRS Diamond Road Safety Award

AUSTRALASIAN COLLEGE OF ROAD SAFETY

TO ENTER & MORE INFORMATION, VISIT

www.acrs.org.au/award

Entries open 1st May 2013 and close 5pm (EST), 13th September 2013.

3M

International Road Safety Conference, Sydney, 2013

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Cover image

The UN Decade of Action road safety tag is a symbol of the global movement to improve safety on the roads. See www.roadsafetyfund.org for more information.

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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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By submitting a paper, authors give their permission to the College to make minor editorial changes to conform to the College in-house style manual; to print the paper in the *Journal of the Australasian College of Road Safety*; to send it for indexing to SafetyLit, Informit and other relevant databases; to make the full text of the paper available online through the ACRS website and Informit; and to promote the paper through media releases or by giving permission to re-print it in full or part in other hard copy or online resources that promote road safety. All photographs and diagrams for which the author or the author's employing organisation does not hold copyright must be accompanied by permission from the copyright holder to be used as indicated above.

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Inquiries about membership and College activities should be directed to the Executive Officer.

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From the President

Dear ACRS members,

"Imagine if improvements to combat road trauma were a top national public health priority - the effect on our nation's health, economy and wellbeing would be a gold standard for the global community."

That is the opening statement in our submission to all Federal politicians in the long lead up to the election in September. You will be able to see a copy of that submission on our website. It has been developed in the College by our Executive Officer Claire Howe with help from many members across Australia.

It is pleasing to note the appointment of a Federal Minister for Road Safety, the Hon Catherine King, who has been a good friend of the College over many years. The submission we believe will provide her with guidance for her new portfolio.

Can I encourage you to read the full submission and consider giving a copy to or asking your local candidate to support the suggestions in the submission in the many portfolio areas highlighted?

We need to demonstrate to the community and particularly opinion leaders, election candidates and future governments that road safety performance is not just a matter for road and transport departments. There are gains to be had across many portfolios and in many areas in the community from programs which reduce road crashes and road trauma. We don't often get a chance to encourage a broader road safety agenda in Australia. The better our message, the more members who help promote it, the better our trauma reductions will be.

It is timely to reflect that the College has just turned 25! The College through its members can be very proud of its achievements over that time and I believe we are in a strong position now to help even further in reducing unnecessary road trauma. We are currently working with the NHMRC to develop a framework for national road safety research. The cooperation of senior researchers from all our road safety research centres in the project, with each other and with the NHMRC is a tribute to the quality of our members. This project will be a milestone for the College in its 25th year.

It is with regret that I mention the passing of one of our highly regarded road safety leaders; someone who mentored and encouraged me to see solutions to road safety challenges - Peter Makeham, past head of the Office of Road Safety. The College has passed on condolences to his wife and family.

Lauchlan McIntosh AM FACRS
ACRS President

Diary

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

29 – 30 May 2013
7th National Electronic Tolling Committee Industry Forum
Brisbane Convention and Exhibition Centre, Brisbane

17 – 19 June 2013
Making Cities Liveable + Sustainable Transformation conferences
Novotel, St Kilda, Melbourne
http://healthycities.wordpress.com/2013-conference/

19 – 22 June 2013
Bicycle Urbanism Symposium: Reimagining bicycle-friendly cities
University of Washington, Seattle
http://www.be.washington.edu/bicycleurbanism/

30 July – 2 August 2013
AITPM National Traffic and Transport Conference
Perth, Western Australia
http://www.aitpm.com.au

25 – 28 August 2013
T2013 International Conference
20th International Council on Alcohol, Drugs and Traffic Safety Conference
Brisbane Convention and Exhibition Centre, Brisbane
www.t2013.com

28 – 30 August 2013
Australasian Road Safety Research, Policing and Education Conference 2013Brisbane Convention and Exhibition Centre, Brisbane
http://www.rsrpe2013.com.au/

6 – 8 November 2013
ACRS Conference
National Wine Centre of Australia
Adelaide
http://acrs.org.au/conference/

Celebrating the Second Anniversary of the UN Decade of Action: What does it mean?

Message from the Minister

The Australian Government places a great deal of importance on road safety – both at home and abroad. The National Road Safety Strategy is about to enter its third year with positive progress on many of the initiatives designed to reduce deaths and injuries on Australian roads. Equally important is our international contribution. We are the largest donor to the World Bank's Global Road Safety Facility; we contribute to regional road safety measures through international forums like APEC; and our aid-funded infrastructure programs in developing countries are delivering tangible improvements in safety. On the second anniversary of the Decade of Action on Road Safety, Australia remains committed to exchanging ideas, experiences and expertise to help realise the shared goal of safer roads worldwide.

The Hon Catherine King MP
Minister for Road Safety
Australian Government

The early years of the Decade of Action for Road Safety

In 2010, 1.24 million people died on the world's roads and up to 50 million more were injured. Road traffic injuries are the eighth leading cause of death globally and the leading cause of death for people aged 15–29.[1] The burden of road related trauma is unevenly distributed, with over 90% of road fatalities occurring in low-income and middle-income countries.

In March 2010, the United Nations unanimously proclaimed the Decade of Action for Road Safety 2011-2020 and a Plan to deliver improved road safety for the decade was developed.[2] The Plan is based on safe system principles and covers key pillars of action: Road Safety Management; Safer Roads and Mobility; Safer Vehicles; Safer Road Users; and Post-crash Response (though many of us involved in its preparation supported having Safe Speeds as a separate pillar, given the dramatic and inexpensive safety gains to be made via speed management). Nonetheless, the plan has been influential and effective.

Estimates that road safety is costing low and middle income countries up to 2.5% of their GNP have brought road safety into focus from an economic development perspective and this has been influential. It is perhaps disturbing that in my experience and that of many others, that this statistic often has more influence on policy than the sheer tragedy of the large numbers of deaths and debilitating injuries. However, this economic argument directly confronts the common view that road trauma is the inevitable price of economic development; via the realisation that road trauma is holding back development. The Decade of Action and the Plan have produced dramatic effects, with many developing countries setting targets for road toll improvements in line with the Decade Plan, and working towards stronger road safety accountability, improved monitoring, better management, significant investment and delivery of road safety. This is being supported by organisations funding expert road safety assistance in developing countries including the World Bank and the Global Road Safety Partnership. Bloomberg Philanthropies and others have provided generous support. With continued and growing commitment to the Plan, the predicted dramatic increases in road trauma, as low and middle income countries motorise, can be averted.

By Soames Job,
Principal for Global Road Safety Solutions and Adjunct Professor, Transport and Road Safety, University of New South Wales

Our national strategy is Australia's primary domestic response to the UN Decade of Action on Road Safety.

The National Road Safety Strategy is the umbrella framework to ensure all Australians can enjoy the benefits of safer roads. The Strategy complements the state and territory plans and completes an extensive suite of evidence based action at the national, state and local levels.

While it's too early to evaluate the impact of the NRSS on trauma outcomes, it is clear that since its launch we have seen an important renewal in efforts nationally to improve road safety.

The Decade of Action on Road Safety aims to reduce by 50% the projected global increase in road related deaths over the next ten years. For nations like our own who are projecting reductions in deaths we have an additional obligation to assist countries to build their capacity to meet their road safety challenges.

By David Shelton
Executive Director
Strategy and Planning
Road Safety Coordinator, VicRoads
Chair National Road Safety Executive Group

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[1] WHO (2013) *Global status report on road safety 2013: Supporting a decade of action*. WHO: Geneva.

[2] United Nations (2011). *Global Plan for the Decade of Action on Road Safety 2011-202*. Geneva: WHO.

The UN Decade of Action requires us all to do more. Some states have great initiatives underway but at the national level I feel Australia is sadly tracking towards a Decade of the Same in many areas. An unambitious strategy target, with insufficient resourcing is the core of the problem. At the state level we have some great progress and potential - like the $1bn investment by TAC and VicRoads - but what is missing is scale at a national level. We have all the solutions – now all we need is the scale of response within Australia and as part of our global aid investment in a region that accounts for more than 50% of the world's 30-50 million deaths and serious injuries every year. We need real action and we need it now!

Rob McInerney
Chief Executive Officer
International Road Assessment Programme (iRAP)

CARRS-Q perspective on the Decade of Action for Road Safety

The launch of the Decade of Action for Road Safety in 2011 has undoubtedly lifted the global profile of the road trauma problem and facilitated a significant boost in funding for low and middle income countries. The 'Five Pillars' around which the initiative is based has provided both a focus for advocating action and a starting point for national strategic approaches. Besides enabling some very concrete projects like RS10, the Decade of Action has acted as a 'call for action', which has encouraged a more collaborative approach across the many different types of organisations and institutions involved in road safety around the world. Nonetheless, more needs to be achieved if the Decade of Action is to realise its full potential in the coming years. At an international level, capacity building efforts need to focus on developing local and sustainable expertise in the low and middle income countries experiencing rapid motorisation. This will entail developing innovative approaches to information sharing, the building of collaborative networks, and the distribution of scarce road safety funds. At a national level, we need to ensure that the road trauma reduction aspirations inherent in the Decade of Action are reflected in our national and state road safety strategies and action plans, and that Australia plays a strong leadership role in enhancing road safety both globally and in our immediate region.

Professor Barry Watson
PhD Director
Centre for Accident Research and Road Safety - Queensland (CARRS-Q)

Global Decade of Action: Need for Sustained and Coordinated Global Action

The importance of actively participating in the Decade of Action (2011 – 2020) is underlined by the scale of the global road safety problem. Annually about 1.24 million people are killed and 50 million injured on roads across the world, and in the absence of any action to address this global health crisis it is expected that road fatalities will continue to increase and that they will climb from the ninth greatest cause of death in the world to fifth greatest by 2030. In response to this challenge a number of road safety activities to aid developing countries have been initiated in Australia. Examples of the range and types of current activities include: road safety capacity building in developing countries; the initiation of 'twinning' programs to bring together Australian 'experts' and practitioners from developing countries; and practical actions of immediate benefit such as ARRB's program of providing bicycle helmets to schools in developing countries.

Michael Tziotis
National Technical Leader and Manager
Safe Systems, ARRB Group

Letters

RE: Leadership Failure

In 1957 The Victorian Division of the National Safety Council of Australia (NSCA) asked me to chair a 12-month community road safety campaign in the Latrobe Valley in Gippsland where I was a general practitioner and an occupational physician active in safety. I had previously (in 1952) told the NSCA that I never got tea on time every second Saturday night because I was on call treating road accident victims due to very drunk drivers. This was well before blood alcohol tests, breathalysers, booze buses and RBTs. Pubs then closed at 6pm and were not open on Sundays.

The idea came from Tom Paterson, the Director of the Australian Road Safety Council, (ARSC) who had seen a community road safety campaign for a 3500 population in Palmerston North in New Zealand and asked the six state members of the ARSC to run a pilot campaign in their states. Five ARSC Members were from their State Transport Departments and Victoria's was an NGO, the NSCA, the only member to develop a campaign. The RASC was very dysfunctional. Later the Federal Transport Department asked my old headmaster, Sir James Darling, to sort it out, but it was too dysfunctional to improve. This does not bode well for current leadership coordination. It confirmed my views that Australia's Federation does not work well. The ARSC showed no leadership or coordination.

When I accepted the challenge, I asked the NSCA, "What should I do?" They said, "Make it up as you go along." Such was the state of road safety in 1957. Tom Paterson was more helpful. He gave me Halsey's book and copies from the US President's Highway Safety Conference that helped me with organisation and coordination of the three towns' Sub-Committees in Morwell, Moe and Yallourn with a population of 35 000.

Tom Paterson also gave me four quarterly copies of Operation Safety from the US National Safety Council full of examples of pamphlets, press releases, radio messages, projects and other useful ideas for single emphasis programs. I used many of the suggestions in Operation Safety. We used three single emphasis programs for one month each. For Speed the Apex Clubs sponsored roadside "Speed Kills" and "Slow Down" signs for two weeks and then we had two unmarked Police cars from Melbourne (courtesy of Rupert Arnold, Deputy Police Commissioner and a member of the NSCA) for two weeks trying unsuccessfully to catch speeders. The bicycle dealers sponsored bike safety; setting up bike lanes in schools and bicycle safety checks like those later used in Bike Safe. We felt we should get off motorists' backs for a while and had a month on Pedestrian Safety at crossings, after checking the crossings first and then aiming messages at school children and other pedestrians.

The Campaign was hard work but it reduced by 20 percent road accidents reported to the local Police stations within the 12 months of the campaign. I have not heard of a similar reduction from any other road safety effort since then.

Half-way through the Campaign the Victorian Sate Government withdrew its road safety funding from the NSCA to form the Traffic Commission but the NSCA supported the Campaign till it ended on the 30th of June 1958. I sent my final report to the NSCA which had no more road safety involvement and to the Traffic Commission that had no involvement in community road safety.

Walter Phelps Eno was a pioneer of road safety in the early 29th century and founder of the Eno Foundation that published Halsey's book. Eno introduced red intersection traffic lights and many other safety devices. He developed traffic plans for London and Paris. I have not heard of any Australian road safety expert referring to him, his Foundation, Halsey's book or Eno's pioneering road safety work. I would hope that you could convince some road-safety-historian to submit an article to the Journal on Eno and his pioneering work. We should learn from history; not make the same mistakes; and help members study and learn from the early history of road safety.

Ric Bouvier
Associate Fellow

College news

National Office news

Welcome to new corporate members

Australian Mobile Telecommunications Association, Canberra
Brisbane Motorway Services, Brisbane

Celebrating 25 Years

Congratulations to ACRS on reaching the significant milestone of 25 years of work in the road safety community, providing a rich, collaborative environment and a focus on saving lives and serious injuries on our roads.

RRSP Profile: Kerry Armstrong

Dr Kerry Armstrong, BSSc (Hons Psychology), PhD is a senior research fellow at Centre for Accident Research and Road Safety – Queensland (CARRS-Q), which is based at the Queensland University of Technology. Kerry has been actively involved in road safety analysis, initiatives, and research for the past 12 years. In this time she has conducted and managed research in a number of road safety/injury prevention domains including roadside drug testing, random roadside breath testing, women and alcohol, unlicensed and unregistered driving,

fatigue and sleepiness, and safety culture in the heavy vehicle industry (both nationally and internationally). In a typical day, she manages and conducts research projects for agencies such as Austroads, Department of Transport and Main Roads – Queensland, Queensland Police Service, Queensland Health and many others. As a senior staff member of a large University,
she is also responsible for supervising a number of PhD, Masters and Postgraduate Research students as well as ensuring the research she is involved in is published and disseminated to the wider community.
She has involvement with a number of committees including: current Chair of the ACRS – Queensland Chapter; a Pillar Leader for the 33,900 Australian Road Safety Collaboration Safer Road User Pillar; editorial board member for Modern Traffic and Transportation Engineering Research, and also sits on a number of University committees. In addition to this, she is a Registered Psychologist with the Psychology Board of Australia.
What she values most about her ACRS membership is the networking opportunities with road safety practitioners, researchers and policy advisors across Australasia. Kerry states: "Since joining the ACRS in 2008 I have had the opportunity to meet numerous people by attending chapter seminars and meetings as well as the ACRS conferences; all of which has enhanced not only collaborative opportunities but professional relationships as well. Further, the email alerts, which are sent to members by the National office on a weekly basis, are an invaluable resource that allows me to remain up to date with what is happening across Australasia and around the world, as well as highlighting for me future events and opportunities that I may not have been aware of otherwise. Finally, the current road safety issue that concerns me the most involves the issue of sleepiness and fatigue. We know that sleep-related driving is an important contributory factor in fatal and serious injury crashes, yet a large portion of people continue to drive when they feel sleepy. Based on responses from over 1,600 interviews, we found that approximately 19% of those we spoke to reported being involved in a near-miss or crash as a result of driving when tired. I believe we need to continue our efforts in this area."

Chapter reports

Victorian Chapter

The Victorian Chapter held a road safety hypothetical seminar on 20 March 2013. The session focussed on a hypothetical crash scenario and the aim of the day was to generate discussions around some of the factors, both obvious and less so, that led to the hypothetical crash and its outcome. The seminar was held in a 'coronial inquest/ courtroom' style format.

The audience had the opportunity to hear the views of 'witnesses' - experts in the field of road engineering, law, vehicle safety, workplace safety, crash reconstruction and policing. The session generated some lively and thought provoking discussions on where responsibilities and solutions lie and the best approaches moving forward.

The session was very well attended and the feedback received has been extremely positive. Thank you to the committee for organising a successful seminar and a big thank you also to our facilitator and guest speakers for their assistance.

Jessica Truong
Victorian Chapter Chair

New South Wales Chapter

As this edition of the Journal goes to print, the NSW Chapter is kicking off 2013 with a Members Forum and Annual General Meeting on May 2. This is a chance for you to get involved, have your say on the topics and types of activities you would like from the Chapter, and to elect the Chapter Executive Committee for the next two years.
If you missed out and would still like to contribute, you can always find details of the Chapter Executive, activities and contact details on the ACRS website: acrs.org.au/about-us/ chapters/new-south-wales-sydney.

A/Prof Teresa Senserrick,
NSW (Sydney) Chapter Chair and Representative on the National ACRS Executive Committee

ACT Chapter

The ACT Chapter held the first of its new seminar series in March. About 50 people attended a Seminar on A Culture of Speed, led with very thought-provoking presentations by Dr Soames Job and Dr James Warn.

This will be followed on the 7th of May by a second Seminar on Trauma on ACT and surrounding NSW Rural Roads, with presentations by Professor Mary Sheehan AM and Victoria Pyne from ARRB as well as a number of participants from the regional area around Canberra.

Our thanks are extended to the NRMA – ACT Road Safety Trust for its support of these Seminars.

Eric Chalmers
ACT Chapter Chair

South Australian Chapter

The South Australian Chapter has continued with the popular Lunchtime Dialogue series, with a mixture of topics ranging from safety technologies to overall policy directions.

Dialogues:
Video analysis improving road safety
Professor Anton van den Hengel,
School of Computer Science, University of Adelaide

Thinker in residence report on road safety by Professor Fred Wegman
Presented by Jeremy Woolley (CASR)

The safety implications of cyclist conspicuity
Simon Raftery (CASR) & Dr Michael White (SafeWork SA)

Safety cameras: An update on the South Australian approach
Supt Robert Fauser (SAPOL) and Jamie Mackenzie (CASR)

Lunchtime Dialogues are scheduled bimonthly and upcoming topics include the South Australian Black Spot Program and SA Police (SAPOL) accident reconstruction.

A special thank you goes to committee member Supt Stuart Mclean, who has moved on to another area of SAPOL. Stuart was particularly enthusiastic in promoting road safety and his replacement, Robert Fauser has already proved a worthy replacement.

The Committee is now heavily involved in organising the National Conference, scheduled for the 6th to 8th of November this year.

Jeremy Woolley
South Australian Chapter Chair

Queensland Chapter

The Queensland Chapter has held three Chapter meetings, with an accompanying seminar, in the period between September 2012 and March 2013. The first seminar entitled "Discussion of road safety related trends influencing the Queensland 2010 road toll: the lowest since 1952" was presented by Mr Samuel Bailey, Senior Behavioural Scientist, Transport Safety, Customer Services, Safety and Regulation Division, Department of Transport and Main Roads on Tuesday 4 September 2012.

The second seminar, entitled "Roadside Drug Testing in Queensland: Future directions', was presented by Assistant Commissioner Peter Martin (APM), Operations Support Command, Queensland Police Service on Tuesday 4 December 2012.

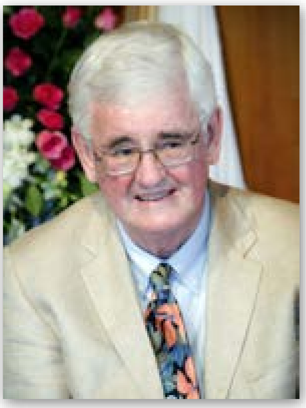
The third seminar, "Findings of the Motorcycle Rider Safety Project" was presented by Professor Narelle Haworth, CARRS-Q on Tuesday 5 March 2013.

All seminars were well attended and prompted considerable discussion among members and other attendees. Professor Barry Watson and Dr Kerry Armstrong were involved in the two-day workshop to progress the draft National Road Safety Research Strategy. Professor Watson has agreed to remain on a 'Drafting Group" to progress the development of the framework.

Kerry Armstrong
Queensland Chapter Chair

Vale Peter Makeham

19 June 1939 – 20 February 2013



It is with sadness we report the death of Peter Makeham who was Director of the Federal Office of Road Safety for ten years from 1988 and then General Manager, Safety and Environment Policy at the National Transport Commission for a further six years.

Peter worked in the Federal Office of Road Safety (FORS) for around 15 years and led it at a time of major change and new initiatives. He was unfailingly polite, thoughtful and, once he made up his mind, determined to achieve sensible outcomes. He was a thorough gentleman and his uncompromising and methodical approach to developing sound policy generated widespread respect and support in FORS and the broader national and international road safety and vehicle emissions community.

Under his leadership, FORS became a significant player on the Australian and international road safety and vehicle emissions stage and was at the forefront in the management of road user safety, vehicle safety and vehicle emissions. He was a master of explaining complex technical issues in a way understandable to the lay person. He was a great believer in research led policy and in the need for meaningful communication with stakeholders at all levels – a "must" in reaching agreement in Commonwealth/State forums and with major industry bodies.

Some of the major road safety and vehicle emission policy initiatives which Peter led were:

Unleaded petrol

Peter was deeply involved in the work leading to the introduction of unleaded petrol in Australia. Peter's unfailing politeness and persistence were a wonderful example of achieving consensus on difficult issues between federal and state governments and with industry.

Motor Vehicle Standards Act

Peter was intimately involved in developing the Motor Vehicle Standards Act. There had been previous attempts to achieve Federal leadership of vehicle standards but the powers remained essentially with the States – a classic Federal /State standoff. Peter had the job of selling the proposal to the states and industry and having it introduced in record breaking time. The MVSA allowed the Commonwealth to engage in research programs on vehicle safety and become a player, rather than a spectator, in research and development.

Vehicle emissions

Peter's background and experience was invaluable in developing several rounds of emission standards for road vehicles both while at FORS and the NTC.

National Road Safety Strategy

The National Road Safety Strategy was a response to the steadily increasing road toll in Australia and the Kempsey and Grafton bus crashes. With the help of many State and Territory stakeholders, the strategy helped Australia make major reductions in the road toll. It focussed on vehicle standards and road user initiatives and helped Australia to punch well above its weight in international arenas. The Black Spots road program and the ten point plan were part of an integrated package that allowed governments to adopt a range of measures to start the downward movement in the road toll. The ten point plan required State and Territory Governments to put in place ten road safety initiatives, in return for access to the Black Spots program funding. Peter's experience helped ensure the program was achieved without scandals of misuse of resources.

One of his telling management tools was a simple graph on his office wall that showed the decline in the annual road toll from around 2,900 deaths in 1988 to around 1,750 when he retired from FORS in 1998 – and now is around 1,300. It was testament to him and all those in federal, state and territory government and industry who joined in his dream to make Australian roads safer. Peter, with modesty, was pleased with this legacy he left and he would encourage us all to keep pursuing the ultimate objective of a "Vision Zero."

National Transport Commission

Peter continued his pursuit of safety and emission reform at NTC for six or seven years, particularly in relation to the heavy vehicle transport industry. The highlights were: benchmarking heavy vehicle safety; the introduction of a national heavy vehicle safety strategy; the adoption of national road rules; the introduction of in-service vehicle emission standards; new noise standards; and the adoption of new fuel quality standards reflecting EuroV.

On a lighter side, it has been said of Peter that he could:

- lead fascinating discussions on an amazingly wide range of topics;
- retain his cool, while all about him others were losing theirs;
- while being instrumental in improvements in vehicle safety standards, spend as much of his free time possible, with vehicles which predated any known safety design standards;
- fill Canberra's streets with "adoring" motorcyclists on at least two occasions during the debate on the introduction of "lights on" for motorcylists; and
- Introduce the Biblical "10 point Road Safety Package.

Peter is survived by his wife Pat, two sons and their families. He was a dedicated family man with interests in vintage cars and classical music, travel and hiking around the world. He loved people and could engage in chats on just about any topic, coming up with many wonderful stories and apt sayings.

He will be sadly missed.

Dennis McLennan and Keith Wheatley

Other news

The 4th International Road Safety Conference, Sydney: A truly international event

The conference, held in Sydney on March 4 and 5, 2013 is the fourth in the series of practical and successful international road safety conferences. It has previously been held in Dubai (twice) and in Perth. This conference was again truly international, with over 120 delegates coming from 16 countries.

Delegates were treated to papers of the highest standard, with the many keynote speakers (Menno Henneveld, Rob McInerney, Councillor John Mant, Martin Small, Mike Stapleton, Professor Mark Stevenson, and Professor Shaw Voon Wong) all providing excellent and powerfully practical contributions. The conference also included two workshops, with one on the evolutions of safe systems and introducing the International Safe Systems Institute for Road Safety (ISSI) - a not-for-profit institute with the aim of promoting safe systems practice in road safety. The second workshop presented the powerful practical methods behind the NSW success in enforcing Chain of Responsibility Laws for heavy vehicles, showing the turn around since a few high profile heavy vehicle crashes. The employment of a combination of determined, intelligent enforcement, courageously frank discussions with industry, and genuine use of powers to investigate companies was described through the combined efforts of three experts: Assistant Commissioner John Hartley (NSW Police); Peter Wells (the Director responsible for Compliance in the NSW Roads & Maritime Services); and Lori Mooren (Transport and Road Safety, University of New South Wales, and Executive Director, ISSI).

Congratulations go to Professor Ann Williamson, of Transport and Road Safety from the University of NSW for winning the Best Presentation Award, for her paper: *Is there a flaw in the Safe Systems Approach?*

Successful conferences do not happen without support and work. In this case the sponsors and key supporters were: Smart Vision International, ISSI, CarrsQ, the Sydney City Council, MIROS Malaysia, the World Bank, and the United Nations. The steering committee included: Ghassan Daban, Professor Raphael Grzebieta, Lori Mooren, Martin Small, Professor Barry Watson, and Ken Welsh. The Scientific Committee was comprised of: Professor Barry Watson (Chair), A/ Professor Dr. Shaw Voon Wong, Professor Mary Lydon, A/Professor Thaweesak Taekratok and Peter Johansson.

Soames Job,
Principal for Global Road Safety Solutions, and Chair of the Conference Steering Committee

Professor Ann Williamson, winner of the Best Presentation Award, with Martin Small, Professor Shaw Voon Wong, Professor Soames Job (on Ann's left), and Ghassan Duban, Peter Hartzell, Faisal Magableh,
and Lori Mooren (on right).

Professor Barry Watson, Chair of the Scientific Committee, speaking at the conference.

Peer-reviewed papers

Associations between helmet use and brain injuries amongst injured pedal- and motor-cyclists: A case series analysis of trauma centre presentations

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Abstract

A retrospective case-series study of pedal- and motor-cyclists presenting to a major metropolitan trauma centre over an 18 month period was undertaken. The injury data were coded according to a number of outcome variables, including intracranial injury of AIS severity ≥ 2. Helmet use was coded. After stratification by rider type, data were analysed to examine the relationships between helmet use and injury using logistic regression. A total of 220 injured motorcycle riders and 137 injured pedal cyclists met the study's inclusion criteria, with 195 motorcycle riders and passengers (88.6%) and 87 pedal cyclists (63.5%) wearing helmets. Helmets were associated with a significant reduction ($p<0.05$) in the likelihood of head and intracranial injury in both rider groups. Associated with helmet use was a reduction in intracranial injury likelihood of 66% for both helmeted motorcycle riders and pedal cyclists. The study is further evidence of the benefits offered by helmets.

Keywords:

Bicycles, Brain Injury, Helmets, Motorcycles

Introduction

The mandatory requirements to wear pedal- and motor-cycle helmets differ greatly between and within countries as do voluntary helmet usage rates, despite strong evidence that helmets are effective in reducing head injury [1-12]. A 2001 meta-analysis of pedal cycle helmet effectiveness by Attewell *et al*. demonstrated that there was a significant 50-60% reduction in the risk of head and brain injury for helmet wearers compared to non-wearers; although, in 2011 Elvik considered this an overestimation [1, 13]. In 2011, new research from Amoros *et al*. identified Odds Ratio (OR) of 0.3 for head (brain and skull) injuries of Abbreviated Injury Scale (AIS) severity 3+ and 0.76 for any head injury associated with pedal cycle helmet use [14]. Regarding motorcycle helmets, the National Highway Traffic Safety Administration estimated that in 2008, helmets saved the lives of 1829 motorcyclists in the USA [15]. Further, the USA data showed that helmets are 37% effective in preventing fatal injuries [15].

In Australia it is mandatory, via road rules and consumer legislation, for both pedal- and motor-cyclists to wear a helmet certified to a Standards Australia standard, respectively, AS/NZS 2063 and AS/NZS 1698. Helmet wearing rates in New South Wales (NSW) based on casualty accident data for pedal cyclists and motorcyclists are 79.4% and 95.9%, respectively [16, 17]. However, actual wearing rates may differ by age, with children and adolescents having lower wearing rates than adults [18, 19]. Importantly, helmet use is one element in a Safe Systems approach for unpowered and powered two-wheelers (pedal- and motor-cyclists). Internationally there appear to be different regional approaches to implementing elements in a Safe System for pedal cyclists. For example, some countries provide cycle-paths for pedal cyclists, but have modest helmet wearing rates, e.g. the Netherlands and Denmark; while others have limited pedal cycle specific infrastructure but have mandatory or high helmet wearing rates, e.g. Australia and New Zealand [20, 21]. Motorcyclists, on the other hand, are not separated from other road users and are exposed to high-energy impacts and related injury risks. The 2010 International Road Traffic and Accident Database

(IRTAD) report noted that in 2008 motorcycles accounted for only 1% of vehicle kilometres in Australia but 20% of motor vehicle user road deaths and 30% of motor vehicle users hospitalised after road crashes [22]. This is part of a worldwide phenomenon that is counter to road safety trends for motor vehicle occupants. In the same year, pedal cyclists accounted for 2% of road user fatalities, down from 3% in 1990 (a reduction from 80 to 27 fatalities) around the time mandatory helmet wearing was introduced in Australia [22].

In 2004-05, pedal cyclists (17.1%) and motorcyclists (18.5%) comprised 36% of the 4178 persons with traumatic brain injury (TBI) as the principal diagnosis due to a transport incident [23]. When the types of TBI's are considered, concussion only cases accounted for 67% of all pedal cyclist TBI's and 68% of all motorcyclist TBI's. A review of NSW Roads and Traffic Authority pedal and motor cycle rider casualty data for the calendar years 2008 and 2009 showed that there were a total of 21 fatalities and 2234 casualty cases for pedal cyclists and 118 fatalities and 4833 casualty cases for motorcycle riders in that state [16, 17]. Only 63.2% of the fatally injured pedal cyclists were reported to have been wearing a helmet compared to 79.5% of the casualty cases. In contrast, 90.8% of the fatally injured motorcycle (riders and passengers) were reported to have been wearing a helmet compared to 96.0% of the casualty cases.

Australian Governments were some of the first in the world to introduce mandatory helmet use laws for both motorcyclists in the 1960's and pedal cyclists in the early 1990s [2]. Current knowledge on helmet performance in relation to head and neck injuries in Australia has stemmed from research work completed on average twenty years ago [24-28]. Some of that research contributed to changes in Australian and New Zealand helmet standards, such as the removal of the resistance to penetration test and lowering of the pass/fail acceleration criterion in the bicycle helmet standard. Since the mid 1990's, however, little in-depth research has been conducted to investigate helmet performance in Australia and assess the test standards applied.

Recently, there has been extensive renewed public debate about the benefits of mandatory pedal-cycle helmet legislation in Australia [29]. A retrospective analysis of hospital admission data around the time mandatory helmet laws were introduced showed that head injury rates for cyclists decreased significantly more than limb injury rates, indicating that mandatory helmet laws were beneficial [29]. Arguments made by some anti-helmet advocates specific to helmet performance include that helmets increase the risk of head and brain injury, in particular diffuse axonal injury (DAI), or at best decrease superficial head and skull injuries but not brain injury [30]. Similar debates about bicycle helmet use are taking place in Europe and North America, and continue to take place in the USA regarding motorcycle helmets [19, 31]. In Asia and Africa, pedal- and motor-cycles constitute an important component of transport systems, and there is interest in improving both helmet wearing rates and identifying helmet designs that are suitable for hot and humid climates whilst still providing protection [11, 12, 32, 33]. With this in mind, and in recognition that the lines between human powered two-wheelers, low powered two-wheelers (motorised bicycles and mopeds) and powered two-wheelers are becoming blurred, it is also of interest to compare and contrast the general performance of two types of helmets.

This paper reports on a retrospective case series study of pedal and motorcyclists presenting to a Level 1 trauma centre in Sydney, NSW. These important data are used to provide an up-to-date profile of head and neck injuries sustained by both helmeted and unhelmeted pedal- and motor-cyclists. The study was conducted to assist with the interpretation of cases investigated as part of a major prospective crash investigation focussing on the performance of current pedal- and motor-cycle helmets. Because of mandatory helmet wearing legislation in Australia, this study provides a unique international opportunity to study the potential role of helmets in preventing head and brain injury and to provide some additional guidance on helmet protection.

Methods

Data for pedal- and motor- cyclist injuries were extracted from the trauma registry of St. George Public Hospital (SGH) in Sydney, a level one trauma centre. The SGH is a 600-bed acute care tertiary referral facility and admits more than 50,000 patients annually. Data are collected prospectively on all major trauma presentations and stored in a purpose built data registry, maintained since 1991. Data are obtained from a number of sources, including: ambulance case sheets, in-patient medical records, and patient interviews. The registry provides comprehensive physiologic data (including Glasgow Coma Scores – GCS) and injury descriptions, as well as limited crash descriptors of certain incident-related factors, including helmet use. Trauma registry entry criteria required the pedal- or motor-cyclist to be in a collision of greater than 30 km/h or to have an altered physiologic state at presentation, eg. GCS less than 14 or multiple fractures (Appendix A).

In this case series study, all pedal- and motor- cyclists who were admitted to SGH for primary treatment of injuries sustained during a road crash, and fulfilling the trauma registry entry criteria during an eighteen-month period between July 2008 and December 2009 were selected. Non-identifiable data were provided for analysis. This study protocol was approved through an institutional ethical review process at the University of New South Wales.

Injuries were coded according to the Abbreviated Injury Scale (AIS) 2005 Revision [34]. The overall injury severity for each cyclist was measured by both the Injury Severity Score (ISS) and the New ISS (NISS) [34]. For each case, the main body region of injury was identified by SGH staff and information on all injuries was recorded. Information included body region, nature of injury (e.g. fracture) and AIS code including severity. Cases were also coded using the following dichotomous indicators, with a focus on head, face and specific intracranial (IC) injuries: concussion; IC injury (including concussion); skull fracture; base of skull fracture; facial fracture; cervical spine fracture or dislocation; upper limb (UL) injury of AIS severity ≥ 2; lower limb (LL) injury of AIS severity ≥ 2; and, trunk (thorax, abdomen, pelvis, lumbar and thoracic spines) injury of AIS severity ≥ 2. Included in the IC injury category were: forms of intracranial haemorrhage (subdural, epidural etc), contusions and diffuse axonal injury. If a case had more than one injury meeting the criterion, e.g. a subdural haemorrhage and concussion, it was counted only once in the category IC injury (including concussion). It is important to note that concussion is not DAI. DAI has a severity of 4 or 5 according to AIS 2005, whereas, concussion is typically AIS 1 or AIS 2, and in cases with loss of consciousness of between one and six hours, is AIS 3.

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) Version 20 software. Descriptive statistics were calculated. Logistic regression was used to assess the associations between the three outcome variables head (excluding face) injury as the main region of injury, concussion and intracranial injury (including concussion) and predictor variables helmet use, age, gender, upper limb injury of AIS severity ≥ 2, lower limb injury of AIS severity ≥ 2 and trunk (thorax, abdomen, pelvis, lumbar and thoracic spines) injury of AIS severity ≥ 2 [35]. A backward Wald method was used to include predictor terms in the model. Age was also assessed represented by a dichotomous variable (< median age, ≥ median age). The associations between upper limb injury of AIS severity ≥ 2, lower limb injury of AIS severity ≥ 2 and trunk injury of AIS severity ≥ 2 and helmet use were assessed using logistic regression. For pedal cyclists and motorcycle riders, an independent samples Mann-Whitney U test was applied to assess differences in the distribution of age, GCS, ISS and NISS for helmet wearers and non-wearers and a Pearson Chi-squared test was conducted to assess differences in the distribution of head (excluding the face) AIS injury severities. Statistical significance was set at $p<0.05$.

Results

A total of 220 motorcycle riders, six motorcycle pillion passengers and 137 pedal cyclists met the study's inclusion criteria. Approximately eighty percent of patients wore a helmet at the time of the crash: 195 motorcyclists riders and passengers (88.6%) and 87 pedal cyclists (63.5%).

Demographics

The age distributions for the samples of motorcycle riders and pedal cyclists compared to equivalent NSW state-wide casualty data for a similar time period are shown in Figure 1 [16, 17]. The median age of the 220 motorcycle

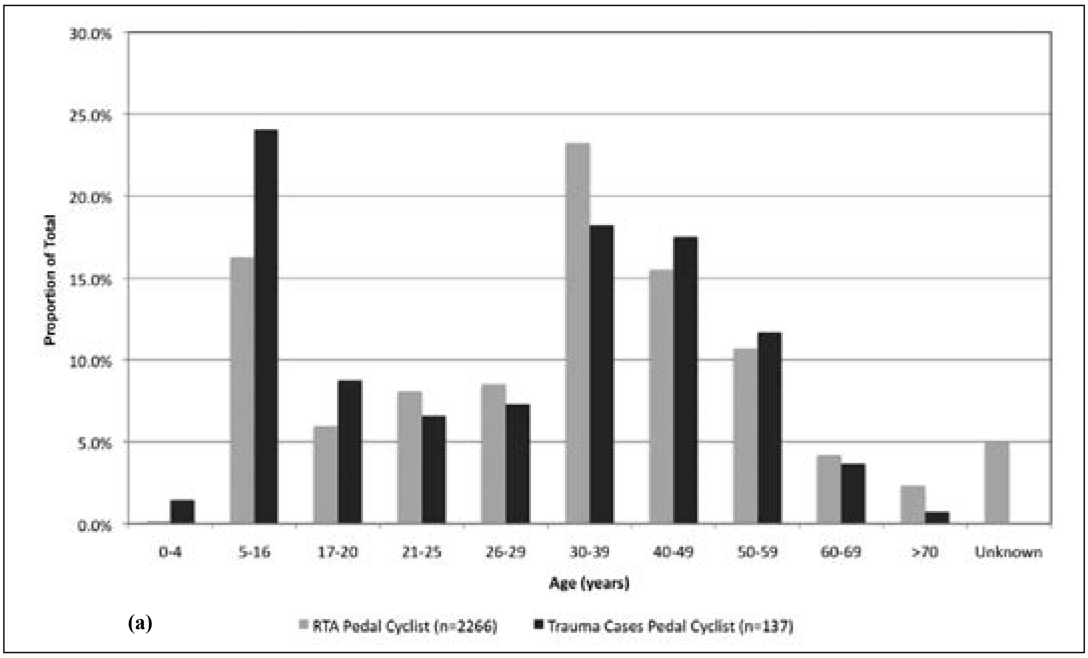

Figure 1. Distribution of (a) pedal cyclists and (b) motorcycle riders by age group

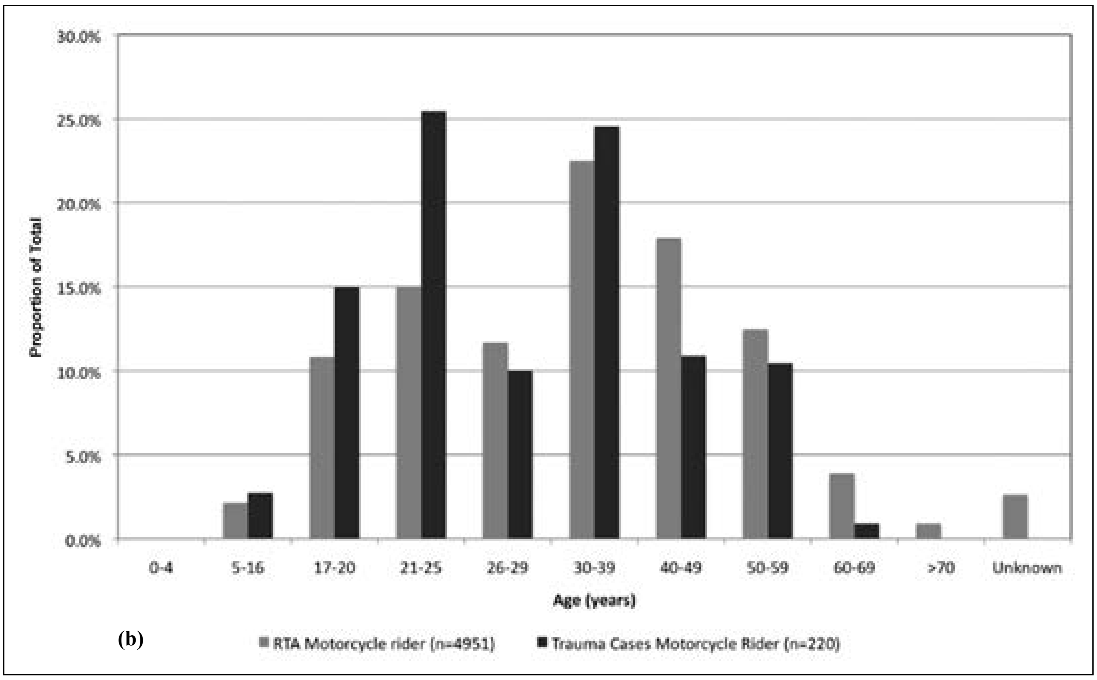

Table 1: Distribution of head and cervical spine injury severity by two-wheeler type and helmet use

		Motorcycle rider (n=220)				Pedal cyclist (n=137)			
		No Helmet		Helmet		No Helmet		Helmet	
	AIS severity	n	%	n	%	n	%	n	%
Maximum AIS for Head (excl. face)	0*	17	57	152	80	20	40	57	66
	1	0	0	0	0	0	0	0	0
	2	8	27	31	16	26	52	28	32
	3-5	5	17	7	4	4	8	2	2
	Total	30	100	190	100	50	100	87	100
Maximum AIS for Cervical Spine	0	29	97	185	97	47	94	85	98
	1	0	0	0	0	0	0	0	0
	2	1	3	3	2	3	6	0	0
	3-5	0	0	2	1	0	0	2	2
	Total	30	100	190	100	50	100	87	100

*An AIS=0 means no injury to that body region riders was 28 years (inter-quartile range (IQR): 22-39). The median age of the 137 pedal cyclists was 30 years (IQR: 16-45). Eighty-three percent (83.2%) of pedal cyclists and 94.1% of motorcycle riders were male. Three of the six motorcycle pillion passengers were female. The median ages for unhelmeted and helmeted motorcycle riders were 22.0 years and 30.0 years, respectively. The median ages for unhelmeted and helmeted pedal cyclists were 21.0 years and 36.0 years, respectively. The age of the unhelmeted pedal cyclists (p=0.010) and motorcycle riders (p=0.000) was significantly lower than their helmeted counterparts.

Profile of head and neck injuries

Due to the small number of motorcycle pillion passengers and the potential differences in related injury mechanisms, only data for motorcycle riders are considered further. Table 1 presents the distribution of head and cervical spine injury severity by cyclist type and helmet use. It can be seen that a higher proportion of helmet wearers have lower severity injuries compared to non-wearers. A Pearson Chi-squared analysis of the AIS distribution by helmet use found a significant difference for maximum head (excluding the face) AIS severity for motorcycle riders (Chi-square=11.71, df=4, p=0.02) and pedal cyclists (Chi-square=12.08, df=4, p=0.017). Non-helmet wearers had the higher severity injuries; for example, the maximum AIS head injury severity for 65.5% of pedal cyclists wearing a helmet was zero (no head injury) compared to 40.0% for non-wearers. Cervical spine injuries were few and not greater than an AIS severity of three for all pedal cyclists and motorcycle riders.

Helmet effectiveness

Table 2 presents the frequencies of discrete injuries by cyclist type and helmet use. Table 3 presents the results of the binary logistic regression for discrete head and brain injuries. There was a significantly lower likelihood of a pedal cyclist experiencing a head injury (Exp(B) = 0.21), concussion (Exp(B) = 0.46), or IC injury (including concussion) (Exp(B) = 0.33) associated with wearing a helmet. The results also show that there was a significantly lower likelihood of a motorcycle rider experiencing a head injury (Exp(B) = 0.35), IC injury (Exp(B) = 0.34), but not concussion, associated with wearing a helmet.

Logistic regression analyses found no significant relationships between helmet use and the following variables: upper limb injury (AIS ≥ 2), lower limb injury (AIS ≥ 2) and trunk injury (AIS ≥ 2).

Because of the low number of cases with fractures (skull, facial, base of skull and cervical spine), no hypothesis testing regarding these specific injuries and helmet use was undertaken. There were six skull or base of skull fractures amongst motorcycle riders and eight amongst pedal cyclists. There were seven facial fractures amongst motorcycle riders and seven amongst pedal cyclists. There were no cases of DAI amongst the pedal cyclists, regardless of helmet use. There were six cases of DAI amongst the motorcyclists, two of whom did not wear a helmet. In each of these cases the adult motorcyclists suffered multiple severe head injuries with a maximum AIS head injury severity of either four or five.

Table 2: Frequencies of cases with specific injuries by cyclist type and helmet use

	Motorcycle rider			Pedal cyclist		
	No Helmet (n=30)	Helmet (n=190)	Total (n=220)	No Helmet (n=50)	Helmet (n=87)	Total (n=137)
Head Injury (as main body location of injury)	8	21	29	30	21	51
Concussion only	8	31	39	25	28	53
IC Injury (including concussion)	13	39	52	30	30	60
Upper Limb (AIS ≥ 2)	7	49	56	8	23	31
Lower Limb (AIS ≥ 2)	4	36	40	4	10	14
Trunk (AIS ≥ 2)	6	27	33	4	6	10

Table 3. Results of binary logistic regression for head injury as main location of injury, concussion only and intracranial injury (including concussion)

Injury		Variables	B	S.E.	Wald	df	Sig.	Exp (B)	95% CI for Exp(B)	
Head Injury	PC	Helmet	-1.56	0.392	15.813	1	<0.001	0.21	0.097	0.453
		UL AIS ≥ 2	-1.048	0.522	4.022	1	0.045	0.351	0.126	0.977
		Constant	0.636	0.312	4.161	1	0.041	1.89		
	MC	Helmet	-1.061	0.486	4.762	1	0.029	0.346	0.134	0.898
		UL AIS ≥ 2	-1.281	0.639	4.018	1	0.045	0.278	0.079	0.972
		LL AIS ≥ 2	-1.272	0.764	2.772	1	0.096	0.280	0.063	1.253
		Constant	-0.634	0.44	2.082	1	0.149	0.53		
Concussion only	PC	Helmet	-0.786	0.367	4.601	1	0.032	0.456	0.222	0.934
		Constant	0.041	0.286	0.02	1	0.886	1.042		
	MC	Helmet	-0.86	0.484	3.16	1	0.075	0.423	0.164	1.092
		Median Age	0.67	0.382	3.078	1	0.079	1.954	0.924	4.132
		Constant	-1.186	0.431	7.584	1	0.006	0.306		
Intracranial Injury (including concussion)	PC	Helmet	-1.099	0.37	8.82	1	0.003	0.333	0.161	0.688
		Constant	0.457	0.293	2.427	1	0.119	1.579		
	MC	Helmet	-1.085	0.41	7.013	1	0.008	0.338	0.151	0.754
		Constant	-0.268	0.368	0.53	1	0.467	0.765		

Table 4: Comparison of GCS at admission, ISS and NISS by two-wheeler type and helmet use. The medians and IQRs are presented.

	Motorcycle rider				Pedal cyclist			
	No Helmet		Helmet		No Helmet		Helmet	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Initial GCS	15	14-15	15	15-15	15	14-15	15	15-15
ISS	8	4-21	5	2-9	5	3-9	5	2-6
New ISS	9	4-29	5	3-9	6	3-9	6	3-9

Table 4 presents GCS on admission, ISS and NISS for pedal cyclists and motorcycle riders. Mann-Whitney U tests showed that the distributions of GCS (p=0.002), ISS (p=0.004) and NISS (p=0.007) for motorcycle riders were significantly different between helmet wearers and non-wearers. GCS was slightly higher (more normal) for helmeted motorcycle riders and the ISS and NISS were higher (worse) for unhelmeted riders. Mann-Whitney U tests showed that the distribution of GCS for pedal cyclists was significantly different between helmet wearers and non-wearers (p=0.001). GCS was slightly higher for helmeted pedal cyclists. There were no differences in the distribution of ISS and NISS for pedal cyclists by helmet use.

Overall pattern of injuries

The most frequent main body region of injury for all motorcycle riders was the upper limb (28.2%) and for all pedal cyclists the head (37.2%). The shoulder girdle in particular accounted for 16.8% of all motorcyclist injuries. The most frequent main body region of injury for unhelmeted motorcycle riders was the trunk (30.0%) and for helmeted motorcycle riders the upper and lower limbs were equal (29.5%). The most frequent main body region of injury for unhelmeted pedal cyclists was the head (60.0%) and for helmeted pedal cyclists the upper limb (33.3%). Examples of the more severe spectrum of non-head injuries for motorcycle riders were leg amputation, haemothorax and bilateral pulmonary contusions, and for pedal cyclists fractured patella and tibia, fractured ribs, fractured clavicle and haemo-pneumothorax. Table 2 also presents the frequency of upper limb, lower limb and trunk injuries of AIS severity ≥ 2, whether or not they were identified as the main body location of injury.

Ratios of the frequencies of head to upper limb injury as main body region of injury for unhelmeted and helmeted motorcycle riders were 1.33 and 0.39, respectively, and for pedal cyclists 7.5 and 0.72, respectively. Ratios of the frequencies of any intracranial injury (including concussion) to any upper limb injury (AIS severity ≥ 2) for unhelmeted and helmeted motorcycle riders were 1.86 and 0.80, respectively, and for pedal cyclists 3.75 and 1.30, respectively.

Discussion

This study shows that helmets are associated with a large reduction in the likelihood and severity of head injury. In particular, the study provides an evidence base that demonstrates the benefits offered by helmets in reducing brain injury and contradicts the related arguments of anti-helmet advocates.

The age distribution of riders presenting to SGH was similar to the statewide distribution of pedal- and motor-cycle casualties for 2008 and 2009 combined [16, 17]. The proportion of pedal cyclists and motorcycle riders wearing a helmet in this case series was also comparable to the Centre for Road Safety data, but slightly lower than reported in casualty cases in a similar period [16, 17]. Therefore, there is some justification for considering that these results are applicable to a wider population of two-wheelers in NSW. There were differences in the age characteristics of helmeted and unhelmeted pedal- and motor-cyclists, with those wearing helmets tending to be older. This is consistent with the Boufous et al study of pedal cyclists data from the Australian state of Victoria [18].

Results from this study show that wearing a helmet is associated with significant reduction in the likelihood and severity of head and intracranial injuries in injured cyclists attending a major trauma centre, as previously reported in the literature. The gross estimate of the reduction in head injury likelihood for pedal cyclists associated with wearing a helmet was 79% and is similar to earlier assessments [1, 8, 36]. The inclusion criteria provide at least a baseline that indicates that the more severe head injury cases are not being compared to very trivial crashes. By examining specific intracranial injuries, the study also demonstrated that helmets were associated with the prevention and/or reduction in the severity of brain injuries. There was a reduction of intracranial injury by 66% associated with wearing a helmet for both motorcycle riders and pedal cyclists. Because of the claims made by anti-helmet campaigners that helmets cause DAI, it is important to note that no pedal cyclist was diagnosed with DAI [37]. If the claim was made on the erroneous conflation of concussion with DAI, then it must be highlighted that helmeted pedal cyclists had a reduced incidence of concussion. Those motorcyclists diagnosed with DAI suffered severe multiple brain injuries; most likely indicative of the head impact severity. Associated with helmet use was a non-significant decrease in the frequency of concussion for motorcycle riders and a significantly lower likelihood of concussion for pedal cyclists; both around 50%. Although this is a positive result, it also highlights the challenge of preventing equally well both severe head and brain injury and lower severity brain injury, such as concussion, with current helmet designs [38]. The results, and in consideration for the broader incidence of concussion only TBI's in this population, suggest that further development of helmets should include the objective of reducing concussion. This objective should not be achieved at the expense of reducing the protective benefits offered in severe impacts. The study demonstrates that the use of helmets certified to the relevant Australian and New Zealand standards is associated with substantial benefits in terms of head and brain injury reduction.

The nature of the trauma cases analysed in this case series will be biased towards injury to multiple body regions due to the trauma registry selection criteria. The data indicate that injured motorcycle riders, particularly unhelmeted riders, suffered more severe and multiple injuries than pedal cyclists. For example, median NISS scores were nine and five, respectively, for unhelmeted and helmeted motorcycle riders, compared to five and five for unhelmeted and helmeted pedal cyclists. In the absence of a helmet, head injuries were the most frequent injury suffered by pedal cyclists and motorcycle riders suffered most frequently trunk injury. When motorcycle riders were wearing helmets the injury burden shifted to the upper and lower limbs and for pedal cyclists to the upper limb. The results highlight the need to develop better systems for protecting the pedal cyclists and motorcycle riders, including personal protective equipment (PPE) that protects the limbs and trunk. The potential benefits offered by PPE and helmets presents opportunities and challenges for manufacturers and researchers to provide effective products that meet the ergonomic requirements – mobility, weight, thermal comfort – for two-wheelers in a range of climates and riding situations.

Two major limitations of this study are that: the severity of each crash independent of the injury outcome is unknown; and, only injured cyclists were sampled and uninjured cyclists are absent from the data [39]. For example, the head impact speed, the struck object/s, the impact sequence and collision partners are unknown. These data are typically documented poorly or not at all in hospital clinical notes. In order to examine more specific helmet functions an in-depth crash study of helmeted pedal- and motor-cyclists was conducted in parallel to the study reported here. From a biomechanical perspective, a helmeted rider could strike their helmeted head in a crash and due to the performance of the helmet be uninjured and not present to a trauma centre. Therefore, there is a potential bias towards helmeted riders presenting with head injuries as a result of more severe crashes being represented in the sample. The finding of no significant associations between helmet use and upper limb injury (AIS ≥ 2), lower limb injury (AIS ≥ 2) and trunk injury (AIS ≥ 2) is an indication that the helmeted and unhelmeted cyclists were involved in similar severity crashes.

Another limitation is that the sample size is not large enough to consider differences in helmet performance for different age groups and riding patterns (commuter/recreational/sport). The specific type of helmet, full-face, open face, shell or shell-less, was not known and so it was not possible to assess whether the performance differences observed between hard shell and 'foam' pedal cycle helmets in Norway occurred in Australia [40]. However, the majority of pedal-cycle helmets on the Australian market are micro-shell helmets and the shell-less foam helmets or hard shell helmets that were available in the early 1990's in Australia do not appear to be in circulation [26]. Finally, the SGH registry only categorises helmet use as 'yes' or 'no'. If information on whether a helmet was worn were not available in the hospital or ambulance notes, it would most likely have been entered as 'no'. Data on whether a helmet came off during the impact, which is also critical in evaluating its effectiveness, were not available [41].

Notwithstanding these limitations, this study reinforces the importance of helmets in preventing head and brain injuries amongst cases with severe enough injuries to warrant trauma system admission. The study refutes claims made by some that helmets increase the risk of brain injury. The study indicates that if helmet-wearing rates in pedal cyclists increased even further, there would be additional gains in head and brain injury reduction, as observed amongst motorcyclists who have a higher wearing rate. The study highlights the need for programs that increase helmet use amongst younger motorcycle riders and pedal cyclists.

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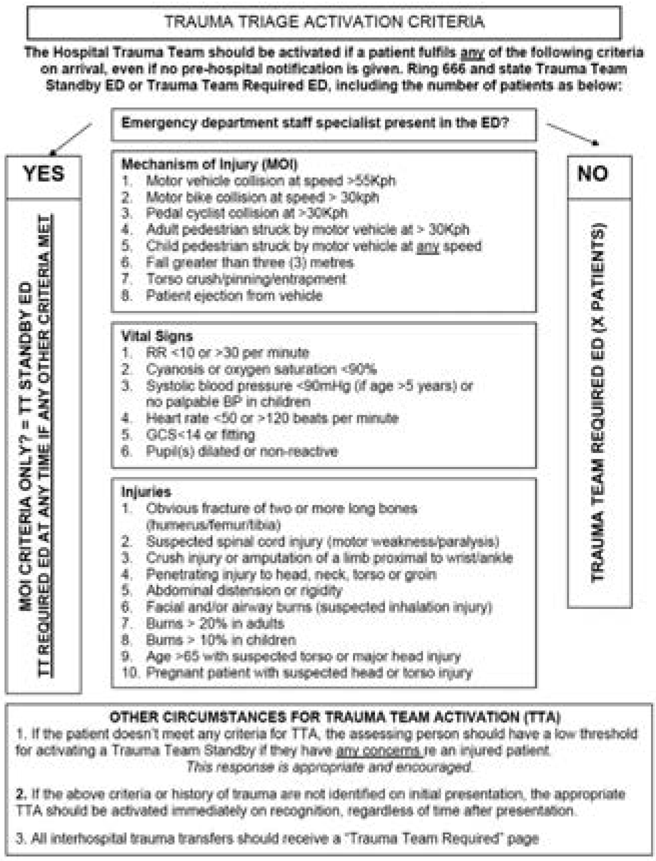
Appendix A: St George Public Hospital trauma activation criteria



Indigenous road safety in Australia and the "Drivesafe NT Remote" project

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Abstract

Indigenous Australians are substantially more likely than the non-Indigenous population to be killed or seriously injured in a road crash and much more likely to receive a custodial sentence for unlicensed driving. A number of projects in Australia have been designed to address these issues. The "DriveSafe NT Remote" Project makes advances on previous projects by providing an 'on-site' opportunity for Indigenous people to obtain a licence, by bringing a driver trainer and full Motor Vehicle Registry services to remote communities. The two-year trial program provides help with proof of identity, training, and licence testing. This paper describes the program, its implementation, the logic behind the expectation of road safety gains, and early results. Process analysis shows that a large proportion of clients needed help with proof of identity, which is challenging for many Indigenous people. Interest within Indigenous communities has exceeded all expectations and 318 learner licences have been issued in less than a year of operation, passing the target of 280 licences that was set for the first two years of the program, while 67 drivers have moved from learner to provisional status or have advanced to public passenger vehicle licences. The *DriveSafe NT Remote* team has also issued another 125 licences outside of the project scope while in communities, including renewals and upgrades. They have also delivered training on Motor Vehicle Registry processes for many community members including local police officers, local government officers and teachers. The program has also generated flow-on benefits including increasing employment and social opportunities in remote communities.

Keywords:

Indigenous road safety, driver licensing, driver training, remote road safety

Introduction

Based on age standardised rates, Indigenous Australians are 2.7 times more likely to be killed in a road crash and 1.2 times more likely to suffer a serious traffic-related injury than non-Indigenous Australians [1]. Henley and Harrison's [1] analysis also found that the fatality rate among Aboriginal and Torres Strait Islander car occupants was 2.9 times that of other Australian car occupants, while the fatality rate among Aboriginal and Torres Strait Islanders as pedestrians was 5.5 times that of other Australians as pedestrians. For serious injury the equivalent values were 1.6 and 2.5. In addition, these data represent an underestimation (of unknown size) of road trauma rates for Indigenous people, due to under-reporting of Indigenous status [2, 3]. Serious injuries (defined through admission to hospital) may also be under-reported for Indigenous people, who have more difficult and distant access to hospital treatment.

The problem has been recognised for some time [4] and formed the basis of relevant actions in the Rural Road Safety Plan 1996 [5], discussed later.

The over-representation of Indigenous people in road trauma reflects the influence of a number of factors, including remoteness and road related features associated with remoteness [6, 7], less access to safe vehicles (for example, see Figure 1 from NSW Centre for Road Safety [2], and see [4]), larger numbers of passengers, and lower rates of licensed drivers [8].

Rates of fatality and serious injury among Indigenous people increase with remoteness. Among Aboriginal and Torres Strait Islander people, 70% of those fatally injured and 60% of those seriously injured resided in outer regional, remote or very remote areas. By contrast, close to four-fifths of other Australians fatally and seriously injured resided in major cities or inner regional areas [1]. The increased representation of Indigenous people in remote area trauma in part reflects place of residence and issues with remote roads [see 6].

In addition, a significantly higher proportion of car passengers relative to car drivers were fatally or seriously injured among Aboriginal and Torres Strait Islander people, compared with other Australians [1]. This may be related to greater numbers of vehicle occupants per vehicle for Indigenous people [2].

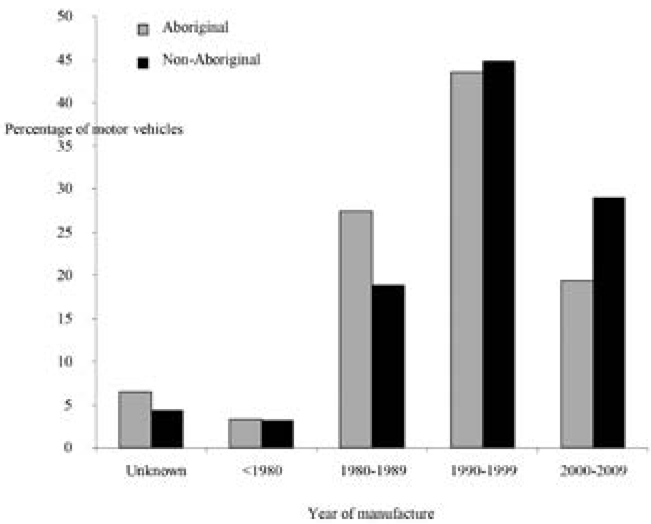

Figure 1: Year of manufacture of vehicles involved in fatal crashes in NSW [from 2]

Remote area crashes are also likely to be more severe, due to less forgiving roads, to delays in emergency responses and greater rates of risky driving, including drink-driving [for analysis of Queensland data see 9]. The Fifth Indigenous Road Safety Forum in 2010 reported evidence of a number of contributory factors critical in Aboriginal road safety risk, with data available from New South Wales (NSW): 33% of Aboriginal fatalities were not wearing restraints compared with 21% for the rest of the NSW population; 50% of Aboriginal drivers and riders killed were over 0.05 compared with 26% [2].

Analyses of the Vehicle Accident Database of the NT Department of Transport show that in the Northern Territory, 50% of the people killed in road crashes are Indigenous. In comparison, Indigenous Territorians make up about 30% of the Northern Territory's population. Of the Indigenous fatalities, 58% were not wearing a seatbelt (compared to 42% of non-Indigenous fatalities) and 65% were alcohol related, compared to 35% of non-Indigenous fatalities [10].

A number of factors contribute to the increased risk of crashes and increased severity of outcome in the event of a crash for Indigenous people. Factors contributing to crash risk include drink-driving and lack of licensing (considered below). Factors contributing to increased severity of outcome in the event of a crash include remoteness (slower emergency response time, higher speed limit roads), poorer roads, lack of seat belt use, more occupants per vehicle, and older, less protective vehicles.

This paper reports on the *DriveSafe NT Remote* trial program which greatly improves access to licensing processes for Indigenous people in remote communities. The paper reviews the Indigenous road safety problem, describes the project and the road safety rationale for it, and finally presents early results from the trial.

The unlicensed driving problem: context and brief history

In NSW from 2000 to 2009, 18 of 36 Indigenous drivers killed were unauthorised drivers (50%) compared with 9% for the non-Aboriginal population [1]. These data suggest that unlicensed driving among Indigenous people is an Australia-wide problem rather than a problem only for the states and territories with vast very remote areas.

It is critical to understand the reasons for the high rate of unlicensed driving by Indigenous people, and the failure of conventional methods of addressing the problem [8]. Indigenous lack of access to effective transport is part of, and perpetuates, the broader economic and social deprivation [4, 8]. Indigenous Australians have difficulty legally accessing the road transport system as licensed drivers due to a nested set of issues including challenges with proof of identity, language, literacy, numeracy [8], remoteness, and access to training [4, 8]. Lack of formal birth records creates difficulties with proof of identity and of age, as normally required for licensing, and names may be changed during a person's lifetime for cultural reasons. For some Indigenous people, for whom English is not their native language, this challenge is compounded by the need for sound English literacy skills and understanding of formal processes in order to determine the appropriate course of action to overcome the problem. In the Northern Territory context, the remoteness of communities and vast distances between major population centres creates additional challenges to accessing driver training service providers and relevant authorities. There is often also limited access to legal vehicles. Similar problems are faced by Indigenous communities in the remote regions of Western Australia, Queensland, South Australia and NSW. Furthermore, the problem is self-perpetuating: the lack of licensed drivers in Indigenous communities to begin with makes access to supervising drivers more difficult for learners.

The social consequences of these factors and outcomes are profound. Indigenous people without a driver's licence are unable to access many employment opportunities which require driving for work, as well as opportunities which require driving to reach the point of employment. The lack of a driver's licence also limits access to education and other services, as well as social opportunities. This contributes to the continuing economic gap between Indigenous Australians and others.

The lack of effective transport, as well as commonly unsealed roads and the dust they create, also contribute to other health issues and ineffective treatment of them [8].

Lack of licensing also contributes profoundly to the incarceration of Indigenous people. Analyses of records for this paper show that in the Northern Territory, about 82% of all prisoners are Indigenous, and driving offenders make up about 25% of the prison population. Analysis of incarcerations also points to the failure of conventional means of addressing the problem, though stronger enforcement. Anthony and Bragg [8] present a detailed analysis of the effects of increased enforcement in remote Indigenous communities following the *Northern Territory National Emergency Response Act 2007* (Commonwealth) which had the indirect effect of greatly increasing enforcement of driving related offences including unlicensed driving. Consequently, driving offences were criminalised through high rates of custodial sentences [11] yet recidivism did not drop and road safety did not improve [8]. Thus, the usually highly successful approach of more effective enforcement did not work in this case. Enforcement can be expected to work when the required safe/legal behaviour is a viable alternative. However, in this circumstance with so many barriers to the required legal behaviour (of having a licence before driving) enforcement alone is unlikely to succeed. This pattern of outcome is consistent with repeated questioning of the top-down approach to policy and enforcement to address Indigenous issues (for example, see the 1991 Royal Commission into Aboriginal Deaths in Custody), and the problem is particularly acute for driving offences which have been the majority of recorded Indigenous offences since 2006 [8].

The problems of unlicensed driving, remoteness, barriers to licensing and greater road safety risk for Indigenous people are well recognised [4, 6, 8, 10] and the top end jurisdictions as well as NSW, Victoria, and South Australia have all introduced programs with the aim of facilitating driver licensing for Indigenous people. These have included Western Australia's Driver Support Program, NSWs' driver's licence program in Wilcannia and dedicated Aboriginal driver training officers in Lismore and elsewhere. There are a number of programs in Queensland [12] including one with greatly improved pass rates [13]; South Australia's Right Turn Driver Education Program, and Victoria's Let's GET connected Gippsland East Aboriginal driver education project [see 8], plus a number of programs in the NT [14,15].

Strategic Directions

Analyses of the barriers to Indigenous licensing and analysis of existing programs [e.g., 4, 8, 12] lead to several key recommendations in common, including diversion of resources from enforcement to facilitation of licensing, the need for improved access to licensing for Indigenous people, improved access to driver training, the need for access to be supplied via bringing it to the remote communities rather than expecting the communities to travel to distant facilities, the need to address issues with proof of identity and language/literacy issues. Various programs as listed above have included a number of these features.

The Rural Road Safety Action Plan 1996 [5] acknowledged the distinctive and substantial problems of rural and remote road safety, including the issues faced by Indigenous people. However, the action called for was not specific ("formulate special arrangements…" to address the problem), and it was subsequently criticised in the Australian College of Road Safety policy papers for failure to deliver. However, the above list of programs addressing the issue in many Australian jurisdictions, shows that action has occurred since then.

Programs, which address the road safety and related problems arising from the difficulties Indigenous people face in obtaining a licence to drive are consistent with a number of recent strategic considerations as well as the recommendations of the analyses cited above.

First, the National Road Safety Strategy (NRSS) [10] addresses Indigenous safety in many areas of endeavour, including safe systems, safe roads and safe people. The Strategy again notes the over-representation of Indigenous people in road trauma and the poor access to related services. It identifies the strategic direction to substantially improve access to graduated licensing, and to vehicles with higher safety ratings, for Indigenous people (p84). The NRSS calls for actions to improve Indigenous safety, including the following: "Implement programs addressing the road safety needs of Indigenous communities and disadvantaged groups …[including]… Develop and implement programs to increase the opportunities for driving practice for disadvantaged learner drivers, particularly in Indigenous communities (p85)."

Finally, the NRSS also identified synergies with strategic commitments such as meeting the *Closing the Gap* target for Indigenous people of reducing the 17-year life expectancy gap between Indigenous and non-Indigenous Australians. Improved employment opportunities available to licensed drivers also reduce economic and social disadvantage.

Relevant recommendations from the Fifth Indigenous Road Safety Forum held in Coffs Harbour in 2010 [16] included:

1. A fund for Indigenous road safety projects be established by the National Road Safety Council (NRSC). Funds could be directed to projects on agreed road safety priorities that produce measurable change, sustainability and capacity for replication in other settings; and
2. Each jurisdiction, based on their particular circumstances, develops Indigenous road safety programs and policies to address alcohol use, restraint use, licensing, vehicle safety, public transport access and roads.

The *DriveSafe NT Remote* trial project reported here is consistent with these recommendations.

The logic behind expected road safety benefits

The *DriveSafe NT Remote* trial aims to provide a holistic approach to Indigenous driver education and licensing in remote communities, including access to relevant authorities, help with proof of identity, road safety education, driver training and testing. Improved licensing rates offer a powerful tool for improved access to employment and health care and thus reduce the life expectancy gap as well as economic and social disadvantage.

The case for road safety benefits is not as obvious and thus is outlined below. This is because improved licensing rates may be seen simply as creating increased exposure through more Indigenous people driving. However, given the existing extensive and well recognised problem of unlicensed driving in remote communities, any increase in driving exposure is likely to be small, and may be offset by reducing the demand to carry more passengers than there are seat belts. A number of benefits should accrue to offset any small increase in driving exposure.

Unlicensed driving itself is likely to contribute to the key behavioural risk factors associated with Indigenous over-representation in serious crashes: drink-driving; lack of seat belt use; and even use of older, less safe vehicles. Lack of licensing is a likely contributor to these crash risk factors through three core mechanisms. First, despite the broad lack of good evidence for safety benefits of training of car handling skills and advanced driver training, as concluded in the key Chochrane Library review [17], and explanations of this failure [18], there is evidence for the safety benefits of on-road experience with a supervising driver prior to beginning solo driving [19, and see 20]. Thus, the lack of training and licensing processes is likely to contribute to less safe solo driving. Second, key elements of driver behaviour management in every state of Australia include the demerit point system and the threat of licence loss. These systems provide a significant disincentive for illegal driving behaviours such as non-use of seat belts, drink-driving, and speeding. Furthermore, there is evidence suggesting that the demerit points provide a stronger disincentive than fines [21]. This disincentive process is obviated by driving unlicensed. In addition, the attitudes and beliefs created by starting a driving career outside the law, and by perceiving little choice in this behaviour (due to lack of access to supervised practice opportunities, the licensing process, and proof of identity) may not engender safe driving. Rather, driving under these circumstances, at least initially, provides practical rewards (such as mobility) for ignoring road rules. In these circumstances road rules regarding blood alcohol concentration limits, seat belt use, and driving a registered vehicle may seem largely irrelevant when driving unlicensed.

Finally, at a broader level, programs which provide access to licensing and supervised on-road practice for remote and disadvantaged people may also benefit licensing policy for the entire population. With the evidence for reduced crash rates by novice drivers following more hours of on-road supervised practice, many jurisdictions have moved to, or are considering mandating, more hours of supervised driving before the learner is allowed to move to the next stage of licensing. A limiting factor for such policy is access to the required training for remote and disadvantaged people. Programs such as *DriveSafe NT Remote* help overcome this barrier and thus may allow more effective training of novice drivers throughout the relevant state, territory or country.

The *DriveSafe NT remote* trial

In response to the above evidence, logic and strategic needs, the Northern Territory Department of Transport, the (former) National Road Safety Council (NRSC), the Territory Insurance Office (TIO) and the Australian Government are supporting an innovative Indigenous driver access, training and education program being delivered to specific Indigenous communities in remote areas of the NT over a two-year period. The program, which commenced in April 2012, is being delivered to 14 remote major communities across the Northern Territory.

All 14 communities selected to participate in the *DriveSafe NT Remote* trial identified driver licensing and/or road safety as significant issues for their development in their Local Implementation Plans that have been developed through community consultation with all levels of government. By delivering a holistic program, DriveSafe NT Remote aims to not only support novice drivers to obtain a C class licence, but also to improve road safety outcomes and driver behaviour, achieve greater access to job opportunities and services and reduce incarceration rates for driving offences.

Success of *DriveSafe NT Remote* is critically dependent on the level of local community buy-in and endorsement. To achieve this buy-in, extensive consultation is undertaken with community leaders and local organisations prior to the program's commencement. This allows the community to identify its priority groups for the program (such as students, Commonwealth Development and Employment Program employees, young mothers, and young men); to identify a minimum of 20 potential participants; outline existing local services (with which the program may co-ordinate to avoid duplication and increase local ownership); and any cultural or other constraints that must be considered.

Core elements of the *DriveSafe NT Remote* program being delivered in each identified community includes help with proof of identification, such as accessing birth certificates;

theory tutorials on road rules in a group setting; learners licence testing; formal driving lessons; supervised mentor driving lessons; road crash first aid training; knowledge for car owners; road safety; drug and alcohol awareness; and on-road tests. In recognition that most program participants will have English as a second, third of even fourth language, both training and testing are undertaken verbally, with visual aids, to address some challenges of lower literacy levels. Significantly, the program is free of cost for participants at each step – including accessing a birth certificate, getting their Learner licence, and undertaking driving lessons and tests.

This work is carried out over a period of several months, during which time the *DriveSafe NT Remote* team will spend week-long blocks in the community. These intensive blocks are supported by the mentoring and development of community-based Learner Driver Mentors, who provide supervised driving practice throughout the program delivery. The visiting team includes a driving instructor who delivers training, and a Motor Vehicle Registry Officer to help with proof of identity and other licensing issues. For proof of identity resolution the *DriveSafe Remote* staff act as a point of liaison between the client and Births, Deaths and Marriages. Resolution is pursued by officers in processes after the visit to the community and includes other processes such as making applications for a change of name, to resolve inconsistencies between birth records and current name, which may have changed.

The program works with local ‘host’ organisations to champion and support its delivery in the community, including arranging access to accommodation and training facilities and promotion and coordination of program participants. The pre-consultation with the community recognises the diversity of the communities participating in the trial program, and supports the *DriveSafe NT Remote* team to tailor the program delivery to suit the particular circumstances of each community. See Figure 2 for an example of materials. This approach fosters a true collaboration, reducing risks that can flow from imposing a ‘one-size fits all, top down’ program.

Teaching includes classroom instruction and on-road experience with mentors. Video of the program being run is available from the ABS 7:30 report on the program: http://www.abc.net.au/news/2012-11-16/learning-to-drive-in-the-bush/4377274 or from: http://www.youtube.com/watch?v=WcK2miCiVHw. The DriveSafe NT Remote Facebook page – www.facebook.com/drivesafentremote has many stories, photos and information about program activities.

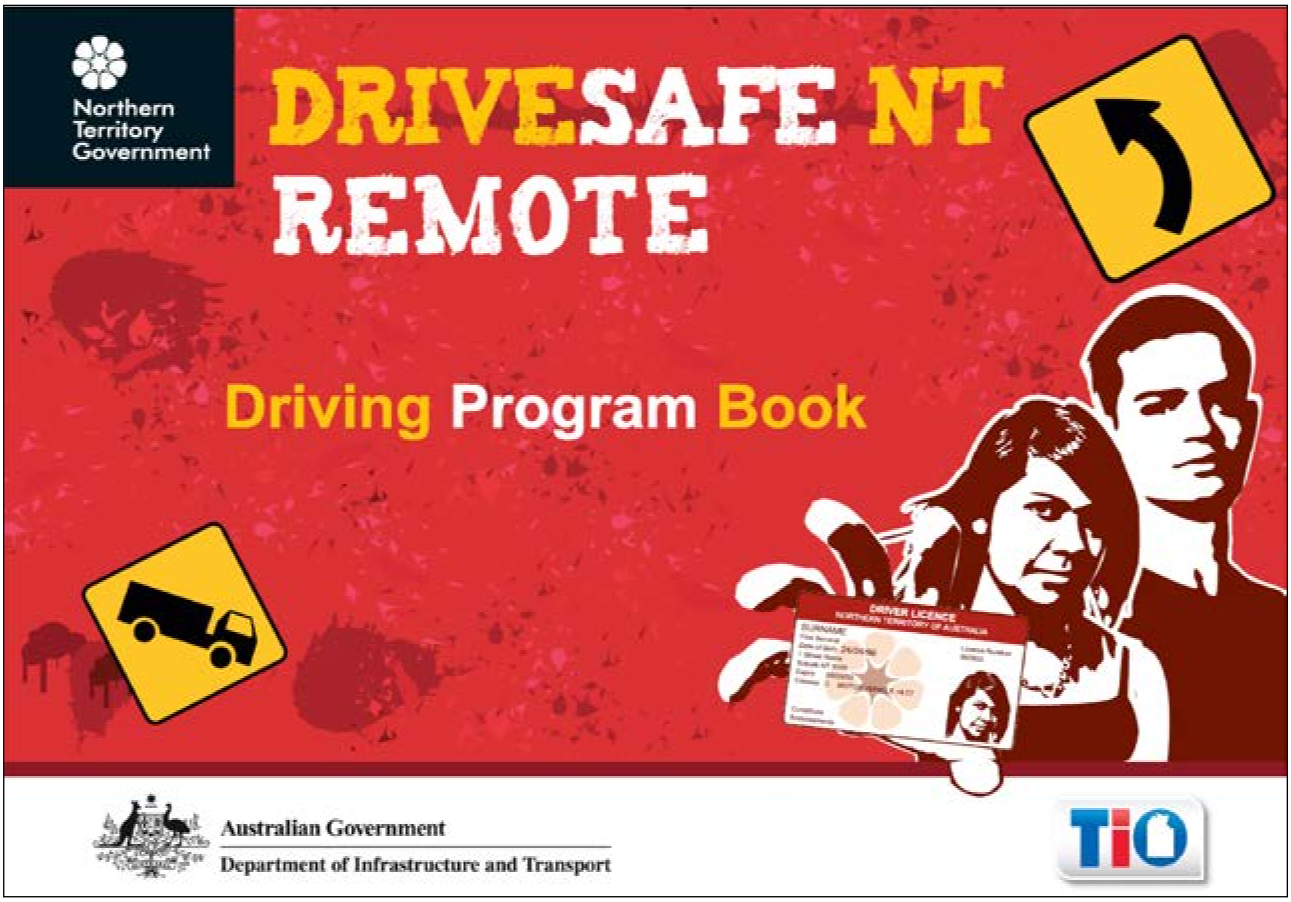

Figure 2: Cover page of the participant handbook

Further monitoring of output and evaluation of the program is underway, although full scale crash outcome evaluation may be limited by the sample size and thus available statistical power.

Early Results

Results from the first year to date of *DriveSafe NT Remote* show a strong take-up in the initial communities of Yirrkala, Gunyangara, Angurugu, Umbakumba, Wurrumiyanga, Gapuwiyak, and Galiwinku.

In 2012, 318 Indigenous people had passed the learner licence test and been issued with a Learners licence (148 males and 170 females), and a further 67 Provisional licences were issued (34 males and 33 females). The team spent 170 days in remote communities and delivered 1064 driving lessons as participants progressed toward gaining their provisional licence. The first 10 weeks of experience showed great interest with classes averaging 29.7 participants per community, well above the target of 20 per community. *DriveSafe NT Remote* team members also delivered tests for public passenger licences with seven such licences being issued and assisted many people with proof of identity documents. This included the issuing of 127 Birth Certificates.

While this is a trial program running over two years in 14 pre-selected communities, it has generated strong interest from local government and service providers outside of these areas, as well as individual communities expressing their interest in participation, which is leading to expansion of the program.

In each expression of interest, the difficulty of gaining a licence, and the importance of being a licensed driver, are acknowledged. Many highlight the job opportunities on offer within their organisation for licensed drivers, should access to a driver training program be available.

Receiving a driver's licence can be likened to receiving a passport. As a passport opens up opportunity to explore the world, so too does a driver's licence open up opportunity to access jobs, health services, education and social connections. Particularly for Indigenous women, a driver's licence delivers freedom of movement for themselves and their children.

Conclusions

The problems faced by Indigenous communities, especially those in remote areas, in obtaining drivers licences have been recognised for some time and a number of programs exist in Australia to address the key limiting factors. The *DriveSafe NT Remote* program addresses the key recommendations arising from many analyses of the problem [4, 5, 8], by providing facilities, training, a Motor Registry officer, help with proof of identity, and a driver mentoring program in communities.

In the short time the program has been running, 318 Indigenous people have received their learner licence, already passing the original target of 280 in the first two years. Substantial additional benefits are already identifiable. As an unexpected benefit of having the relevant staff available in the community, seven people were able to upgrade their licences to allow them to work as commercial passenger vehicle drivers, thereby allowing remote "bus services" to be provided in their communities. Sixty-seven have been tested and moved from learners to provisional drivers. Of the 510 licences issued through the *DriveSafe NT Remote* program since April 2012 only two have been suspended for drink driving. It is hoped that further evaluations will continue to demonstrate success and that programs modelled on this process of bringing facilities, proof of identity, driver training, testing, on-road experience, and ultimately licensing to Indigenous communities will be implemented systematically across Australia.

Other critical aspects of Indigenous road safety, such as improving roads and the safety of roadsides within and around Indigenous communities [23] and for remote areas more broadly [6,7], remain to be effectively addressed and will help improve a key area of road trauma over-representation in Australia.

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Development of an integrated road safety management system in Indonesia: Traffic police as lead agents in a Safe System approach

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Abstract

In accord with the UN Global Decade of Action 2011-2020, Indonesia is committed to reducing its traffic fatalities by 50% by the end of 2020. Traffic accidents in 2010 were officially estimated to result in an annual social cost of about 3.1% of the Indonesian Gross Domestic Product (GDP), rising to 3.7% of GDP in 2011 (i.e., ~AUD 29.8 Billion of a total GDP equivalent to AUD 805 Billion in 2011). With rapid motorisation associated with economic development, annual social costs could approach some AUD 39 Billion or 4.6% of GDP. The Indonesian National Traffic Police Corps (Korps Lalu Lintas Polri, or Korlantas) has a central role in reducing traffic fatalities. Korlantas' role is specified in Law 22 of 2009 relating to road traffic and transportation and includes responsibilities for: road policing, traffic management and traffic enforcement; accident investigation; accident reporting and analysis; driver licensing; vehicle registration; and traffic education. Law 22/2009 provides the legislative framework for road safety activities, but the direction is provided by the National General Plan for Traffic and Road Transportation Safety (Rencana Umum Nasional Keselamatan Lalu Lintas dan Angkutan Jalan, or RUNK), which was released in 2011. The RUNK identifies five pillars on which to build road safety and traffic enforcement policies and actions: road safety management; safer roads; safer vehicles; safer road users; and, post crash care. To ensure that reliable and valid accident data are available, Korlantas has – with World Bank funding – developed a web-based accident investigation system (AIS). After piloting in Central Java during 2012, the AIS is available nationwide. Access to comprehensive, reliable and accurate road accident data makes it possible to identify the specific roads, vehicles and road users which need to be targeted with road safety and traffic enforcement interventions. Not only is the IRSMS being used as an accident investigation and policing tool, the system is able to be used by road safety stakeholders. The ability to access up-to-date accident data coupled with the need for Local, Provincial and National road safety interventions, the IRSMS will aid decision makers to develop evidence based strategies to reduce casualties and improve road safety in Indonesia.

Keywords

Indonesia, Road safety, Accident information system, Road safety strategy, ISO 39001, Traffic policing, Road safety management

Introduction

Road accidents[1] are a very serious problem in Indonesia. In 2010, Police reported 31,234 road accident fatalities; equivalent to a rate of road fatalities per 100,000 people of 12.1. This is high compared to Singapore with 4.8 fatalities per 100,000 people, and Australia with 5.2 fatalities per 100,000 people. The preliminary data for 2011 indicate that 30,629 people were killed, 35,787 were seriously injured and 107,281 were slightly injured in 106,129 reported road accidents in Indonesia. Commentators consider that this is an underestimate as traffic accidents may not be reported, and data are inconsistent and difficult to verify: AusAID/ Indonesia Infrastructure Initiative (IndII), for example, has suggested that about 40,000 people died as a consequence of traffic accidents in 2010 [1], suggestive of a level of underestimation of road trauma of 20-25%. Based on the current trend, it is estimated officially that 37,500 people could die on Indonesian roads in 2020 [2](see Figure 1). However, estimates up to 65,000 traffic fatalities per year have been projected for 2020 [3]. The Indonesian Traffic Police Corps commissioned the development of an improved accident database, using a web based accident information and analysis system not only to define the number of casualties and accidents but to capture the details needed to implement and monitor the effectiveness of evidence-based safety interventions.

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[1] In Indonesia, "accident" is used instead of "crash". While not consistent with the Safe System approach espoused by Western nations, the Indonesian terminology is used in this paper.

As part of Indonesia's commitment to the UN Decade of Action 2011-2020 program, an ambitious target has been set to reduce these numbers by 50% to less than 18,750 deaths by the end of 2020 [4]. A five-year program of action was established to support road safety; this program ran over 2008–2012. Priorities have been established with assistance from the World Bank, the AusAID-funded Indonesia Infrastructure Initiative (IndII), the Asian Development Bank, and other stakeholders. A particular priority is for road safety partnership actions among stakeholders to improve capacity by strengthening coordination and management of road safety. Developing capacity is a pressing issue, as the responsibility for road safety action has been, until recently, quite diffuse [5]. These priority programs include:

- Study of locations with a high occurrence of accidents ("blackspots") to better inform decisions regarding road safety engineering and traffic enforcement programs;
- Improvement in the quality of traffic accident investigations and improvement of the traffic accident data recording system;
- Improvement in traffic education from an early age and improvement of the system for issuing driver licenses;
- Trials of a number of new traffic policing actions, including speed enforcement using electronic devices such as radar and LIDAR; and enforcement of drunk driving and drug driving.

Year	Prediction			DoA Target
	Population	Vehicles	Fatalities	
2010	237,000,000	50,000,000	32,192	32,192
2011	237,521,400	52,500,000	32,687	32,514
2012	238,043,947	55,125,000	33,189	32,189
2013	238,567,644	57,881,250	33,698	30,509
2014	239,092,493	60,775,313	34,216	28,828
2015	239,618,496	63,814,078	34,742	27,148
2016	240,145,657	67,004,782	35,275	25,468
2017	240,673,977	70,355,021	35,817	23,787
2018	241,203,460	73,872,772	36,367	22,107
2019	241,734,108	77,566,411	36,926	20,427
2020	242,265,923	81,444,731	37,493	18,747
2025	244,942,599	103,946,409	40,462	12,866
2030	247,648,849	132,664,885	43,667	10,513
2035	250,384,999	169,317,747	47,125	8,700

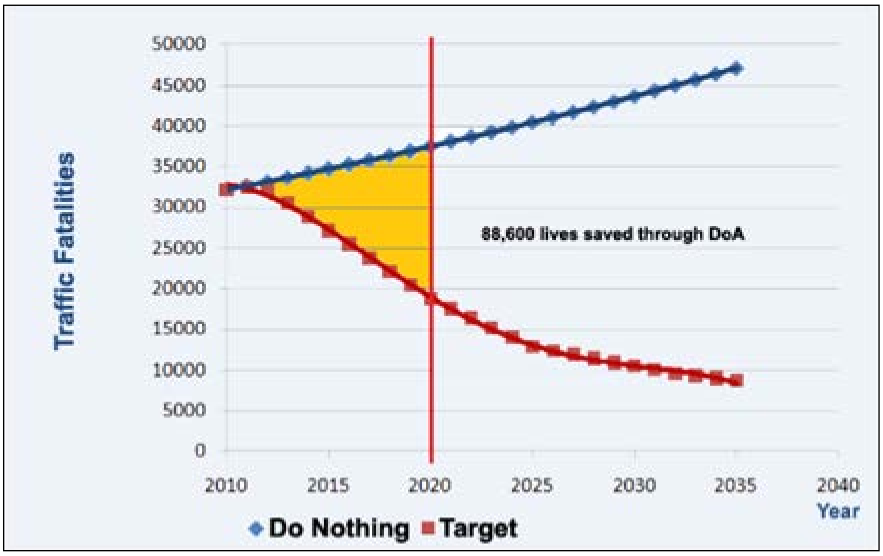


Figure 1: (TOP) Predicted traffic fatalities in Indonesia 2010-2035 and the targeted reduction under the Decade of Action (DoA); (BOTTOM). Targeted reduction in fatalities in Indonesia under to the Decade of Action of Road Safety (from [2])

These programs are most likely to succeed if they use measurable objectives, if all stakeholders are committed and play an active role in implementation, and if they are regularly reviewed to evaluate program success and apply any necessary changes in anticipation of new trends. A forecast impact of these activities on fatality reductions from traffic accidents is shown in the lower part of Figure 1; Year 2010 is used as the base year for the projections [2].

Improvement in the quality of accident data is urgent, as these data form the basis of safety program planning by all stakeholders and serve as performance indicators to assess road transport safety. The success of the UN Decade of Action 2011-2020 programme in Indonesia depends on accurate evaluations of various interventions and these in turn depend on whether accident data are recorded and reported accurately and systematically. Put simply, there is a need to establish an evidence base – statistical data, or practical facts – and to act to place that evidence (those facts) before decision makers, road users, and the general community.

The accident data for Indonesia are provided by the IRSMS Accident Information System (and related databases on driver licensing, vehicle registration, hospital attendance and insurance claims). The Accident Information System is one part of the Integrated Road Safety Management System (IRSMS) being implemented in Indonesia. The IRSMS, as will be outlined in later sections, reflects a holistic approach to reducing road trauma and improving road safety, involving legislation, strategy development, use of valid and reliable accident data as the basis for decision making, an integrated approach (bringing together otherwise disparate functions such as road management, traffic enforcement, road safety education, driver licensing), and seeking to deliver local solutions to address local problems. It is intended that IRSMS will serve as the basis for an integration of the management of road safety in Indonesia across all relevant government agencies (at local, provincial and national levels) and with the private sector and community organisations.

The IRSMS Accident Information System is central to understanding the road safety situation in Indonesia, as it specifies <u>who</u> was involved; <u>what</u> happened immediately prior to, during and after the accident; <u>where</u> the accident occurred; <u>when</u> the accident happened; and describes <u>how</u> the accident took place; and, through police investigations and witness accounts, can establish <u>why</u> the accident occurred.

Of course, there needs to be a belief that change can happen. The moral compass for traffic accident reduction and improvement to road safety in Indonesia is provided by the Safe System approach, as expressed through the strategic plan (RUNK 2011-2035) [5] and action plans developed to address and guide road safety and traffic policing efforts.

The Indonesian National Traffic Police Corps

The Indonesian National Traffic Police Corps (INTPC), Korps Lalu Lintas Polri (or Korlantas) is an independent policing agency under the Indonesian National Police. The INTPC recognises that there is an increase in road trauma across Indonesia, and thus there is an imperative for action to implement more effective traffic policing actions to address road safety risk areas. Institutional capability reviews of INTPC have indicated that the organisation is disciplined and led by experienced senior officers [3]. While there is a good training capability at the Police Academy in Semarang and at the Traffic Education Centre near Jakarta, operational traffic policing capability needs to be improved to detect, contain and reduce illegal road behaviours and to change inappropriate or risky behaviours. In order to do so, further institutional development is required to improve the professional and operational capabilities within INTPC. This is already underway, with budgetary responsibilities being shifted from central to provincial (Polda) levels. It is proposed that a safety directorate be established within Korlantas, tasked with the operation of the IRSMS which includes the accident reporting system, traffic accident statistical analysis and reporting (with more than 3,000 possible analyses available), as well as with stakeholder liaison, audit and quality control functions, training in accident data collection, and a traffic technology development function [3].

Law 22 of 2009 on Road Traffic and Transportation

The legislative framework for road safety in Indonesia is primarily provided by Law 22 of 2009, relating to Road Traffic and Transportation. That is, the primary responsibility for road safety rests with the INTPC rather than with Indonesian transport or public works agencies, although these other agencies retain road safety structures. Under Law 22/2009, the INTPC is charged with the responsibility for road traffic and transport safety. Generally, Law 22/2009 (Article 4, 5 and 12) aims to develop and organise a secure, safe, orderly and smooth land transportation system through:

- The movement of vehicles, people and/or goods on roads;
- The use of traffic and road transportation infrastructure and facilities; and
- Activities related to registration and identification of motor vehicles and drivers, traffic education, traffic management, engineering, and the enforcement of traffic and road transportation laws.

More specifically, the INTPC is charged with:

- Testing applicants and controlling licences for driving motor vehicles;
- Motor vehicle registration and identification;
- Collection, monitoring, processing and presentation of traffic and road transportation data;
- Traffic regulation, surveillance, escorting and patrolling;
- Law enforcement including actions against violations and handling of traffic accidents;
- Traffic education;
- Implementation of traffic management and engineering; and
- Implementation of traffic operational management.

A number of additional laws apply to particular issues, (e.g., provisions of Law 27/2009 on narcotics, relating to taking samples of blood, urine, etc., are relevant to addressing drug driving).

Accident data – information about the circumstances of an accident – are the basis for all targeted road safety interventions. For example, access to comprehensive, reliable and accurate road accident data makes it possible to identify specific roads, vehicles and road users which need to be targeted with road safety interventions. Road safety data can also be disseminated to relevant stakeholders and can aid decision making about the overall direction and strategy for road safety in Indonesia. While road users are required to report accidents, such reports can be made to local INTPC officers up to 40 days afterwards. As well, Law 22/2009 allows accidents to be “resolved at scene”, that is, to be negotiated between the affected parties. This means that an unknown number of accidents may be unreported, as they are settled between the parties and may not be recorded within the accident information system.

The National General Plan for Traffic and Road Transportation Safety (RUNK)

The National General Plan for Traffic and Road Transportation Safety (Rencana Umum Nasional Keselamatan (RUNK) Jalan 2011-2035) [4] was released on 11 May 2011 and reflects the goals outlined for the UN Decade of Action for Road Safety. Indonesia organised national events to launch the RUNK and used the opportunity to advocate for increased attention on the road safety issue. The RUNK estimates that traffic accidents result in an annual social cost estimated to be at least 3.7% of the Indonesian Gross Domestic Product (total GDP is approximately Rp. 831 Trillion, or AUD 805 Billion).

The RUNK has identified five pillars on which to build road safety and traffic enforcement policies, based directly upon the Global Decade of Action for road safety 2011-2020:

- Pillar 1 relates to Road Safety Management. There are number of activities envisaged and undertaken under this Pillar, including:
    - Establishment of a Forum on Road Safety at executive government level - enacted in Law 22/2009;
    - New Government Regulations to regulate road security and road safety;
    - Inclusion of the Provincial and Regency/City Governments – all levels of government are to take an active role in road safety;
    - Targeting the business sector and civil society to take more responsibility for remedial measures to improve road safety, and to promote road safety information; and
    - Bringing leaders in Indonesian society, such as imams and other religious leaders, into the campaign on road safety.
- Pillar 2 concerns Safer Roads. Specific program actions have been identified, including projects to provide:
    - Safer Roadways;
    - Safer Road Planning and Construction (including road furniture); and
    - Safer Road Environment.
- Pillar 3 concerns Safer Vehicles. There are a number of activities envisaged under this Pillar, but an important aspect for vehicle occupant safety is:
    - Legislative reform is needed to make the use of rear seat belts mandatory. The mandatory wearing of seat belts in the front seats of vehicles only has been applied in Indonesia since 1993 (with Law 14/1992, as later revised by Law 22/2009).
- Pillar 4 concerns Safer Road Users. There are a number of activities envisaged and undertaken under this Pillar, including
    - Indonesia Road Safety Week, initially at a limited number of provincial levels in 2010-11, but to be extended to all provinces and to regencies and cities over 2012–2020;
    - Increasing Government Agency participation;
    - Increasing public participation; and
    - Increasing corporate participation.

- Finally, Pillar 5 relates to Post Crash Care. When accidents occur, and it is recognised that in the operation of the road transport system accidents will occur as road users are fallible and make mistakes, then the response and timing of the actions of police, emergency services, healthcare and insurers is important.

To date, most activities have dealt with Pillar 2, relating to Safer Roads [1, 6], but capacity development actions to address all Pillars have been undertaken under IRSMS [3] and under the Indonesian Transport Safety Assistance Program (ITSAP) by AusAID [7,8].

Safe System and the road transport system

The UN Decade of Action for Road Safety and the Indonesian Road Safety Master Plan are based on the belief that improvements in road safety and reductions in road trauma are possible, and that the greatest road safety gains into the future will be achieved through adopting a Safe System approach. The primary aim of the Safe System approach is to prevent accidents from happening, and, in the event of a crash, to ensure that the impact forces released are within the boundaries of human tolerance and that no fatalities or serious injuries resulting in life-long disability will occur [9, 10]. Currently, what a road user understands about the sensibility and appropriateness of a road rule and what they accept as being sufficiently "safe" for travel, are not what is desired by the general community. That is, drivers don't necessarily know or fully understand why a particular traffic law is in place ("what it's for"), and drivers can often have a misplaced faith or expectation that the road on which they are driving, their vehicle, and other drivers are all sufficient to provide a "safe" place, seemingly independent of the manner in which they themselves are driving. In the immediate to medium term, a focus on the management of occupant protection devices (motorcycle helmets, seat belts), vehicles, the road infrastructure, and driving speeds will likely best minimise the probability of death or serious injury as a consequence of a road accident. Appropriate and well-designed behavioural countermeasures are desirable, but reliable mechanisms for ensuring that road users are always alert and attentive, and are compliant with traffic laws, are not well understood or well implemented at present [11].

In the widest view [12], it is accepted that the desires of the population in any jurisdiction, in road transport terms, can be expressed as:

- Wanting to be mobile, that is, to be able to travel;
- Wanting to have access to transport options (road, public transport);
- Wanting to be safe;
- Wanting to have a sustainable environment; and
- Wanting to have a "pleasant" environment in which to live (amenability).

The IRSMS project is built on these general concepts.

The concept of an Integrated Road Safety Management System

The Indonesian IRSMS has been independently developed as a practical system to address road trauma and improve road safety [13]. For this system, the following elements were considered to be necessary to underpin effective management, target setting, the development of countermeasures and interventions and evaluation of actions taken, as shown in Table 1:

- Enactment of a legislative framework to regulate the road transport system;
- Access to valid and reliable data (the practical facts) concerning road trauma and behaviour; and
- A belief that change can happen.

ISO 39001 – Road traffic safety management system

The IRSMS in Indonesia predates the new international standard: ISO 39001:2012 "Road traffic safety (RTS) management systems – Requirements with guidance for use". The ISO 39001 standard was developed to support the United Nations' Decade of Action for Road Safety 2011-2020 and published in late 2012 and sets out the minimum requirements for a Road Safety Management System [14, 15, 16]. Despite being developed earlier than the ISO 39001 standard, IRSMS incorporates all of the necessary elements for a road traffic safety management system, and is, in fact, an exemplar for the implementation of the standard.

The ISO 39001 standard is intended to be a practical tool for governments, vehicle fleet operators and all organisations worldwide who want to reduce death and serious injury associated with road accidents. The standard is intended to be a tool that can be used to support strategies and actions to address risk in the road transport system, including the setting of ambitious road casualty reduction targets, the documentation of performance relative to those targets and the sharing of experiences. It was developed from ISO standards such as ISO 9001 for quality management, including the plan-do-check-act cycle, and a requirement for continual improvement by all public or private sector organizations involved in regulating, designing or operating road transport. It will also help by providing a framework for contracts and communication between regulators, vehicle manufacturers and their suppliers.

Table 1: Elements considered necessary for an Integrated Road Safety Management System (from [3])

A framework	The legislative framework for an Integrated Road Safety Management System in Indonesia is provided by Law 22 of 2009, relating to Road Traffic and Transportation, and related laws. Law 22/2009 establishes INTPC as the lead institution for road safety.
The practical facts	The data on traffic accidents are provided by an Accident Information System that specifies who is involved; what happened immediately prior to, during and after the accident; where did the accident occur; when did the accident happen; how did the accident take place; and, why did the accident happen.
A belief that change can happen	The moral compass for traffic accident reduction and improvement to road safety is provided by the Safe System approach, as expressed through the strategic plan (RUNK 2011-2035) and action plans developed to address and guide road safety and traffic policing efforts.

Background to the IRSMS project for a national road safety management system

The Strategic Roads Infrastructure Project (SRIP) is supported by a loan from the World Bank (IBRD Loan 4834–IND) and has been implemented by the Directorate General of Highways within the Ministry of Public Works since late 2007. Following Law 22/2009, INTPC took over the responsibility for developing IRSMS. Project implementation is expected to be completed by mid-2013. The technical assistance to IRSMS is being undertaken by Consia Consultants.

The SRIP Project included a Road Sector Institutional Development component consisting of:

- IRSMS-1, to develop an integrated Road Safety strategy and long-term plan, including an institutional framework; via the Directorate General of Land transport (DGLT), later cancelled, and
- IRSMS-2, to develop a pilot integrated road accident database/analysis system, and establishing self-sustaining personnel development procedures for the INTPC.

Within INTPC, the IRSMS Project has delivered the following key achievements:

- Development of a web-based accident information and analysis system with a simple user interface for reporting and retrieving accident information;
- A new Accident Record Form has been developed, and Tablets using open source Android operating systems are being procured to improve both data quality and input times;
- An AIS User Manual for data entry and basic reporting has been published;
- From 1 September 2012, accident data collection, coding, entry and processing in the IRSMS server has been extended to the whole of Indonesia, in total, 445 Polres (police districts) of 31 Poldas (provincial offices);
- Daily accident reports are available to the Police Operations Department;
- Presentations on the Accident Information System (AIS) and training on the use of the new system and Accident Record Form has been provided to more than 430 police officers from the 31 Poldas, as well as to stakeholders and to police officers undertaking executive training for senior positions; further training for 500 personnel is planned in the first half of 2013;
- Two workshops on stakeholders' data system requirements have been held;
- Training courses in road safety interventions have been developed, incorporating:
    - Development of a Road Safety Data Collection Manual;
    - Development of a Data Analysis and Applications Manual;
    - Procurement of equipment for INTPC use in speed enforcement, drink drive enforcement, drug driving enforcement and overweight vehicle enforcement;
    - Development of Standard Operating Procedures (SOPs) for traffic enforcement by INTPC;

    - Development of local road safety implementation plans for INTPC Polda (provincial offices) and Polres (police districts) to conduct targeted operations based on the evidence from the IRSMS accident information system and local stakeholder consultation;
    - A series of media campaigns is being made for release in early 2013, including television commercials, newspaper advertisements, billboards and internet media. The campaigns will focus on the key priority means of reducing casualties based on the evidence from the IRSMS accident information system and follow and support the themes of police traffic enforcement;
- An IRSMS public website (www.korlantas-irsms.info) has been established, with web pages in both Indonesian and English languages that explain the system and provide additional background information.

Continued institutional development, training and capacity development in the present project will be closely linked to the development of the IRSMS, both under the SRIP Project to mid-2013 and beyond. In particular, much attention will be devoted to address the technical and institutional causes for the underreporting of road accidents.

A basic need for data: The IRSMS Accident Information System

IRSMS is designed to provide valid, reliable and verified data for road accidents in Indonesia [2, 3, 13]. Information about the circumstances of an accident is the basis for all targeted road safety interventions [16]. For example, access to comprehensive, reliable and accurate road accident data makes it possible to identify specific roads, vehicles and road users which need to be targeted with road safety interventions.

Through Law 22/2009, the INTPC is charged with the responsibility for accident data collection and investigation. A user manual was developed to explain the methods and procedures that the INTPC needs to use to collect and analyse these accident data. The user manual provides basic and practical guidance for police and other stakeholders when entering accident data and utilising the information that is contained within the database system. At present, there are published versions of the user manual in both Indonesian and English. The AIS User Manual Version 1.2 describes the accident input process reporting a road accident under the IRSMS Accident Investigation System [17]. Further development for system users will address issues of data verification (validation), general data analysis and reporting, usability issues, and administration of the Accident Investigation System.

As well, an expansion has been approved that allows for a broadening of the scope of the project in two pilot provinces to include electronic data collection for accident reporting, system design automation and digital transmission using tablet computers on site to gain automatic GPS location of the accident and to document the scene and gather relevant photographs and witness statements (if available).

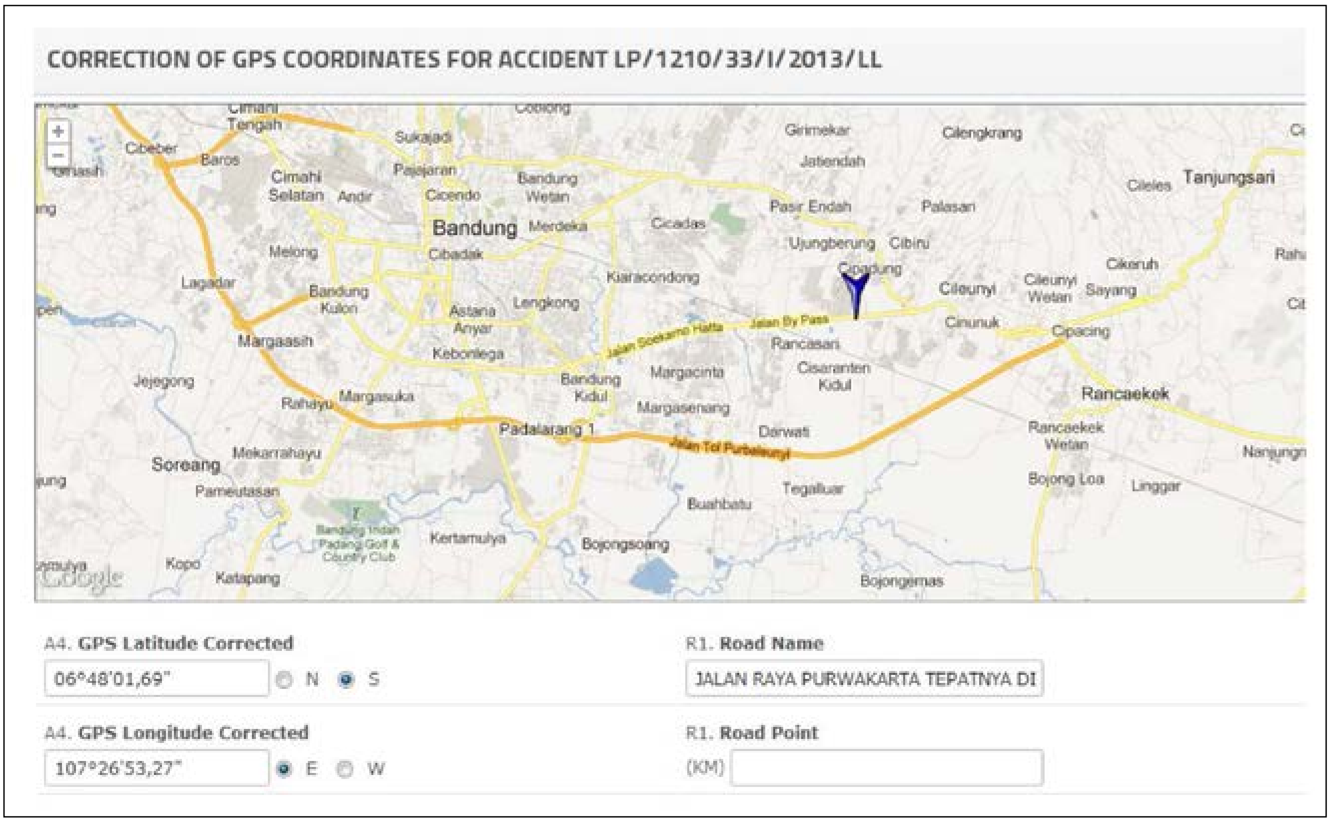
IRSMS Accident Information System functionality

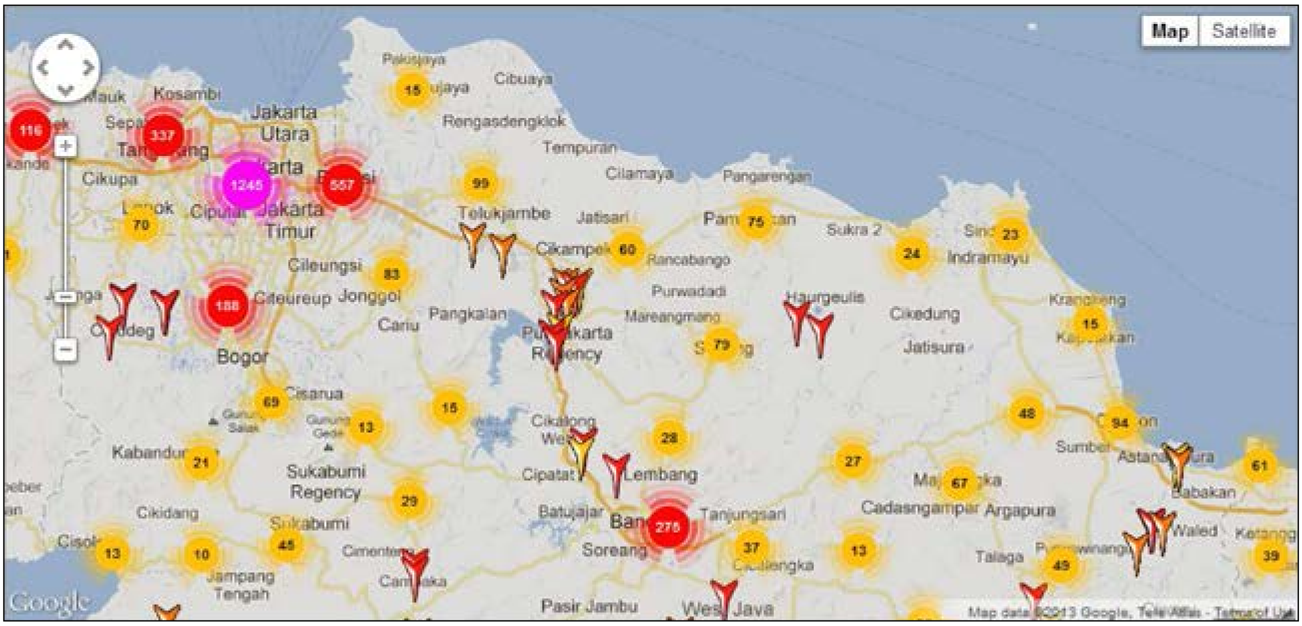
At present, data are collected by police filling in a notebook entry or the paper accident report form at the accident site. The information about the accident is then later entered onto the database at the police station. The location of the accident is registered as geographical coordinates, but this has occasionally been problematic as Indonesia straddles the Equator, and North/South latitude co-ordinates can be confused.

A user-friendly interface guides the registration of data from paper forms. The location of the accident can easily be corrected by simply dragging the accident indicator (see Figure 2) on a map. The name of the road is automatically registered once the accident location is selected and confirmed. Eventually, the data collection will be made by means of a tablet computer at the accident site, which will enable use of GPS for automatic registration of the location of the accident in geographical coordinates. Use of a tablet also enables data control to be effected at the accident site, minimising coding errors associated with multiple entry of data, as well as automatic transmission of data to the national database. Furthermore, photographic evidence and recordings of witness statements can be collected with the tablet and attached to the accident record. Images are stored as an integral part of accident information and can therefore be accessed at accident level, while witness statements are available to authorised users to support later criminal prosecutions. Additional documents can also be attached to the accident record. Output from the system is designed to serve for prosecution, investigation, planning and accident analysis purposes (for example, the system produces the main report that is necessary for court proceedings).

When analysing accident information, the easiest procedure is to use the map facility where accident concentrations can be found by zooming in on specific locations (see Figure 3). At any time the user can click on an accident and get a summary description of data and time, location, vehicles involved and injuries. An accident diagram and pictures of the accident are also displayed. A number of standard reports such as daily, weekly and monthly reports, and standard tables are also at the disposal of the user. On top of this the system, can generate a cross-tabulation of any given pair of variables in the system. Some cross-tabulations that are common to statistical reporting of accidents are provided as programmed options within the system.

Figure 2: Screen for correcting the location of the accident





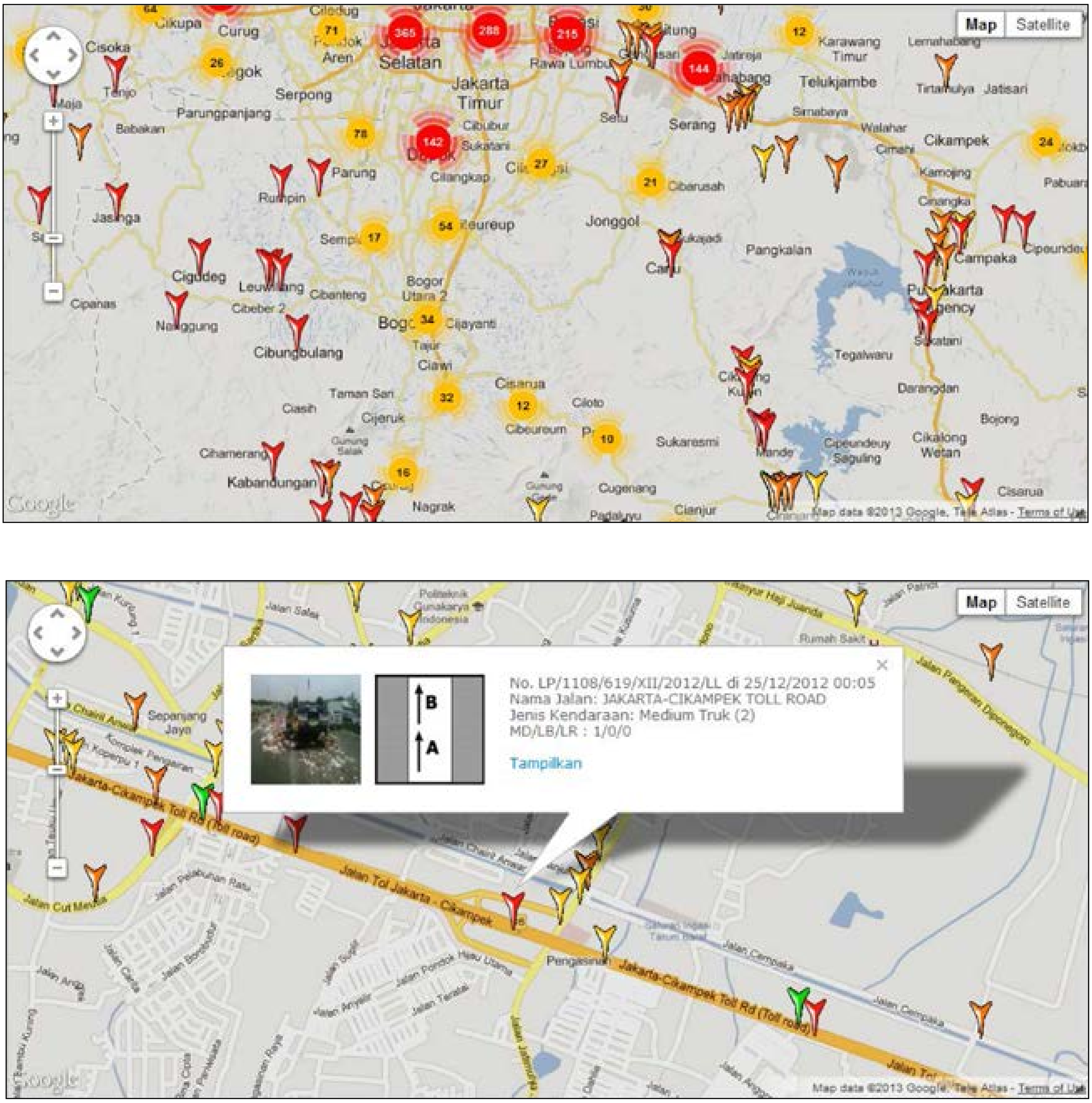


Figure 3: Zooming in on a map and selecting a specific accident

Some final comments

Overall, IRSMS should improve the capacity of Indonesian agencies – and, in particular, the INTPC – to undertake actions to reduce road trauma and enhance road safety outcomes, thus further contributing to improvement of road safety in support of the Indonesian Road Safety Master Plan (RUNK) [4] and based on the UN Decade of Action for Road Safety.

IRSMS allows additional stakeholders (journalists, and the general public) to be able to identify specific data and to highlight where actions could be made, rather than providing accident data only to "approved" stakeholders from various government agencies, planners and road system designers. With IRSMS it is possible to give all stakeholders access to the web-based front end of an accident information and analysis system, as part of an integrated road management system as envisaged by ISO 39001. Using IRSMS, general accident data can be accessed by all stakeholders and still meet all legal privacy requirements. The confidentiality of individual names and personnel data is restricted to the needs of a particular registered user who can be allowed various levels of access (e.g., for the normal evidentiary data needs of police prosecution). The current data system used in Indonesia is simple enough to be accessed by any registered user anywhere globally, and more than 3,000 different summary report formats can be generated, as well as allowing for the investigation of the mechanics of individual accidents.

Data applications using IRSMS are already being developed, for example:

- AusAID/Indonesia Infrastructure Initiative (IndII) have requested an independent analysis of hazardous locations – black spots and black lengths – using IRSMS data to review more than 20 black spot road locations in Jateng, Central Java, that are proposed for priority funding for improvements to the road or reconstruction of the road. To support such analyses, an IRSMS Data Analysis and Applications Manual is being developed.
- IRSMS allows situations where there are accident clusters to be identified. These may be common crash types at particular locations or at particular times of the day, and may involve particular types of vehicles, or travel for particular purposes. The draft IRSMS Data Analysis and Applications Manual discusses the OLA approach used in Sweden [18] to present objective data to stakeholders, get the stakeholders to make a list of solutions that can address the problem, and agree to the actions that are to be performed and plan or schedule those actions.
- IRSMS allows the review of sections or the full length of roads to identify poorly performing roads. This can involve not only examination of accident records, but additional data about road use, enforcement data, road safety audit reports, to allow for the development of an integrated response, such as targeted enforcement, a review of road signage, road alignments, etc.
- Finally, IRSMS can support new tactics to target the inappropriate and illegal behaviours that contribute to an increased risk of road trauma. IRSMS is being used to assist in the development of new traffic policing tactics for INTPC. Working together with AusAID, a priority program will be a demonstration of speed enforcement as an effective tool in speed management and reducing road trauma. A pilot program is being undertaken on a selected toll road east of Jakarta which has a history of high road trauma. Different interception techniques will be applied, using proposed new Standard Operating Procedures (SOPs). New speed enforcement equipment (radar, LIDAR, time X distance measurement) will be trialled and evaluated for wider use across Indonesia.

The design of the continued development of IRSMS will strengthen the institutional environment under which road safety and traffic policing actions are planned, undertaken and evaluated. If policies or decisions are based on limited or unreliable data, this can result in adverse results from program implementation and an unnecessary waste of resources. Road safety data, collected every day, can fulfil this purpose if they are properly recorded and compiled in a reliable system that can subsequently be used for data processing and analysis. The results can also be disseminated to relevant stakeholders and, when used effectively, can aid decision making on overall direction and strategy for road safety in Indonesia.

An analogy is that of “moving on an escalator of progress”. The “escalator” moves from a situation where doing any form of road safety activity seems limited and likely ineffective, to a vantage point from which activities can be initiated and expanded, where researchers can investigate real events, where journalists can access real data to report on what has worked and what has not worked, and where politicians in turn are able to be better informed and be more realistic in their major economic and safety decisions concerning funding allocations and infrastructure planning.

To summarise, one way of thinking about what is being done in Indonesia is a series of small iterative changes that introduce web-based access to a safety database that can not only be used by the hosts (the INTPC) but, once officially launched in April 2013, can expand rapidly to be used by all stakeholders in Indonesia. The aim of IRSMS, together with the RUNK and with planned legislative changes under Law 22/2009, is to provide the practical facts that can be used to accelerate institutional change and underpin decisions about capacity development needs. This should not only start to stabilise the rapidly increasing casualty rate associated with road accidents but to accelerate the reduction so that a 50% reduction by 2020 becomes a planned reality rather than a remote possibility.

Acknowledgments

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What are the offence and offender risk factors for Indigenous repeat drink drivers in Queensland?

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Abstract

In Australia and internationally, there is scant information about Indigenous repeat drink drivers. The aim was to identify the risk factors associated with repeat offending. De-identified data on drink driving convictions by offenders identifying as Indigenous in Queensland between 2006 and 2010 were examined. A range of univariate analyses were used to compare first time and repeat offenders on gender, age, court location and region (based on the accessibility/remoteness index of Australia), blood alcohol concentration and sentencing severity. Multivariate logistic regression adjusted for confounding variables. Convictions for repeat offenders were more likely from locations other than 'major cities' with the association strongest for courts in the 'very remote' region (OR=2.75, 2.06-3.76, p<.001). Indigenous offenders 40 years or older were found to be at reduced risk in comparison to offenders aged 15-24 years (OR=0.68, 0.54-0.86, p=0.01). After controlling for confounding factors, gender, sentencing severity and blood alcohol concentration levels were not significantly associated with recidivism. The association of recidivism and remoteness is consistent with higher rates of alcohol-related transport accidents involving Indigenous Australians in isolated areas. This study provides a platform for future research and allows for early attempts to address the need for intervention to reduce Indigenous drink driving recidivism.

Keywords:
Indigenous, drink driving, recidivist

Introduction

Road crashes are a serious road safety issue for contemporary Indigenous Australians and contribute to the existing health gap between this group and the wider population [1].[1] For Indigenous peoples, both in Australia and internationally, drink driving contributes to high road injury rates [1-4] with a large proportion of these injuries attributable to road crashes caused by drink drivers who have multiple previous drink driving convictions [5]. In Australia, recent studies specifically investigating the predictors of repeat drink driving offending, have identified that being of Indigenous background is a significant predictor [6,7]. Preliminary estimates of Indigenous drink driving recidivism in Western Australia report that Indigenous people account for 28 percent of offenders, defined in that study as having been convicted of drink driving for the third time [8], yet only represent 3.5 percent of the state's population [9]. It may be that differences in the patterns of alcohol consumption for Indigenous peoples compared to non-Indigenous underlie or exacerbate this overrepresentation. Recent studies on alcohol consumption among Indigenous populations suggest that, while fewer Indigenous Australians as a whole consume alcohol [10], those who do are more likely than other Australians to consume at rates that are characterised as 'risky' or 'high risk' [11]. Identification of risk factors for mainstream repeat drink driving offending has received significant attention and this has enabled both the effective design of countermeasures and policy development. However to date, little is known about the characteristics of their Indigenous counterparts.

The principal paradigm guiding the development of many drink driving countermeasures such as imposition of financial penalties and licence disqualification is deterrence theory [12]. However, research has consistently shown that many repeat drink driving offenders are not receptive to the threat of legal sanctions, and continue to offend. For Indigenous drink drivers, licence disqualification as a result of a drink driving conviction often leads to further driving-related offences including unlicensed driving [13,14]. This is of particular concern in remote areas where there are no public transport systems. The lack of alternatives to private vehicle use is a serious social justice issue, as it contributes to higher numbers of driving-related arrests and to the overrepresentation of Indigenous peoples in incarcerated populations.

Over the last three decades rehabilitation programs have been developed as an alternative approach to legal sanctions. These programs vary considerably in content, but can be classified broadly as 'educational' (to improve knowledge, attitudes and skills), 'therapeutic' (involving

[1] Indigenous Australians refers to peoples who identify as Australian Aboriginal and/or Torres Strait Islander

psychotherapy) or a combination of both. Remedial programs for recidivist offenders attempt to address the high levels of self-reported alcohol misuse and dependence [15], as well as those personality traits associated with drink driving offending more generally such as poor impulse control. In relation to effectiveness, the most promising results come from rehabilitation programs that combine elements of education, therapy and follow-up contact (e.g. probation supervision). Evaluations of programs suggest that combining completion of a program with licensing sanctions, is more effective in reducing recidivism among repeat offenders than imposing licensing sanctions alone [16]. However, the current programs in Australia are primarily designed for and informed by research of mainstream offenders in urban settings, and may not be useful for Indigenous Australians. For instance, differences in contextual factors surrounding unlicensed driving exist for Indigenous peoples in Australia, particularly for those who live in more remote locations such as pressure to fulfil kinship obligations [13], and the same may exist for drink driving among Indigenous Australians. This notion is supported by research internationally, where there has been more attention towards drink driving in Indigenous communities and therefore greater understanding of the factors that facilitate it [17]. Such research indicates that similar kinship obligations, along with other differences in contextual factors, when compared to mainstream drink drivers, exist as well as demonstrating the need for suitable strategies for this population.

In summary, the issues and shortcomings identified above have meant a dearth of literature pertaining to the profiling of offender and offence characteristics for Indigenous repeat drink drivers. Moreover, there is little understanding of the cognitions of Indigenous repeat drink drivers or the contextual factors which may contribute to or exacerbate Indigenous drink driving. In light of this limited understanding, the current study aimed to: i) quantify Indigenous repeat drink driving in Queensland between 2006-2010; and ii) compare the demographic characteristics and offence details of first time Indigenous offenders with those Indigenous offenders who commit multiple drink driving offences. As the official court records now permit offenders to identify their Indigenous status it is possible to separate data on this basis. Thus the study is timely in that it possible to attempt to identify factors that may be significant in predicting Indigenous drink driving recidivism.

Method

Description of data

Records of persons prosecuted in Queensland for driving under the influence of alcohol between 1 January 2006 and 31 of December 2010 were obtained from the Department of Justice and Attorney-General, Brisbane, Australia. The dataset included the following offence variables of interest: date of offence and conviction, charge number, sentencing court location, offence code, and sentencing outcome description. It also included the following offender details, namely date of birth, gender and self-identified Indigenous status. The data were de-identified with each conviction assigned a unique case number. The Queensland University of Technology Ethics Committee approved this study (Approval number: 1100000636).

Data management

Using the Indigenous status field, all convictions for drivers who did not self-identify as an Indigenous person were removed. Evaluations of information collection for Indigenous status have noted some issues with utilising Indigenous status including limited understanding of the reasons for collecting data and the uses of data, non-use of the standard Indigenous status question, lack of quality assurance measures and a perception of reluctance among Aboriginal and Torres Strait Islander peoples to disclose their Indigenous status [18]. In addition, all matters that did not result in a conviction (n=128), or had missing data for variables of interest (gender missing n=1; age missing n=5) were excluded. Convictions for people under the age of 15 years were also excluded from analysis (n=18).

From a legal standpoint in Queensland, the term “recidivist” refers to an individual who has incurred more than one drink driving conviction in the last five years [19]. As the data was de-identified, deterministic linkage was used to match individuals to multiple convictions. Date of birth, gender, specific Indigenous status (Aboriginal, Torres Strait Islander or both Aboriginal and Torres Strait Islander) and sentencing court location were used to match convictions committed by the same individual. Completing this linkage technique is usually conducted to identify individuals within multiple data sources. Studies linking de-identified data have found linkage techniques to identify individuals within data to have high specificity, however sensitivity is dependent on the number of variables and has been found to range from 60.4-96.1%, dependent on the number of variables used [20]. All offenders were assigned a code on the basis of number of offences to distinguish the repeat offenders (value=1) from first offenders (value=0). The offences of individuals classified as repeat drink drivers were arranged in chronological order, and the data related to the first offence was then used to conduct the statistical comparisons with first time offenders. Within the current data, some repeat offenders who committed more than one offence did so prior to the court determination for the first offence. Because this means that those offenders would not have been exposed to the intended deterrence of sentencing for the first offence before committing the subsequent offence, they were excluded from this analysis (n=298) as a primary focus is on effective methods of deterring Indigenous offenders.

The authors of the study acknowledge there are limitations with identifying repeat offenders in the manner described which utilises a five year period of data only. This method has been adopted due to the commencement date for self-identification of Indigenous status within the Department of Justice and Attorney-General official records. Data for this field is not available for records prior to 2006. Therefore, some offenders categorised in this study as first time offenders may have had a recorded conviction prior to 2006. This limitation will be discussed further in the discussion.

Classification of court location, blood alcohol concentration offence level and sentencing severity for the analysis

The legal breath alcohol limit for driving in Australia varies according to class of licence or restrictions. It is 0.00g/100ml for licensed drivers on provisional or probationary licences and professional drivers (i.e. taxi and truck drivers), but between 0.01g/100ml and 0.049g/100ml for drivers on an open, full licence [21]. For this study three categories of BAC were used to classify the offence for which an individual driver was prosecuted. These correspond to the legal classifications of BAC offences, and are: above the zero limit (0.01-0.049g/100ml); the general alcohol limit (0.05-0.149g/100ml); and, the high range alcohol limit (≥ 0.15g/100ml). Since the data for this study was supplied, the legislation for BAC limits has changed in Queensland to include a fourth category of BAC offence, referred to as mid-range (0.10-0.15g/100ml) [21].

As a higher number of alcohol-related road crashes amongst Indigenous peoples occur in remote areas in comparison to metropolitan and regional areas, location of the offence was regarded as important in this analysis. However, the supplied data did not record the location of the offence, so the location of court of the conviction was used as a proxy for this. The majority of cases in the data had a short period of time between the offence and conviction date, suggesting that these matters were dealt with in a timely manner by the court in the region the offence occurred rather than being transferred to another court. For this research, the accessibility/remoteness index of Australia (ARIA+) was used to allow exploration of associations between remoteness and drink driving behaviour [22]. The ARIA+ was used to categorise court locations into five levels of remoteness, 'major cities', 'inner regional', 'outer regional', 'remote' and 'very remote'. The ARIA+ has been used previously in road safety and public health research [23-25].

With regard to the location of the offence, it is also essential to recognise alcohol sale and consumption legislation varies across Queensland. Alcohol management plans were introduced in remote Indigenous communities in Queensland during 2002 and 2003 in response to high rates of alcohol-related injuries. These plans are initiatives that involve local community justice groups (statutory bodies consisting of Indigenous Elders and others) in partnership with government agencies. Plans consist of a three-tiered approach including supply reduction strategies in collaboration with demand and harm reduction strategies. The supply reduction strategies are the main component and contain alcohol possession and sale limits [26].

After several years of operation, a review of the alcohol plans was conducted. As positive outcomes associated with supply reduction were identified, there was a tightening of the alcohol restrictions in these plans, with alcohol prohibited in some remote Indigenous communities from 2008. It is not the purpose of this study to explore what effect these tighter alcohol restrictions have had on repeat drink driving, as the analysis will not be specifically investigating changes at an individual court level. However, the study does acknowledge these differences in alcohol sale and carriage legislation across Queensland and differing enforcement of alcohol restrictions in remote Indigenous communities. The majority of these communities are classified as being 'very remote' according to ARIA+ classification.

The Penalties and Sentencing Act of Queensland provides judicial discretion at sentencing, and the deterrent effect of different penalties may differ. We were therefore interested in examining whether severity of the penalty had an impact on reoffending and created a code to categorise the severity of sentences. Sentences were categorised in order of sentencing severity, specifically 'convicted not further punished', 'other' (such as, victim compensation), 'monetary fine', 'community based order' (including probation, community service and intensive corrections), 'suspended sentence' and 'imprisonment'. For repeat offenders the sentencing outcome for the first offence was used for the comparison to first offenders.

For general criminal offences, rates of recidivism are higher for Indigenous males than for Indigenous females and higher for those whose first court appearance occurs when they are younger compared with those who are older [27]. Hence initial analyses were completed separately for males and females; and for three age brackets (15-24 years; 25-39 years and 40+ years). In the course of the study, when age is referred to, it is the age of the offender at first offence that appears in this data.

Data analysis

Data were entered and coded into the Statistical Package for the Social Sciences, version 18.0 (SPSS Inc., Chicago, IL). Chi-square analyses were conducted to compare first time and repeat (multiple convictions within the five year period for which data was supplied) offenders with risk factors, namely gender, age at first offence, BAC, geographical region (according to the ARIA+ classification of location of the court where the conviction was recorded) and sentencing severity. To identify cell differences within the analyses, standardised adjusted residuals were calculated for each cell in order to determine cell differences that contributed to the chi-square test results. Values greater than 2.0 are reported on. The risk factors were then subject to univariate and multivariate logistic analyses. Risk factors entered into the model were age (15-24 years; 25-39 years; and, 40+ years), gender, BAC category (<0.05g/100ml; 0.05-0.149g/100ml; and, ≥ 0.15g/100ml), geographical region ('major cities'; 'inner regional'; 'outer regional'; 'remote'; and, 'very remote'), and sentencing severity ('convicted not further punished', 'other', 'monetary fine', 'community based order', 'suspended sentence' and 'imprisonment'). Odds ratios were calculated with 95% confidence intervals (CI) [28]. Lastly, for offenders categorised as repeat offenders within this study, the time between first conviction and date of the second offence is reported.

Results

First offenders versus repeat offenders

Demographic characteristics for the sample are displayed in Table 1. As shown, of the 7,834 Indigenous drink drivers, 7,128 were categorised as first time and 706 were repeat offenders, meaning there was a 9% recidivism rate. The majority of first and repeat offenders were male, 75% and 78% respectively. The median age of first time male and female offenders was 43 years (range: 15-81) and 46 years (range: 15-65), respectively. For repeat offenders the median age of male offenders was 28 years (range: 15-62), and 28 years also for female repeat offenders (range: 15-56). Comparisons on the basis of age at first offence show statistically significant differences between first time and repeat offenders for both males (χ^2 =7.64, df = 2, p=0.02), and females (χ^2 =6.59, df = 2, p=0.03). Adjusted standardised residuals revealed male repeat offenders were more likely to be 15-24 years than 40 year or older compared to their first offender counterparts. For females, adjusted standardised residuals revealed a significantly higher rate of re-offenders between 25-39 compared to offenders aged 40 years and older.

Table 1: Characteristics of first time versus repeat Indigenous drink drivers in Queensland Courts between 2006 - 2010 at index offence

RISK FACTOR	FIRST TIME			REPEAT			TOTAL (100%)
	Males n (%)	Females n (%)	Total n (%)	Males n (%)	Females n (%)	Total n (%)	
BAC							
<0.05g/100ml	228 (4.3)	94 (5.3)	322 (4.5)	29 (5.2)	3 (2.0)	32 (4.6)	354
0.05-<0.15g/100ml	3,005 (56.0)	1,138 (64.7)	4,143 (58.1)	280 (50.5)	99 (65.5)	379 (53.6)	4,522
≥ 0.15g/100ml	2,134 (39.7)	529 (30.0)	2,663 (37.4)	246 (44.3)	49 (32.5)	295 (41.8)	2,954
Region							
Major Cities	1,145 (21.4)	430 (24.4)	1,575 (22.1)	61(11.0)	18 (11.9)	79 (11.2)	1,651
Inner Regional	851 (15.8)	282 (16.0)	1,133 (15.9)	91 (16.4)	24 (15.9)	115 (16.3)	1,248
Outer Regional	1,878 (35.0)	605(34.4)	2,483 (34.8)	190 (34.2)	64 (42.4)	254 (35.9)	2,737
Remote	660 (12.3)	237 (13.5)	897 (12.6)	83 (15.0)	29 (19.2)	112 (15.8)	1,009
Very Remote	833 (15.5)	207 (11.8)	1,040 (14.6)	130 (23.4)	16 (10.6)	146 (20.8)	1,186
Age							
15-24 years	1,862 (34.7)	589 (33.4)	2,451 (34.4)	236 (42.5)	46 (30.5)	282 (40.0)	2,733
25-39 years	2,405 (44.8)	847 (48.8)	3,252 (45.6)	226 (40.5)	87 (57.6)	313 (44.3)	3,565
40+ years	1,100 (20.5)	325 (18.5)	1,425 (20.0)	93 (17.0)	18 (11.9)	111 (15.7)	1,536
Total	5,367 (75.3)	1,761 (24.7)	7,128	555 (78.6)	151(21.4)	706	7,834

Table 2: Risk factors (Crude and adjusted odds ratios) of repeat drink driving offending

RISK FACTOR	Crude	95% CI	P value	Adjusted	95% CI	P value
Gender						
Female (reference)						
Male	1.21	1.00-1.45	0.05	1.16	0.97-1.40	0.11
Region						
Major Cities (reference)						
Inner Regional	2.02	1.50-2.72	<.001	1.97	1.47-2.63	<.001
Outer Regional	2.04	1.57-2.64	<.001	2.10	1.63-2.71	<.001
Remote	2.49	1.84-3.35	<.001	2.53	1.88-3.39	<.001
Very Remote	2.79	2.10-3.72	<.001	2.71	2.04-3.61	<.001
Age						
15-24 years (reference)						
25-39 years	0.89	0.75-1.06	0.21	0.89	0.75-1.06	0.11
40+ years	0.73	0.58-.917	0.01	0.73	0.57-0.91	0.005
BAC						
<0.05g/100ml	1.08	0.74-1.58	0.66	1.00	0.69-1.48	0.96
0.05-0.149g/100ml (reference)						
≥ 0.15g/100ml	1.21	1.03-1.42	0.02	1.14	0.97-1.34	0.11
Sentencing Severity						
Convicted, not further punished (reference)						
Other	0.60	0.13-2.61	0.49	1.21	0.25-5.88	0.80
Monetary Penalty	0.89	0.44-1.79	0.74	1.22	0.28-5.87	0.78
Community Based Order	0.85	0.61-1.21	0.38	1.33	0.31-5.80	0.70
Suspended Sentence	0.99	0.65-1.51	0.97	1.50	0.33-6.80	0.59
Imprisonment	1.18	0.67-2.05	0.56	1.29	0.29-5.67	0.73

Examining the BAC of the first offence, a significantly greater proportion of male repeat offenders were convicted for offences in the high range BAC (≥ 0.15mg) category compared to first time male offenders (χ^2=6.49, df = 2, p=0.04). This pattern was not evident for female offenders (χ^2=3.36, df = 2, p=0.18).

Remoteness of the court location was found to be strongly significantly associated with repeat offending for both males (χ^2=48.75, df=4, p<0.001) and females (χ^2=15.30, df=4, p<0.001). Adjusted standardised residuals showed a larger proportion of repeat offenders located in the 'remote' and 'very remote' areas compared to their 'major cities' court location counterparts. For females, adjusted standardised residuals revealed a similar trend with repeat offenders more likely to be convicted in 'outer regional' and 'remote' areas compared to 'major cities' court locations.

The principal penalty imposed at sentencing was monetary for 80% of both first and repeat offenders regardless of gender. The second most common penalty for all groups was a community based order (10%). Overall, there were no differences detected between first and repeat offenders in terms of sentencing severity either for males (χ^2=5.76, df =5, p=0.33), or for females (χ^2=3.63, df=5, p=0.60).

A logistic regression with drink driving repeat offending as the outcome was conducted, with location, age at the time of the first offence and BAC entered as risk factors. Sentencing severity was also included in the model in order to examine any association with recidivism. Crude and adjusted relative risks for repeat offending are presented in Table 2. As can be seen, a strongly statistically significant association was found between remoteness of the location of the court and the odds of recidivism, with association increasing with each increment in remoteness. Offenders who committed their first offence between 15-24 years of age were also significantly more likely to go onto be repeat offenders compared to drivers over 40+ years of age. High range BAC at first offence was not significantly associated with repeat offending, when adjusted for other risk factors. Gender was not associated with repeat offending. Of the six different categories of sentencing severity, none were significant in the model.

Analyses were conducted to identify secondary effects between significant variables. No significant secondary associations could be identified in the models, so interaction effects in the modelling are likely to be minimal. The Hosmer and Lemeshow test ($p = 0.64$), indicated that the model fits the data well.

Repeat offenders - time between first and second conviction

Of the 706 repeat offenders, almost half re-offended within the first 12 months from the date of the first conviction (n=336; 47.5%). The proportion of offenders apprehended and convicted of drink driving on a further occasion declined over time. Between 13-24 months, 149 (21.1%) went on to re-offend. From 25 to 36 months after the first conviction 120 (16.9%) of the repeat offenders relapsed. The remaining recidivist drink drivers in this study (n=101; 14.3%) re-offended more than 36 months after their first conviction.

Discussion

This is the first study investigating the characteristics of recidivist drink drivers among Indigenous peoples specifically on a state-wide level. As mentioned previously, the authors acknowledge that the methodology used in this study has limitations in relation to the certainty that the individuals categorised as first time convicted offenders have in fact been categorised correctly. This is highlighted by the nine percent recidivism rate in this sample, which would seem to be an under estimation compared to the rates of recidivism normally reported for mainstream drink driving populations [19]. However, the authors believe it is important to conduct the analysis of the data at this time because of the critical impact this particular issue has on Indigenous drivers and the communities in which they live, and the subsequent importance of informing the development of interventions to reduce this type of offending. Such data limitations as well as the inconsistency in recording Indigenous status accurately have previously been acknowledged as problems facing researchers in being able to make meaningful conclusions from research attempting to investigate issues affecting Indigenous peoples [29].

Other limitations pertaining to the data include the lack of information on the location of the offence. It may be that the locations of the sentencing court as a proxy may not be an accurate reflection of where these drink drivers live. Nevertheless, it is unlikely that a large number of offenders applied to have their drink driving matters moved from the locations where the offences occurred to another court location. Unfortunately, the specific BAC reading at time of offence was also not available within the dataset. Thus, further analysis of the convictions pertaining to BAC could not be completed other than the three BAC charges under legislation. Recording specific offence details would improve the analysis of the data and therefore the understanding of the risk factors of Indigenous repeat offenders, especially as analysis is already limited to certain datasets because of non-recording of Indigenous status in other databases.

A final limitation lies in the type of data. As this study is based on conviction rates, these may not be an accurate reflection of the repeat drink driving behaviour among Indigenous peoples in Queensland, as there are several factors that impact on such rates. Important factors such as the court clearance rates and level of policing could not be taken into account here. Moreover, enforcement levels, particularly in remote areas, where there are fewer resources to enforce drink driving laws, may vary widely and thus detection and conviction may also vary. However, the patterns and relationships are by no means clear, as it is also possible that in more isolated areas and remote communities, where people are known to each other, enforcement can target known drink drivers or utilise local knowledge in enforcement activities. It is not possible here to say which, if either, of these situations is the most likely or what the size of any effect has been.

Relevance of the findings

Unlike studies from the wider population, such as Beirness et al. (1997), that report that a greater proportion of repeat versus other drink drivers record high range BACs [30], often considered to be because of chronic alcohol misuse, the same pattern is not reflected for this Indigenous offender drink driving sample. For this sample, the proportion of first time Indigenous drink drivers convicted of high range BAC offenses was higher than for mainstream first offender cohorts. For example, in the Drink Driving Discussion Paper, commission by the Queensland Government, 19.6 percent of first offenders in the wider Queensland population were recorded as having a high range BAC [19] while for the current sample 37.3 percent of the first time offenders had this level. One interpretation of this result is that the pattern of alcohol consumption for Indigenous versus non-Indigenous drivers is different; with a large proportion of Indigenous drivers who do not have a prior drink driving conviction apparently being apprehended after consuming a large quantity of alcohol prior to driving. Based on the findings related to BAC from this study, it may also be argued there may be no difference between the recidivist drink driver and first offender patterns of alcohol consumption for Indigenous drivers. This may seem counterintuitive given that consistently high rates of alcohol misuse amongst Indigenous peoples in Australia have been documented for a number of decades [1]. However, it suggests that misuse may occur early for some Indigenous youth. This interpretation is consistent with the research highlighted earlier that suggests that risky alcohol consumption patterns are more common among Indigenous drinkers than non-Indigenous, even though the proportions of Indigenous peoples who consume alcohol is lower than for non-Indigenous people [10,11,31]. What the current research adds is that such risky drinking may begin early for Indigenous drinkers. More speculatively, early onset risky drinking may be exacerbated by the consequences of drink driving offences, such as losing one's license and therefore being unable to gain employment and thus having greater unoccupied time.

Remoteness of the sentencing court location was found to be a strong predictor of repeat drink driving. This result extends previous findings on Indigenous road-related offending such as over representation in alcohol-involved crashes in rural areas and unlicensed driving in non-metropolitan areas [32]. Historically, such driving-related offences in more isolated locations have been attributed to the lack of services, limited alternative transport options [32, 33] and differences in attitudes towards road safety amongst rural populations. Although speculative, there may also be a perception among drink drivers in more isolated areas that the likelihood of apprehension and therefore punishment is low because of limited resources to police this behaviour, thereby fostering a culture of dangerous road behaviour such as drink driving.

An additional factor that may be affecting drink driving patterns in remote Indigenous communities is the legislated control of the sale and possession of alcohol through alcohol management plans. Early evaluations of alcohol restrictions in some Queensland Indigenous communities have reported that these may have reduced assault-related injuries [34, 35]. However, such positive effects of alcohol management may be being undermined by 'sly grogging', where local Indigenous residents from communities where restrictions are present drive to other locations where restrictions do not apply to purchase and consume alcohol [36, 37]. This presents opportunities for drink driving and therefore detection and prosecution. It is unclear to what extent this phenomenon affects recidivism amongst Indigenous drink drivers and unfortunately the scope of this study does not allow for any closer examination of such effects. However, it appears that much more research into this issue in remote Queensland Indigenous communities is necessary.

Lastly, for repeat offenders, the findings reported here suggest that the first 12 months after conviction is a high risk period for recidivism. In turn this suggests that offering services shortly after conviction for a drink driving offence may be critical in reducing re-offending.

The findings in this study are preliminary; nevertheless, we have shown that issues such as risky alcohol consumption and limited transportation alternatives that affect drink driving generally are especially important for Indigenous repeat drink driving in regional and remote areas. As an increase in the population of young Indigenous peoples is expected over the next decade [38], it is likely that there will be an increase in the number of Indigenous youth applying for drivers' licenses or having access to motor vehicles. Research indicates a larger proportion of Indigenous adolescence between 14-17 and 18-24 years of age self-report riskier alcohol use than their non-Indigenous counterparts [39]. Therefore, advancements towards the understanding of drink driving relapse should also be made to allow for the development of effective countermeasures targeting the specific age and regional issues this study has identified.

Development of offender-based therapeutic, treatment programs with long-term support is one option to address these issues. Whilst steps have been made towards developing 'best practice' Indigenous road safety programs [40], further work is required in the area of drink driving. Work is needed on development and testing of multifaceted models focusing on the interaction of legal, social and psychological factors that describe and explain relapse among this cohort, since there is limited literature to inform the development of such a program. Consistent with other researchers, we would urge the inclusion of variables such as predictors of future intentions to drink drive, alcohol consumption levels, and self-reported recent drink driving behaviours [41]. Additionally, illicit drug use and driving should also be included given the recently reported high rates of cannabis in remote Indigenous communities [42]. Given the high level of contact Indigenous peoples have with the justice system, the potential for a treatment program to be delivered as part of a diversionary program for Indigenous drink drivers, with the additional possibility of licence disqualification reductions if completed successfully, also requires serious consideration if this issue is to be addressed. Finally, the fact there is a larger number of Indigenous peoples who abstain from alcohol use should also be considered as a strength, particularly in more rural and remote areas and a possible opportunity to build capacity for drink driving strategies.

Conclusion

This study is the first of its kind in Australia, as it provides information on a state-wide level about the demographics and risk factors associated with Indigenous recidivist drink driving. In contrast to findings on mainstream drink drivers, recidivist Indigenous offenders appear to be considerably younger, and more likely to be living in rural and remote areas. Patterns of alcohol consumption for Indigenous first time drink drivers appear to be different from those of offenders from the wider population: Indigenous first time offenders are likely to be charged with relatively high levels BAC offences, similar to those of their recidivist counterparts. Future direction should move to developing comprehensive models focusing on identifying the various legal, psychological and social factors attributable to recidivist drink driving to inform the development of effective countermeasures. Reducing the injuries and fatalities contributed by recidivist drink driving is needed to address the broader alcohol-related health burden experienced by Indigenous Australians.

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Contributed articles

UN Decade of Action for Road Safety

by Troy Griffiths, NSW Department of Transport

Following from the launch of the United Nations Decade of Action for Road Safety in 2011, the Transport for NSW Centre for Road Safety has developed a NSW Road Safety Strategy for 2012-21. This is a ten year blueprint to reduce death and serious injury on NSW roads by more than 30 per cent.

The development of the strategy has been in close collaboration with the NSW Road Safety Advisory Council, established for the NSW Government to consult with on major road safety developments, and therefore ensuring the strategy has substantial support for its implementation over the decade. Through the development of the strategy, it was identified that there were a number of specific sub-strategies which required attention. This led to development of the NSW Motorcycle Safety Strategy, NSW Pedestrian Safety Strategy and NSW Aboriginal Road Safety Strategy (both of which are currently under development).

The NSW Government is focusing its attention and resources to where the road safety issues are. Road safety data analysis and modelling undertaken to inform the strategy identified the four main crash types on NSW roads, which include vehicle to vehicle head-on, run off-road on straight or curves, intersection crashes and vehicle to pedestrian crashes.

The complexity of the NSW population is also a factor in a range of measures to address the safety of the community, where one third of the population resides in regional rural areas, but account for two-thirds of all fatalities. There are a range of possible factors that also contributed to this, including access to services and remoteness. Therefore the strategy will focus to address safety in rural NSW.

Addressing serious injuries is a major theme of this strategy. A successful data linkage project (Commissioned to the Transport and Road Safety Centre at the University of NSW) found between 2005-2009 that around 26 per cent of all injuries during this period were deemed serious. This detailed data will now allow road safety experts to undertake further analysis to inform the development and revision of current programs to address serious injuries.

Other areas of focus over the next decade include working with and developing closer partnerships with local governments, acknowledging the important role local government plays in delivering services to their local communities. Technologies will also play a key role in addressing road safety – be it through improved vehicles, systems, or infrastructure. Continued integrated enforcement activities will focus on addressing behaviours that lead to crashes and fight to address unacceptable behaviour and attitudes. Addressing post crash response and trauma treatment, highlighting the importance of safer vehicles and positive prevention road safety education will all play a part in improving road safety.

Over the last two years there have been many significant road safety initiatives delivered that will go towards achieving our common goal of reducing road related trauma. Some of these briefly include:

- NSW Speed Camera Strategy;
- Development of a Safer Driver Course for Learner Drivers;
- NSW Audit of Speed Zones (Nominated by the community)
- Breakdown Safety Measures, including the Glove Box Guide;
- Road Rules Awareness Week;
- Continued Enhanced Enforcement Operations;
- Motorcycle Response Team in the Sydney CBD;
- Plan B anti-drink driving advertising;
- Kings Highway Route Review;
- Implementation of the Road Toll Response Package;
- Serious Injury Data Linkage; and
- Heavy Vehicle Safety Technologies Guide.

Overall, the strategy presents an exciting opportunity for road safety professionals in NSW to continue their great work in improving road safety.

Implementing a successful global driver safety program: the Pfizer case

By Teri Snow[1], Dr Will Murray[2] and Ed Dubens[3]
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Since this paper was first presented at the American Society of Safety Engineers Safety 2012 Conference in Denver on June 3-6, 2012 the Pfizer global driver safety program has continued to develop, and has been further rolled out around the globe - including Australasia. Pfizer was also recognised at the 2012 Brake Fleet Safety Forum Annual road safety awards for the global and on-going nature of its program and achieving beneficial road safety outcomes in over 20 countries around the world. Pfizer has also worked tirelessly to benchmark and share good practice with others through the Fleet Safety Benchmarking project (www.fleetsafetybenchmarking.net).

Introduction

With a history spanning more than 150 years, Pfizer Inc. is one of the world's leading pharmaceutical and healthcare companies, represented in over 70 countries by approximately 100,000 colleagues. Approximately one third of those colleagues comprise the sales organisation, and the success of this organization is contingent on accessing key groups such as distributors and medical professionals.

Globally Pfizer operates over 33,200 company cars and 3,500 motorcycles, for which a standardised world-wide fleet safety program has been developed. Additionally, Pfizer has hundreds of site vehicles including trucks, vans and motorized equipment. Driving has been identified as one of the most hazardous activities colleagues undertake. Accordingly, continuous assessment and improvement of Pfizer's global fleet safety effort is a high priority for the safety of colleagues and others in the communities in which we operate.

In 2007, Pfizer's participation in a national employer transportation safety fleet benchmark program identified additional opportunities to address the risks facing colleagues who drive on company business.

The following describes the global implementation of Pfizer's fleet safety program (hereinafter, the 'program'), which was launched internationally in 2010. The program has been launched through a three-phased implementation period and has reached an initial launch of 80% of our fleet. Our paper also identifies how Pfizer:

Worked to develop and communicate the business case and benefits of improved fleet safety via a phased global program.

Benchmarked and analysed areas of opportunities to improve driver safety performance.

Evaluates the success of the program in terms of process, compliance, safety performance, costs, company reputation and corporate social responsibility.

The business case for fleet safety within Pfizer

Having the need for a road safety program, Pfizer worked to develop the business case for a phase global fleet safety program.

The business case

The business case was based on health and safety compliance, reducing colleague injury risks and minimising asset damage costs, as follows:

- Pfizer has a strong commitment to Environment, Health and Safety (EHS) and implemented a Fleet safety global standard in 2009.
- Driving on company business is associated with the most significant colleague injury risk at Pfizer.
- Globally, repairs and increased insurance premiums costs were seen as too high.

The business case identified the opportunity to actively partner with colleagues to improve performance. A three year fleet safety global implementation period was endorsed by senior leadership.

Program design

The key elements of the program are:

- Vehicle selection/maintenance.
- Assessing, communicating and coaching the expected behaviours for Pfizer drivers.
- Risk ranking.

- Communication of results and targeted training/driver coaching.
- On-going encouragement and support.

The program is supported by a customised data management system to track and trend driving performance which has the ability to identify needs for additional supervision or coaching. The program proceeds with the following online and face to face modules accessed via the global portal shown in Figure 1:

1. **Phase1:** Review and execution of Privacy Consent, Local Policy Acknowledgement, and Pfizer Safe Driving Pledge; along with completion of the Pfizer Safe Driver Foundation questionnaire which seeks to ensure knowledge and understanding of the local policy and driver minimum performance criteria, along with a *'Rules of the Road Best Practice Guide*'.
2. **Phase 2:** Completion of a risk assessment tool to assess driver behaviour
3. **Phase 3:** Completion of awareness coaching and for identified at high risk drivers - One to One Manager coaching sessions.
4. **Phase 4:** Completion of country specific gap analysis' to re-evaluate the effectiveness of and set goals to continuously improve the program – (i.e. driver behaviour).

Following program launch and annually thereafter, all participants are required to refresh the Safe Driving Pledge and Safe Driver Foundation questionnaire via the online portal (Figure1); repeat the risk ranking process with a year on year comparison; plus continue awareness coaching selected from a range of appropriate online and face to face modules. The data is reviewed to identify at medium and at high risk drivers, who are then provided with additional coaching as required based on local market decisions.

Figure 1. Branding and reach of our global Fleet Safety program hosted on Virtual Risk Manager

Supporting the program, the Global Fleet Safety Implementation Team is comprised of a Project Leader/ Champion, Fleet Senior Director, Regional Fleet Directors, Director/Team Leader EHS, Global Privacy Office and Human Resource, Global Risk Insurance. Further we subscribe to a commercial fleet safety assessment tool. This group is instrumental in developing our Global Fleet Safety Implementation Guide and Library. This library is hosted on an internal platform that each local team can access and adapt supporting materials for local purposes, and can share new ideas to encourage further creativity.

Key learning for successful implementation

The Pfizer fleet safety program is innovative in its partnership-based approach and the detailed multi-lingual tools, management information system and data warehouse developed to support global, regional and business unit managers in their decision making. This approach has assisted in the successful replication of a globally consistent process, with modifications as required to address specific local needs.

Based on our experiences to date, the five critical success factors or organisational DNA for implementing a successful global driver safety program include:

1. Committed leadership implementing effect management structure with special attention to country business leader buy-in as a result of senior above country leader buy-in; with bottom up commitment that is equally important.
2. Being able to tailor a global vision, standards, objectives and content to local need.
3. Strong Partnerships.
4. Understanding and overcoming international privacy and other regulations.
5. Ensuring the availability of standardized, accurate data and metrics for evaluation purposes.

Partnership approach

Partnerships are a key element of our business program. Pfizer has a number of fleet suppliers who work independently of each other. In March 2010, a meeting was held with all such fleet suppliers to discuss the program, talk through any interdependencies, identify how service to drivers could be improved, increase process efficiencies and enhance working relationships.

One such partner is Interactive Driving Systems (IDS), working to reduce driver collisions and injuries year on year and help us create *'A Culture of Minimal Acceptance* *for Risk While Driving'*. The global road safety partnership between Pfizer and IDS involves a system rollout of Virtual Risk Manager, focusing on building a culture of minimal at-risk behaviours by managers and drivers. Each Pfizer market has been tasked with establishing a local governing committee, policies, processes and procedures as well as driver risk assessment, and program improvement. This includes a detailed application of the DriverINDEX Predictive Modelling and associated risk data warehouse to identify the most at-risk drivers, managers and work allocators requiring further support.

Managing international privacy and data protection laws

Data protection and privacy issues are of paramount importance in any fleet risk management initiative, but particularly when the program is of a global nature – spanning European, Asian, Latin American and North American privacy laws.

Tools that enable the protection of pertinent information includes the high level management information system (MIS) which allows drivers to see their individual driver records (no other records can be accessed by an individual driver) and permits as well as allowing local management to confirm participation and compliance with program milestones. Data privacy practices are driven by local experts who hone the process to ensure appropriate protections.

External benchmarking

The program is benchmarked in a number of ways: via the Network of Employers for Traffic Safety's (NETS) fleet safety benchmark process in the US; through active participation in the American Society of Safety Engineers and Pharmaceutical Fleet Safety Benchmarking forums; and via www.fleetsafetybenchmarking.net. Benchmarking has been used as a key indicator of content, process, metrics and evaluation.

Implementation

In 2007 Pfizer set up to establish a fleet safety program in the United States (US). Within the first two years the US saw the following results:

- 50% reduction in collisions.
- 70% reduction in lost time injuries.
- 72% reduction in costs of collisions.
- Pfizer's US fleet safety program moved into the top tier compared to our peers in the pharmaceutical industry.
- This success re-affirmed commitment to the global program implementation described.
- The program has expanded to consider opportunities to reduce Scope three greenhouse gas emissions.

Key elements from the US experience were built into the global program described in this paper. In addition to road safety, the program is also linked to environmental objectives. One example is Pfizer's *'Mileage Management'* initiative, which aims to reduce business mileage thereby reducing carbon emissions, costs, fuel spend and resource consumption, as well as collision avoidance. The *'Mileage Management'* initiative includes a partnership with IDS to capture carbon footprint data in the fleet database that allows each of our local markets to measure progress with total cost of ownership, collisions and fuel/carbon use.

Evaluation and future efforts

To date, the program has been successfully launched in the 23 countries with our largest fleets and the organisation continues to work hard to roll-out further in-country launches. Pfizer is proud of this global effort and the authors are unaware of a similar program that has been project managed and launched in such a timeframe across a global canvas, ultimately engaging thousands of direct employees and their families in road safety.

During 2012-2013, the program is planned to be implemented in 33 additional countries. To support this, work is on-going to continue to establish an internal community of practice where all in-market teams share good practices and replicate efforts, as appropriate.

During implementation our focus has been to establish consistent data reporting practices. The next phase of the program is to establish formalised collision reduction targets.

Conclusions

Pfizer is in the middle of a roll out of a three-phase global fleet safety program. Reduced collision rates have been seen in a number, but not all, of our markets following roll out of the initial phases of the program. Continued focus and roll out of all three phases is anticipated to result in a reduction in collision rates across the global fleet.

Overall, this paper has highlighted the:

- Business case for the program.
- Key phases of the program.
- Program tool and measures.
- Keys to successful roll out in the multiple markets in which Pfizer operates.
- Next steps to ensure both global coverage and full program implementation.

Subsidising unsafe road use

by Richard Tooth, Director, Sapere Research Group, Sydney, NSW, 2000

Abstract

Motor accident regulation of compulsory third party (CTP) insurance in Australia and New Zealand has the effect of taxing safe-road use and subsidising unsafe road-use. This regulation has significant safety consequences as it inhibits insurers from encouraging road safety. In the UK, where the regulatory environment is different, there is a rapid growth in technology-enabled usage based insurance (UBI). UBI is being used to encourage safer driving, particularly among high risk groups. In the absence of reform to CTP regulation, there is a high possibility that in this decade Australia and New Zealand will fall significantly behind the UK in reducing the road toll.

Keywords:
Insurance economics; usage-based insurance; innovation; road-safety incentives.

Introduction

How much should we subsidise unsafe road use? This might appear a strange question. Readers might ask why we would even contemplate it. However, the question is very relevant because motor accident regulation in Australia and New Zealand has this very effect; subsidising the insurance premiums for unsafe road users and taxing the insurance premiums for safe road users.

This paper briefly examines the subsidies to unsafe road use and the potential benefits and issues in removing them.

The subsidies for unsafe road use

In Australia and New Zealand vehicle owners take out two broad types of insurance: insurance to cover property damage (e.g. damage to vehicles) and insurance to cover the human costs of road crashes (e.g. medical costs, loss of earnings etc). The insurance cover for human costs is mandated and is commonly known as compulsory third party (CTP) insurance.[1]

In all jurisdictions except NSW,[2] the CTP premium for a vehicle type (e.g. passenger vehicles) is fixed regardless of driver behaviour and vehicle choice.[3] Thus, for example, in most jurisdictions the CTP insurance premium for a passenger vehicle is the same regardless of whether the insurance covers a heavy vehicle that is driven recklessly or a compact vehicle that is driven carefully.

Relative to a system in which premiums vary with the expected cost[4] of claims, the regulation has the effect of increasing premiums for the low-risk drivers (i.e. those with a low expected claims cost) and reducing premiums for high risk drivers. As the schemes are designed to recover costs, the effect is to tax safe road-uses to subsidise unsafe road-uses.

This effect is illustrated in Figure 1 below. The curved line depicts the expected CTP claims cost of insured drivers, ordered in terms of their risk (which determines expected claims cost). Those at the left hand side of the figure are high risk drivers; those at the right, low risk.

As reflected in the figure, while all drivers pose some safety risk, there can be substantial variation between the highest and the lowest expected claims cost. For example, as commonly recognised, young inexperienced drivers are much more likely to have a road-crash than a middle aged person with a good driving record.

With some minor exceptions, the regulated CTP insurance premium (depicted by the dashed line in the figure) is constant regardless of risk. In the absence of price regulation, a competitive insurance market would set premiums that mirror the expected claims costs. Thus, relative to prices in a non-price regulated system, the unsafe road users pay less and the safe road users pay more.

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[1] CTP insurance schemes vary by jurisdiction. In some states (NSW and Queensland) there are competing CTP providers. In other jurisdictions there is a single provider (ACT) or a government CTP scheme (Victoria, Tasmania, Northern Territory, Western Australia, South Australia). In South Australia claim management is outsourced to Allianz. Although not described as CTP, in New Zealand, the Accident Compensation Corporation manages a social insurance scheme funded through compulsory motor vehicle license fees (analogous to an insurance premium) and levies included in the price of petrol.

[2] In NSW some limited risk based pricing is possible.

[3] There are other small variations e.g. in Victoria, the scheme premiums can vary by postcode; in Tasmania there is a discount for pensioners; in New Zealand part-funding of the scheme is through petrol levies.

[4] The 'expected cost' simply refers to the average forecast cost.

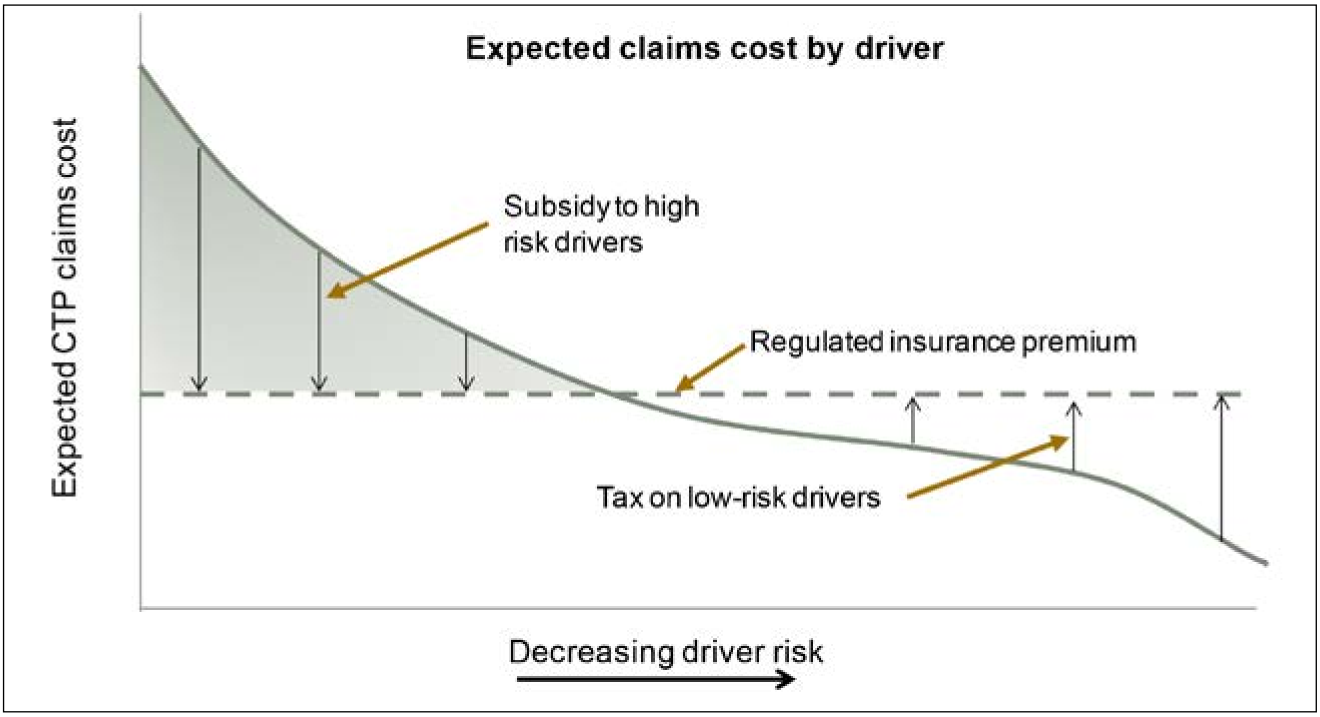

Figure 1: Effect of CTP price regulation in Australia and New Zealand on insurance premiums

The significance of the subsidy

The subsidy, and the underlying regulation, is primarily of concern to the extent that it discourages safe road-use.[5] The regulation may do so directly by restricting the use of CTP insurance premiums to encourage safe driving and safe vehicle choices. The regulation also prevents insurers from bundling CTP insurance with property damage insurance which may further dilute the incentives insurers have for managing the road safety risk.

The impact of the regulation on safety depends on the extent to which insurers and insurance premiums could influence safe road use. One way in which this can occur is in influencing the choice of vehicle and safety features. For example, if premiums reflected the expected claims cost, people would have a financial incentive to use less aggressive and safer vehicles. With risk-based insurance premiums this financial incentive will be greater in value for those more likely to have a road-crash. Thus, in addition to influencing the choice of new vehicles (and the rate at which old unsafe vehicles might be disposed of), risk based insurance premiums could encourage safer use of existing vehicles. The safety of existing vehicles might also be increased through increased incentives to retro-fit safety technology (e.g. anti-collision devices).

A more significant impact is on how insurers can modify driver behaviour. Insurers have long provided financial incentives for maintaining a safe driving record. More recently, there has been an increase in usage based insurance (UBI) whereby insurance premiums are based on *current* driving behaviour. UBI is made possible by telematics solution, solutions that integrate mobile computing and telecommunications, to enable driving behaviour to be monitored. Using this technology, drivers can provide insurers with evidence of their good driving to receive rewards and get feedback for themselves on their driving performance.

There are many examples. The insurer Progressive provides a UBI product in over 30 US states based on braking speed, distance travelled and the amount of night-time driving. In the United Kingdom (UK), there are numerous providers of UBI and there is significant variation in the service provided. For example, different UBI providers use different rating factors (including measures of aggressive acceleration and braking, mileage, speed, the time of day the vehicle is driven and cornering) and different types of rewards (including premium discounts on renewal, additional insurance cover and cash rewards to a pre-paid credit-card).

The limited evidence that is currently available on the effectiveness of UBI indicates that it can lead to significant improvements in safer road use. A UK insurer, insurethebox, tracked driving improvement among their customers (insurethebox 2012). They estimate that, after controlling for normal improvement in young drivers (as they gain more experience), the effect of telematics-enabled UBI was to reduce the rate of accidents involving young motorists (drivers aged 17 to 21) by 35 percent to 40 percent.[6]

The adoption of UBI appears likely to also lead to an overall reduction in average insurance premiums and thus on-road costs. The UK insurer, insurethebox reports[7] that the average premium saving by drivers taking out UBI is over £600 (≈$875 per year). It is possible that this reflects some selection bias – that is some drivers taking out UBI were already careful drivers who are merely using UBI to demonstrate this. Nevertheless, the size of the reported savings and the reduction in accident rates reported suggest that average premiums would reduce with greater adoption. Furthermore there are ancillary benefits associated with UBI; for example, many UBI policies offer an anti-theft vehicle tracking service.

The UK is a useful case-study. In contrast to Australia and New Zealand, there is minimal price regulation of CTP insurance. Rather, in the UK, drivers obtain a combined personal injury and property damage insurance policy[8] and there are no caps on insurance premiums. Price is controlled by competition and insurers are free to provide discounts on premiums to encourage safer road use.[9]

After a slow start, there is now a rapid take-up of UBI in the UK. The British Insurer Brokers Association (BIBA 2012) estimated there were 12,000 active UBI policies in 2009 and 180,000 in 2012 and forecast (in 2012) there would be at least 500,000 UBI policies[10] within two years. The adoption of UBI is greatest among high risk groups[11] as these groups have the most to gain in terms of demonstrating safe driving behaviour.[12]

There is strong support for UBI in the UK and it appears possible (perhaps likely) that UBI will become the norm among high risk groups within the decade.[13] Given the constraining regulation, it appears very unlikely that there will be a similar level of adoption in Australia and New Zealand.[14] Thus, there is a strong possibility that in this decade, in the absence of regulatory reform, Australia and New Zealand will fall significantly behind the UK in reducing the road-toll.

Rationale for the existing regulation

So why does the regulation that constrains CTP insurance exist? The regulation may reflect the belief that insurers could not influence safety. However, as discussed above, this no longer appears to be the case.

A second reason is the risk that people would drive uninsured if premiums were uncapped. This is a significant concern in the UK where insurance premiums can be very high, particularly for young drivers. However, technology improvements, including national databases and number-plate reading technology, means that the risk of uninsured drivers is falling.

If CTP pricing in Australia and New Zealand were to become more cost-reflective, then prices for high risk groups would rise. However, the premiums need not be excessively high. With UBI, a young driver can pay a small insurance premium by driving a non-aggressive vehicle carefully and avoiding night-time driving. Furthermore, it would be possible to restructure existing cross-subsidies in a way that does not discourage road-safety; for example, by having an aged based subsidy.

The reforms to motor accident regulation could be significant. The benefits rely on flexible pricing and a competitive insurance market, which would be a major shift in regulation in many jurisdictions (e.g. where CTP insurance is provided by a government scheme). While in principle, there is no need to modify compensation policies to implement the proposed reforms, in practice, compensation arrangements, scheme pricing and the role of

[5] A subsidy may be undesirable in itself to the extent that it is considered inequitable.

[6] There is some evidence from Australia. Greaves and Fifer (2010) ran a controlled trial in Sydney involving in-car technology that tracked vehicle movement. They found that in response to financial incentives people drove less and were less likely to speed.

[7] See https://www.insurethebox.com/ accessed 12 April 2013.

[8] In the UK insurance third party insurance is also compulsory; vehicle users are required to be covered for third-party human and property damage liability.

[9] There are some important regulations on pricing. On 21 December, 2012, a European Court of Justice's ruling came into effect to prohibit taking gender into account when calculating premiums. This is expected to further encourage the adoption of UBI.

[10] Based on the relative size of the vehicle fleet this is equivalent to around 220,000 Australian UBI policies.

[11] Not surprisingly, UBI policies are generally targeted at young drivers and other high risk groups.

[12] In the UK, high risk groups can pay higher insurance premiums. For example, the AA British Insurance Premium Index Quarterly Report (Quarter 1 2011) reported the average premium for males at different age groups ranging £467 to £3052. The true variation may be understated as high risk groups are more likely to take out a minimum level of cover.

[13] A UK company, Gocompare.com, reports that in a 2012 survey (sample size 2008) "57% of drivers believe they will switch to a telematics or black box insurance policy by 2017". Source http://www.gocompare.com/car-insurance/telematics-car-insurance/, accessed 12 April 2013.

[14] At present there are no telematics based UBI offerings in Australia like that in the UK. AAMI provide a discount on car insurance to customers who take-up the offering by betterdriver (see www.betterdriver.com), a telematics based service that provides feedback on driving but the data is not used by the insurer for setting premiums.

private insurers are closely linked. Finally, if reform were undertaken, transition arrangements might be considered whereby the price changes might modified slowly over time.

Insurers as regulators

The reforms discussed would lead to private insurers undertaking a much greater role in road-safety regulation and enforcement. For example, in the UK, UBI insurers are involved in researching and identifying unsafe driving practices (e.g. aggressive braking and acceleration), setting penalties and rewards,[15] monitoring behaviour (using telematics technology) and enforcement (through application of penalties).

There are significant advantages in having private insurers as road-safety regulators and enforcers. Relative to traditional enforcement (e.g. police, speed cameras), telematics offers a clear advantage in having constant, real-time monitoring and enforcement. In theory, it might seem possible for governments to employ telematics technology. However, whereas people willingly offer their driving behaviour information to insurers to get lower insurance premiums, it seems likely that privacy concerns would restrict governments from collecting such information.

Regardless, there are other reasons for wanting private insurers involved. Insurers can more flexibly trial different programs. Importantly, with the right incentives, insurers would compete to innovate and find the best programs that achieve safety goals without being overly burdensome or unreasonably restricting freedoms. Those insurers that failed to determine and enforce the safe driving practices would face higher claims costs and be forced to modify their practice. Those insurers that enforce unnecessary burdensome conditions would lose business to those that didn't.

We might question for what purposes — aside from ensuring that drivers are insured — are there advantages to traditional road-safety regulation and enforcement over private insurance markets. The answer may be very little. Rather, relative to existing regulation and enforcement, an insurance market-based approach has potential to be more efficient, fair and effective. A step change improvement — potentially a 'silver-bullet' solution — to road-safety (while reducing the burden of road-safety regulation) may be achieved through greater insurance industry involvement.

However, getting the full value of the insurance industry in road-safety would require getting the incentives right. Even with the aforementioned reforms, the value of preventing a road-crash would be much greater than the claims liability which provides the insurance industry with its incentives for road safety. There appears no reason why this gap in incentives could not be addressed through reforming CTP insurance regulation. However, how this may be achieved is beyond the scope of this paper.[16]

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[15] At the time of writing, the UK insurer iKube (www.ikubeinsurance.com) set a £100 pound penalty for driving between 11pm and 5am.

[16] This article draws from a prior conference paper by the author presented at the ACRS 2012 National Conference (Tooth 2012). That paper discusses in more depth the issue of insurer incentives and reforms to give insurers the desired incentives for road-safety.

New iPhone app aimed at reducing youth road toll

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Please note: ACRS has not evaluated or endorsed the LDR app but take the opportunity to inform readers of new products and technologies as they become available.

Melbourne based company, e-log Systems™ Pty Ltd has released a new, patented iPhone app aimed at addressing any concerns over suspected false, misleading and incorrect entries currently being recorded by learner drivers into their paper log books. In doing so, e-log Systems™ Pty Ltd is ensuring that learner drivers Australia-wide are properly completing all required practice hours and are better equipped to tackle our roads when they receive their P-Plates.

There appears to be some evidence to suggest that ensuring learner drivers complete their hours properly, may have an impact on the $27 Billion that is spent annually on road fatalities and road trauma victims.

Learner drivers in all Australian states are required by law to input entries into a paper log book before and after completing every driving session. The manual method of log book entry can be tedious, time consuming and often confusing to calculate. By downloading and using LDR®, learner drivers will have a beneficial and advanced tool to ensure accurate tracking and recording of every driving session, no matter how long or short. LDR® will improve the efficiency, accuracy and recording of time driven, and ultimately the driving ability of the learner driver.

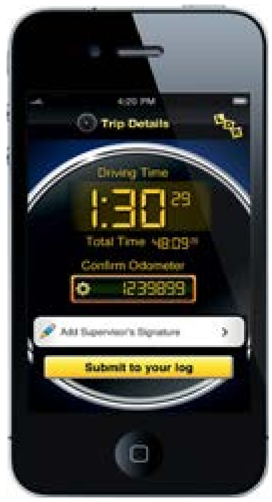
Road authorities in Australia have over the years expressed concerns about legitimacy and accuracy of hours logged through a manual log book. LDR® has been designed and developed to remove such concerns.

Although the LDR® app is not currently endorsed by road traffic authorities, e-log Systems™ Pty Ltd, will be encouraging relevant authorities around Australia to accept LDR® as an alternative means of logging and recording learner drivers' hours. In the meantime e-log Systems™ Pty Ltd is advocating the use of LDR® as an insurance policy; ensuring learner drivers' data is protected and backed up in the event of losing or misplacing their log book.

What makes LDR® unique enough to obtain a Certified Innovation Patent? On completion of each driving session, LDR® requires the logged information to be validated and authorised before it can be submitted. This literally means the supervisor must sign off on the iPhone screen with his/her finger so that it can be recorded as a legitimate driving session for the learner driver. Once "submitted", all driving sessions are uploaded via the LDR® app to a secure website, backed up daily, and available for viewing online through the LDR® website at (http://www.ldr.com.au).

Learner Drivers can see via a Google Map overlay exactly where they have driven, how far and at what dates/times leaving little doubt in any roads officers' mind as to the accuracy of data. Detailed driving session printouts are also available in accordance with each state's requirements.

But more importantly it will make recording of all log book requirements easy and fun by using a method that our youth understand. Technology!



Initially to be released in Australia, then worldwide, LDR® is set to change and improve the way learner drivers approach their required driving hours. With more than 600,000 new learner drivers annually in Australia, e-log Systems Pty Ltd is keen to ensure that as many as possible complete their required hours accurately and properly, and in doing so, would see a reduction in fatalities and injuries in the 18-25 year old demographic which are in the highest risk category.

The new iPhone app "Learner Driver Recorder" (LDR®), is available now on the iTunes App Store. An Android version of the LDR® App is due for release in coming months.

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Mastering the art of risk assessment

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Keywords:

Risk; Risk assessment; Risk management; Hazard.

Abstract

Risk Assessment is a key component of the Risk Management process and is commonly relied upon when undertaking Road Safety Audits and Risk Management Plans. The *Standards Australia* Document, '*AS/NZS ISO 31000:2009 Risk management – Principals and guidelines'* provides the industry standard framework for undertaking Risk Management.

Currently the 'Risk Assessment' component of the risk management process is broken up into three distinct steps: Risk Identification, Risk Analysis and Risk Evaluation. This paper explores some of the limitations associated with these steps, when considered in the context of road safety, and discusses opportunities to enhance the existing process.

The paper will also discuss how different organisations within Australia interpret the guidelines differently and the impact this can have on risk ratings and/or consequence of that risk. In addition, the influence the public and media can have on risk ratings will also be discussed.

The paper will also use examples to demonstrate that a robust risk assessment is more than just confirming that design standards have been met, but that sometimes compliance or non-compliance with standards can have a counterintuitive impact on the actual risk.

Introduction

What is risk?

Risk in the context of road safety, is the possibility of injury, damage or loss and refers to an 'event' that, whether predictable or not, has an uncertain outcome. Risk is the 'shadow side' of traffic and road use, attached to existing hazards and/or hazardous situations, waiting for a specific set of circumstances to occur which leads to such an event.

Types of risk

In regards to road safety, risk can fall into one of the following categories:

- *New risks*, which are associated with new design or a newly constructed facility;
- *Ever-present risks*, which are always present and constitute the majority of risks a road user may face;
- *Concentrated risks*, in which a combination of numerous, individual risks interact with each other;
- *Contagious risks*, in which a small risk triggers a larger risk, and causes a cascade effect of subsequent events; and
- *Sudden risks*, which occur without warning.

Risk management

Risk management is the systematic application of management policies, procedures and practices to the task of establishing the context, identifying, analysing, assessing, treating and monitoring risks. In the context of Road Safety, the risk management process is directed toward facilitating road usage, whilst managing adverse effects.

It should be noted however that some risk cannot be completely eliminated at a reasonable cost. Therefore instead of being eliminated, risk must be properly assessed and managed.

Within road authorities, risk management can be seen as managing internal and external influence to maximise positive outcomes, including safety, legal liability, public opinion, and budgets. Risk management also includes minimising the potential for damage (human, financial or image), loss, injury, or death.

Some of the benefits of risk management are:

- Improved planning, road performance and road users safety;
- Improved information for decision making;
- Personal wellbeing; and
- Safer outcomes for road users and pedestrians.

Existing risk management process

The *Standards Australia* Document, *'AS/NZS ISO 31000:2009 Risk management – Principals and guidelines'* provides the industry standard framework for undertaking risk management. It should be noted that these guidelines are not specific to road safety but cover all forms of risk across different industries and disciplines. While the *Standards Australia* document provides a robust basis from which to assess and manage risk, it is also open to interpretation when used in the context of road safety. In some cases this can lead to misinterpretation, mistakes and in extreme cases manipulation of the process to meet preconceived outcomes. This paper explores some of the limitations associated with the existing guidelines, and discusses opportunities to enhance the existing process.

Risk management process

Risk assessment is a key component of the risk management process and is commonly relied upon when undertaking Road Safety Audits and Risk Management Plans. The *Standards Australia* Document, *'AS/NZS ISO 31000:2009 Risk management – Principals and guidelines'* provides the industry standard framework for undertaking risk management. Figure 1 shows the risk management process outlined in the Standards Australia guidelines.

The risk assessment component (highlighted with dashed line in Figure 1) of the risk management process is broken up into three distinct steps: risk identification, risk analysis and risk evaluation. This paper explores how the application of these steps could be modified in order to achieve a more consistent road related risk assessment.

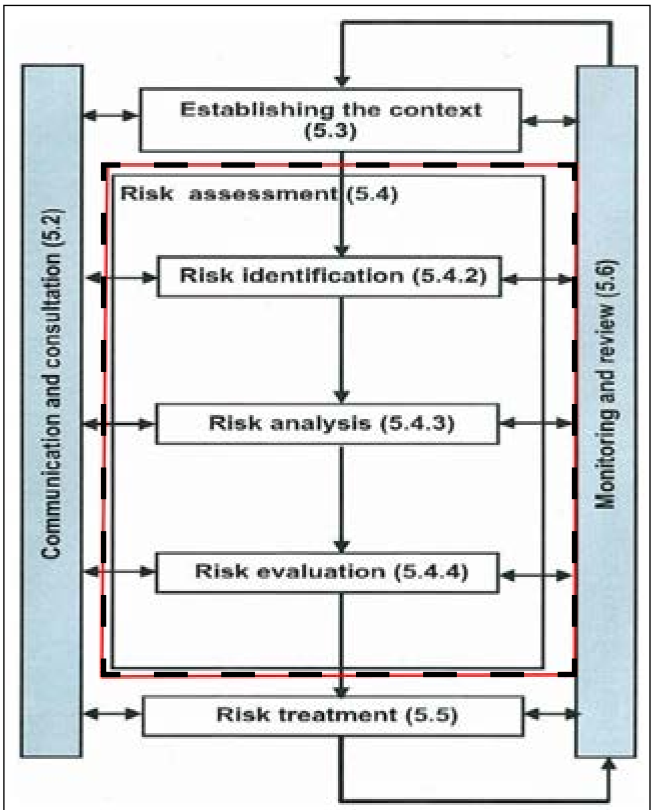


Figure 1: Risk management process (AS/NZS ISO 31000:2009)

Risk identification

Risk identification is the first identified step in the risk assessment process. However in the context of a road related risk assessment, risk cannot be identified nor could the idea of its existence be present without first identifying deficiencies. Therefore **deficiency identification** should be the starting point of every road related risk assessment.

Once all the deficiencies have been identified, each deficiency needs to be assessed to determine whether it represents a hazard (either individually or in combination with other hazards) or not. This can be considered as the **hazard identification** stage.

While the majority of identified deficiencies are likely to create hazardous situations (that carry some risk), not all of them do so. For example, an old-fashioned sign that is still clearly visible, retro-reflective and sending the clear message to the drivers does not create a hazardous situation. If a deficiency is not recognised as a hazard or does not create a hazardous situation, then no further consideration is required. Therefore the hazard identification stage also acts as a filter, meaning that not all deficiencies have to progress to the risk analysis stage.

In terms of the risk assessment process (in the context of road safety) these two steps effectively replace the risk identification stage, as shown in Figure 2 below.

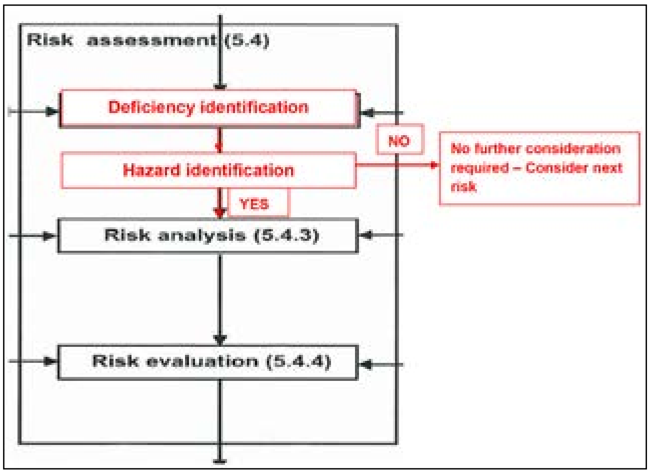


Figure 2: Refined risk identification process

Risk analysis

Risk analysis is the next step in the risk assessment process. The risk analysis process analyses the risk related to each hazard by combining estimates of likelihood and consequences.

Currently there is no uniform approach when it comes to determining likelihood and consequence. Instead, several organisations around Australia have developed their own criteria, resulting in a number of different likelihood and consequence tables.

Likelihood

Tables 1 to 4 show some of likelihood tables currently used in Australia, in which different terminology is used as well as different descriptions of their meaning. For example, according to Table 2, the lowest likelihood rating is described as the event that may *'occur less often than once every ten years'*, while according to the Table 3 the same likelihood rating is described as *'one incident occurs only once every three years'*.

These different definitions can lead to misinterpretation, mistakes and in extreme cases manipulation of the process to meet a desired outcome.

Consequence

Tables 5 to 8 show the corresponding 'consequence tables' used in Australia, in which different terminology is used as well as different descriptions of their meaning.

For example, according to Table 7, the second highest consequence rating is *'single fatality'* while according to Table 8 this would only result in *'serious injury'*.

As with the likelihood tables, the different definitions of consequence can lead to misinterpretation, mistakes and in extreme cases manipulation of the process to meet a desired outcome.

To reduce the opportunity of misinterpreting or misusing these tables, a standard set of definitions for both likelihood and consequence should be developed and rolled out nationally. Alternatively one of the existing definitions should be adopted as the industry standard.

Risk evaluation

Risk evaluation is the final step of the risk assessment process, and combines the likelihood and consequence of a risk. An evaluation of risks is required in order to prioritise risks, as road authorities are unable to mitigate all potential risks, given a finite level of resources.

Currently, there are a number of different risk rating matrices used to establish the threshold of what constitutes an unacceptable exposure (refer to Table 9 to 12).

Depending on which of these matrices is used, the resulting risk level would be different despite having the same likelihood and consequence.

For example, (with reference to Tables 3 and 7), if as a result of a hazard, a bus has 'negligible' chance to be hit by a train at a level crossing, which would most likely result

Table 1: Likelihood tables (AS/NZS ISO 31000:2009)

Rating		Likelihood of occurrence
Rare	1	The event may occur in exceptional circumstances or as result of a combination of unusual events.
Unlikely	2	The event may occur at some time but not likely to occur in the foreseeable future.
Possible	3	The event may occur within the foreseeable future or medium term.
Likely	4	The event will probably occur in most circumstances at least once.
Almost certain	5	The event will occur in most circumstances.

Table 2: Likelihood matrix (Austroads 2009 Guide to road safety Part 6: Road Safety Audits)

Frequency	Description
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five or ten years
Improbable	Less often than once every ten years

Table 3: Likelihood matrix for railway crossing (Roads and Maritime Services (RMS), 2011)

Likelihood rating	Description	Frequency of road users' crashes at, on approach and departure , or during the operation of a railway crossing
Extreme	The event is expected to occur in most instances	One incident occur at least once a month
High	The event will probably occur in most instances	One incident occurs between once a month and once in three months
Medium	The event might occur at some time	One incident occurs between once in four months and once in a year
Low	The event could occur at some time	One incident occur between once a year and once in three years
Negligible	The event may occur in exceptional circumstances	One incident occurs less than once in three years

Table 4: Likelihood table (Australian Risk Services Pty Ltd, 2008)

Rating code	Risk likelihood	Description
A	Almost certain	Common or repeating occurrence
B	Likely	Known to occur or "it has happened"
C	Possible	Could occur or "I've heard it happened"
D	Unlikely	Not likely to occur
E	Rare	Practically impossible

Table 5: Consequence table (AS/NZS ISO 31000:2009)

		Consequence area	
Rating		Damage	Human
Insignificant	1	Up to $10,000	First aid
Minor	2	Up to $1 million	Medical treatment
Moderate	3	Up to $5 million	Hospital treatment
Major	4	Up to $15 million	Single death
Catastrophic	5	Above $15 million	Multiple deaths

in 'multiple fatalities', the resulting risk is evaluated to be 'Medium' (refer to Table 11). If however AS/NZS ISO 31000:2009 risk rating matrix is used to evaluate the risk level for the same event, the resulting risk level would be "High" (refer to Table 9).

As a result, funding may be provided for remediation measures in the high case but not considered important enough in the medium case.

When undertaking any risk evaluation, it is also important to consider the motivations and expectations of the local community. However it is important not to be overly influenced by public opinion and to remain impartial when undertaking the risk evaluation.

Being influenced by public perception of the risk, means many professionals consider the 'worst case scenario' (as opposed to the most likely scenario) when assessing the consequences, especially if vulnerable road users such as pedestrians and cyclists are to be considered. Such an approach would result in as almost every single vulnerable road user related risk being assessed as 'High', making it very difficult to prioritise the allocation of fund for remedial measures. Alternatively, the magnitude of consequences should consider the 'most likely' outcome. This way, the estimated risk levels are more diverse, thus making it easier

Table 6: Consequence table (Austroads 2009 Guide to road safety Part 6: Road Safety Audits)

Severity	Description	Examples
Catastrophic	Likely multiple deaths	High-speed, multi-vehicle crash on a highway. Car runs into crowed bus stop. Bus and petrol tanker collide. Collapse of a bridge or tunnel.
Serious	Likely death or serious injury	High or medium-speed vehicle/vehicle collide. High or medium-speed collision with a fixed roadside object. Pedestrians or cyclists struck by a car.
Minor	Likely minor injury	Some low-speed vehicle collisions. Cyclist falls from bicycle at low speed. Left-turn rear-end crash in a slip lane.
Limited	Likely trivial injury or property damage only	Some low-speed vehicle collisions. Pedestrian walks into object (no head injury). Car reverses into post.

Table 7: Consequence table for railway crossing (Roads and Maritime Services (RMS), 2011)

Consequence rating	Road Safety
Negligible	No medical treatment required for road users
Low	Medical treatment required for road users
Medium	Serious injury occurs for road users
High	Single fatality occurs for road users
Extreme	Multiple fatalities occur for road users

Table 8: Consequence table (Australian Risk Services Pty Ltd, 2008)

Rating code	Risk likelihood	Description
1	Extreme	Fatality or permanent disability
2	Major	Serious injury or illness
3	Moderate	Moderate injury or illness
4	Minor	Minor injury or illness
5	Insignificant	No loss time injury

Table 9: Risk rating matrix (AS/NZS ISO 31000:2009)

Likelihood	Consequence: Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	High	High	Extreme	Extreme	Extreme
Likely	Moderate	High	High	Extreme	Extreme
Possible	Low	Moderate	High	Extreme	Extreme
Unlikely	Low	Low	Moderate	High	Extreme
Rare	Low	Low	Moderate	High	High

Table 10: Risk rating matrix (Austroads 2009 Guide to road safety Part 6: Road Safety Audits)

	Frequent	Possible	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 11: Risk rating matrix for railway crossings (Roads and Maritime Services (RMS) 2011)

RISK LEVELS	Consequence: Negligible	Low	Medium	High	Extreme
Likelihood: Extreme	M	H	E	E	E
High	L	M	H	E	E
Medium	N	L	M	H	E
Low	N	N	L	M	H
Negligible	N	N	N	L	M

Table 12: Risk rating matrix (Australian Risk Services Pty Ltd, 2008)

Likelihood	Consequences: Insignificant	Minor	Moderate	Major	Extreme
Almost certain	Significant	Significant	High	High	High
Likely	Medium	Significant	Significant	High	High
Possible	Low	Medium	Significant	High	High
Unlikely	Low	Low	Medium	Significant	High
Rare	Low	Low	Medium	Significant	Significant

to allocate funding for remedial measures. The following example describes this approach (see Figure 4).

As a result of an identified deficiency (the existing pedestrian crossing sign is too far removed from the pedestrian crossing), pedestrians could be hit by a car travelling at the speed limit of 10 km/h. Under such an unlikely scenario, the 'most likely outcome' would be minor injuries for a pedestrian and overall risk level would be evaluated as "Low". However in a very small number of cases the pedestrians, when hit, may fall awkwardly, hit their head and be killed. While this is the worst case scenario, the risk should still be assessed as "Low" despite the potential of a fatal outcome.

Figure 4: Example from a Road Safety Audit

Risk assessment: more than just compliance with the standards

A robust risk assessment is more than just confirmation that design standards have been met. Individual road elements may be quite safe in isolation but when combined with other standard elements, be unsafe (i.e. lead a significant number of road users to make errors).

The two examples below explain how sometimes compliance or non-compliance with standards can have a counter-intuitive impact on the actual risk.

Example 1: Public concern was raised regarding pedestrian and cyclist safety on the shared path over The Entrance Bridge (refer to Photo 1) due to its close proximity to the vehicular traffic.

The kerbs separating the road from the shared path were found to be substandard as they are not painted in white retro-reflective colour. Such a deficiency would normally be considered as a hazard but in this particular case, this deficiency actually improves the pedestrian and cyclists' safety. The grey coloured kerbing does not provide enough contrast with its background, ultimately resulting in drivers feeling uncomfortable about driving close to the edge of the road with traffic slowing down and keeping their vehicles away from the shared path. In this case, despite the described deficiency, the resulting risk evaluation was "Low".

Example 2: A newly constructed passing lane on the Bruce Highway was provided with new lighting which is fully compliant with design standards. Despite this, the provided road lighting does not extend far enough along the passing lane, resulting in excessive contrast between bright and dark areas (refer to Photos 2 to 4), causing eye strain and temporary blindness when entering the dark zone. This could result in drivers losing control, leading to a serious accident.

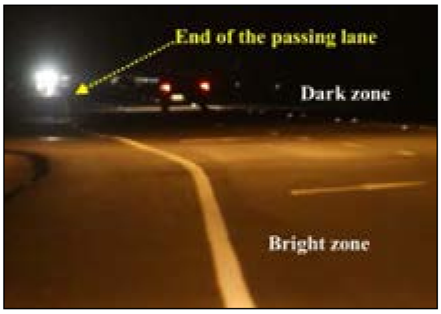
In this case, despite being designed and installed to the standards, the resulting risk evaluation was "High".

Photo 1: The Entrance Bridge

Conclusions

The paper provides the following conclusion in relation to the existing road related risk assessment process:

- when undertaking a road related risk assessment, the risk identification process should be replaced with two distinct steps - deficiency identification and hazard identification. Not only do these steps help to better define the risks, the hazard identification stage also acts as a filter, meaning that not all deficiencies have to progress to the risk analysis stage.
- the risk analysis process analyses the risk related to each hazard by combining estimates of likelihood and consequences. Currently there is no uniform approach when it comes to determining likelihood and consequence. Instead, several organisations around Australia have developed their own criteria, resulting in a number of different likelihood and consequence tables. These different definitions can lead to misinterpretation, mistakes and in extreme



Photos 2 and 3: Bruce Highway

Photo 4: Bruce Highway

cases manipulation of the process to meet a desired outcome. To reduce the opportunity of misinterpreting or misusing these tables, a standard set of definitions for both likelihood and consequence should be developed and rolled out nationally. Alternatively one of the existing definitions should be adopted as the industry standard.

- when undertaking any risk evaluation, it is important to consider the motivations and expectations of the local community. However it is important not to be overly influenced by public opinion and to remain impartial when undertaking the risk evaluation. When assessing risk, the most likely scenario should be considered and not the worse case scenario.
- a robust risk assessment is more than just confirming that design standards have been met, but that sometimes compliance or non-compliance with standards can have a counter-intuitive impact on the actual risk.

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