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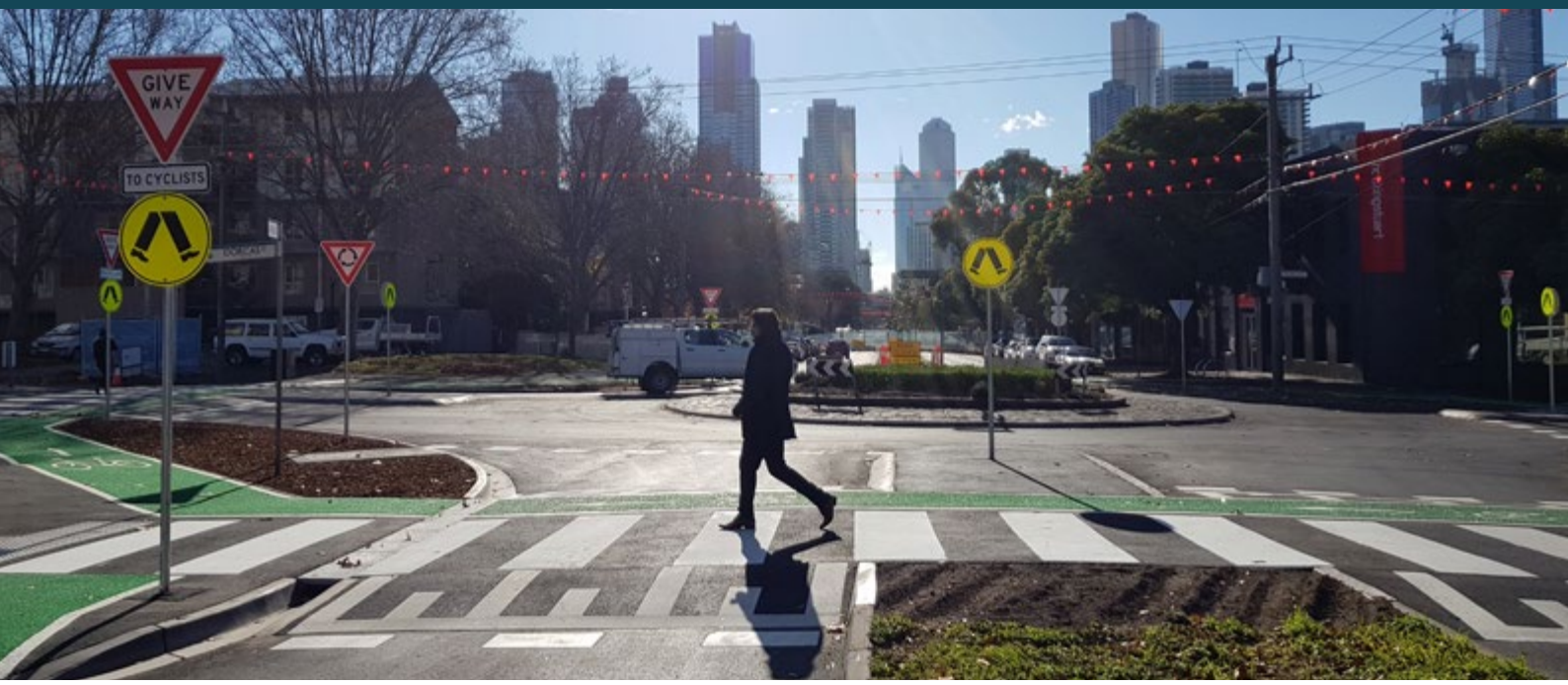
Journal of the Australasian College of Road Safety



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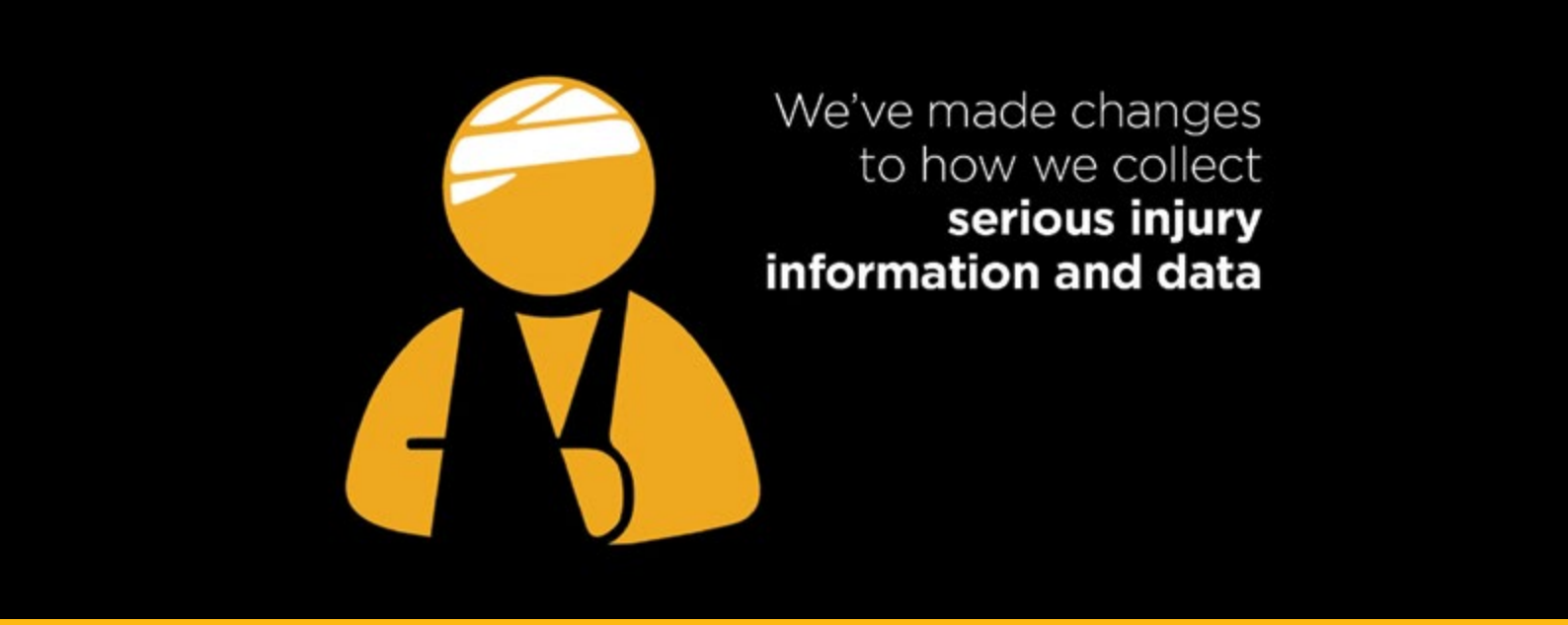

The Centre for Road Safety (CRS) at Transport for NSW has some of the most extensive and high quality information on road crashes in the world and it is continuously being enhanced.

As part of the data linkage program, we've recently expanded the sources from which we collate and provide road crash statistics to include comprehensive data from NSW Police Force crash reports, hospital admissions and Emergency Department (ED) presentations, CTP claims (from the State Insurance Regulatory Authority [SIRA]), Lifetime Care and Support cases, and Ambulance services data.

Further changes to the collection of serious injuries data involve NSW Health data. In mid-2017 a change was made to the NSW Health Admission Policy so that 'Emergency Department Only Admissions' were no longer classified as admitted patients and were therefore not included in the Admitted Patient Data Collection (APDC).

As ED Only Admissions will no longer be included in the APDC going forward, CRS has retrospectively recast all ED Only Admissions in existing historic hospitalisation data so that they will be comparable with the ongoing admission data. This decision was made after consultation with NSW Health as the data owner and custodian for hospital admissions.

The data change requires CRS to recalculate and reissue serious injuries data from 2005 to enable consistent trend analysis and comparisons into the future.

Serious injury numbers have subsequently been recast and applied to the latest *NSW Serious Injuries – Quarterly report* as well as our online interactive crash statistics.

For more information on the changes, please visit **roadsafety.transport.nsw.gov.au**

Bernard Carlon

Executive Director,
Centres for Road Safety and Maritime Safety

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Austroads

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Cover image

Roundabouts constrain speeds and impact angles for vehicles as they approach and are a positive road safety treatment for cars. However, this positive effect may not equally apply to cyclists. A bicycle route in Victoria, Australia was upgraded based on the VicRoads technical guidance with inclusions of raised pedestrian crossings at all branches of the roundabout. See Road Safety Case Studies article: Tan, T., Haque, S., Lee-Archer, L., Mason, T., Parthiban, J., and Beer, T. (2019). "Bicycle-Friendly Roundabouts: A Case-Study" . J*ournal of the Australasian College of Road Safety*, 30(4), 67-70).
Photo source: Shafiul Haque, Safe System Solutions Pty Ltd.

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The *Journal of the Australasian College of Road Safety* aims to publish high quality papers and provides a means of communication for the considerable amount of evidence being built for the delivery of road safety, to inform researchers, policymakers, advocates, government and non-government organisations, post-crash carers, engineers, economists, educators, psychologists/behavioural scientists, communication experts, insurance agencies, private companies, funding agencies, and interested members of the public. The Journal accepts papers from any country or region and has an international readership.

All papers submitted for publication undergo a peer-review process, unless the paper is submitted as a *Perspective*/*Commentary on Road Safety* or *Correspondence* or the authors specifically request the paper not to be peer-reviewed at the time of original submission. Submissions under the peer-review stream are refereed on the basis of quality and importance for advancing road safety, and decisions on the publication of the paper are based on the value of the contribution the paper makes in road safety. Papers that pass the initial screening process by the Managing Editor and Peer-Review Editor will be sent out to peer reviewers selected on the basis of expertise and prior work in the area. The names of the reviewers are not disclosed to the authors. Based on the recommendations from the reviewers, authors are informed of the decision on the suitability of the manuscript for publication.

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ACRS office contact details
Ms Claire Howe, Chief Executive Officer, ceo@acrs.org.au: For inquiries regarding membership and College activities.

Dr Chika Sakashita, Managing Editor, journaleditor@acrs.org.au: For inquiries regarding submissions, current and back issues, advertising and sponsorship for the Journal.

Contact faa@acrs.org.au for inquiries regarding Journal subscriptions and changes of postal address.

Mailing address: PO Box 198, Mawson, ACT 2607 Australia
Phone: (02) 6290 2509
Head office: Pearce Centre, Collett Place, Pearce ACT Australia

Editorial Board

From the President

Significant policy change is occurring at a national level in Australia and New Zealand, and it is hoped that this will lead to a meaningful contribution when the world's road safety Ministers gather in Stockholm in February next year.

In August this year, Australian Transport and Infrastructure Ministers committed themselves to eliminating road fatalities by 2050. The Australasian College of Road Safety has strongly endorsed this commitment, and has asked that it be extended to the elimination of serious injuries as well. A new national strategy is expected next year and, at a strategy level, it is important to recognise for now:

- the 2017 decision to call a national inquiry into the country's poor road safety performance
- the 2018 independent report which articulated the problem at a national level
- the 2019 re-establishment of an Office of Road Safety in Canberra.

The Government of New Zealand is offering renewed political leadership through a draft road safety strategy, released in July this year, by reinforcing its commitment to the safe systems approach, to the elimination of fatal and serious injury on the road. The draft strategy re-introduces national targets, and proposes they be set at a 40% reduction.

Major new policy and financial investments are required to back these political commitments up. The current road traffic systems of Australia and New Zealand are set to kill many hundreds and thousands of people each year. Another step is required as national strategies are developed.

The 30% reduction targets set in Australia's National Road Safety Strategy 2011-2020 engendered no urgency in addressing the relentless trauma suffered by Australians on the road. Since then, we have seen a flatlining of results around 1200 fatalities each year since 2013, and steadily deteriorating non-fatal injuries over the decade.

But at least Australia has had targets that it can refer to. New Zealand was once a world leader in results-focused management of road safety, which influenced the re-fashioning of the country's entire public management system. However, New Zealand abandoned road fatality and injury targets in 2010. New Zealand entered the decade with some momentum but didn't respond to an independent mid-term evaluation of its Safer Journeys strategy, and results have deteriorated sharply, with the same fatality numbers in 2018 as 2010.

The same sort of dynamics can be seen globally. The fact that it was not seen as a development issue within the Millenium Development Goals stifled investment in road safety, propelling road traffic injury past HIV AIDS as a cause of death. The Sustainable Development Goals (SDGs) to 2030 identified road traffic injury as a major development issue and a set of voluntary road safety performance targets have been prepared within the United Nations system. While the (SDGs) are presented as a matter of concern for low and middle-income countries, our road safety performance in Australia and New Zealand over the last decade suggests they are just as relevant in our affluent, high-income societies.

The Towards Zero Foundation, a United Kingdom registered road safety charity, has called for a new global target to halve road deaths and serious injuries to 2030. The Australasian College of Road Safety provided voice to their 50BY30 campaign at the most recent Australasian Road Safety Conference held in Adelaide in September this year.

Road safety targets do not in themselves reduce road trauma, but they play a critical role in holding all system designers to account, particularly Governments which control almost all public road networks, regulate all aspects of vehicle safety, and pass and enforce all road traffic law.

If our goal is to achieve zero by 2050, the College believes that the only reasonable interim target is for 50% reductions in fatal and serious injury by 2030. These reflect targets that have been set in Europe where they are already a lot safer than Australia and New Zealand now. The College also calls for more equitable outcomes for the most vulnerable members of the community – whether for regional communities facing disproportionately high fatality rates, or for cyclists and pedestrians in our cities where we are still only comprehending the scale of the injury disaster which is unfolding, or for poor or disadvantaged communities.

The College recognises that these targets are challenging, but we know they are achievable. Strong performance management across all public agencies with primary responsibility for road safety will be essential. Bottom up performance and delivery targets are now needed to identify what will be done to achieve our interim goal in 2030. These targets could initially include elimination of fatal and serious injury at all school zones, for example.

There are many options for achieving our interim targets and our ultimate goal, some more expensive and some more effective than others. The College calls on all governments, all organisations, and all communities to work collaboratively with us and together, to achieve our common 2050 goal, and our interim 2030 target.

From a global perspective, road traffic injury is a gateway to poverty. Injury prevention focussed investment through development budgets has the potential to deliver significant poverty eradication benefits across low and middle-income countries. I hope that, as part of the Global Ministerial Conference, Australia and New Zealand will commit to 50% reduction targets by 2030, demonstrate achievability in this major global issue, and follow this up with meaningful support for other countries to achieve the same.

Martin Small
ACRS President

From the CEO

It gives me much pleasure to share an update with members as College CEO, and in particular to let you all know about the successful conference which drew 540 delegates from across the globe to Adelaide last week. I received a lot of positive feedback on the College following my plenary welcome address so thought I would share this with you as it provides insight into College activities, our broad range of benefits, and the flavour of 'Supporting Leadership' which was carried throughout last week's event.

Welcome Address ARSC2019

Thank you Martin & thanks also to all of you for being here – 540 gathered in Adelaide to focus on the very relevant and timely theme of Leadership.

What a day we've woken up to today, seeing leadership chaos in 2 global powerhouses – an impeachment inquiry into President Trump in the US, and the suspension of Parliament by the UK PM Boris Johnson ruled unlawful.

And here today, at this conference, we're strongly supporting best leadership outcomes with unequivocal political support across all parties, all levels of government, all stakeholder groups, and communities. And for that we are very proud.

And that's what I'd like to talk to you about during my brief presentation as ACRS CEO – the College's prime role in supporting leadership in road safety

across our region, by providing an environment that is Collaborative, Evidence-based, and Independent.

The College began in 1988, now 31 years ago, as a result of a meeting of a small group of around 8 like-minded road safety researchers and practitioners who felt there needed to be an organisation providing a space for independent advocacy and collaboration. And we have grown!

In 2017 we were delighted to be awarded a Prince Michael International Road Safety Award for our work in Road Safety Management – for our collaboration and our commitment to evidence-based advocacy. Our programs nominated in that award included our powerful submission to parliamentarians which highlighted our ability to bring major stakeholders together such as the RACS, Carers Australia and the AAA (representing in total around 10 million Australians). And we were also nominated for our excellent quarterly journal which is the only road safety dedicated journal in the world, and is reaching new heights which I will mention shortly.

Today we have 8 Chapters spread across Australasia. We have 18 Executive Committee members across Australasia and have awarded 25 prestigious Fellowships to outstanding road safety researchers and practitioners. (Around 20 Executive members and Fellows were in the audience and were asked to briefly stand – delegates were asked to take a look around and ensure they connected to learn more about the College. It was noted that many of those standing have roles throughout the plenaries and the conference – Rob McInerney FACRS was to speak shortly and Jeremy Woolley FACRS after the break - just 2 examples).

Many of the delegates at the conferenece are members of the College, in fact we consistently see over half of conference attendees are members. For both members and non-members I'd like to briefly outline some of the work of the College, and encourage you all to continue to remain actively involved in our activities.

We've been delighted with the response to this merged Austroads/College ARSC conference series, of which this one is our 5th in the series and which the College continues to manage. Post-event surveys consistently see delegates pinpoint Networking as the most rewarding aspect of attending these events, closely followed by Listening to Experts in their field.

Other benefits include joining us in an environment of independence, collaboration, reliance on evidence, and away from political allegiances and potential funding bias.

We have member discounts to events (such as this one)

We provide weekly e-newsletters which contain a comprehensive summary of regional and international happenings over the week.

We publish the only academic journal world-wide which is dedicated to road safety. Dr Chika Sakashita and Professor Raphael Grzebieta lead us, together with their 18-strong Editorial Board – all experts in their own right. (Chika and Raph were asked to stand delegates were again encouraged to connect up and submit research and practitioner articles for publishing. The most recent copy of the journal was held up and delegates encouraged to take a copy from our exhibition booth). The journal team continues to do an enormous amount of work behind the scenes to drive up the professionalism and outreach of evidence-based, peer-reviewed road safety work via the journal – which is all Open Access I might add, funded through your memberships. Thanks Chika and Raph

Other member benefits include recognition of excellence in road safety leadership, through our awards – our prestigious Fellowship, the highly valued 3M-ACRS Road Safety Award, our new Young Leaders Oration Award – all three to be announced by the Deputy Prime Minister at the Conference Gala Dinner and Awards. As well we have our conference awards celebrating excellence and leadership across 7 categories of awards.

We are continually seeking to improve, and following the recent Strategic Review, this year's College AGM endorsed changes to the purpose, objectives and governance of the College. The intention is for these to be incorporated into a revised Constitution for members to consider next year. As CEO, I was very pleased that in the survey we conducted as part of that review both Members and non-Members affirmed their support for the current College activities, and I make the commitment to you all to continue these activities and to ensuring the highest quality advocacy and member benefits possible.

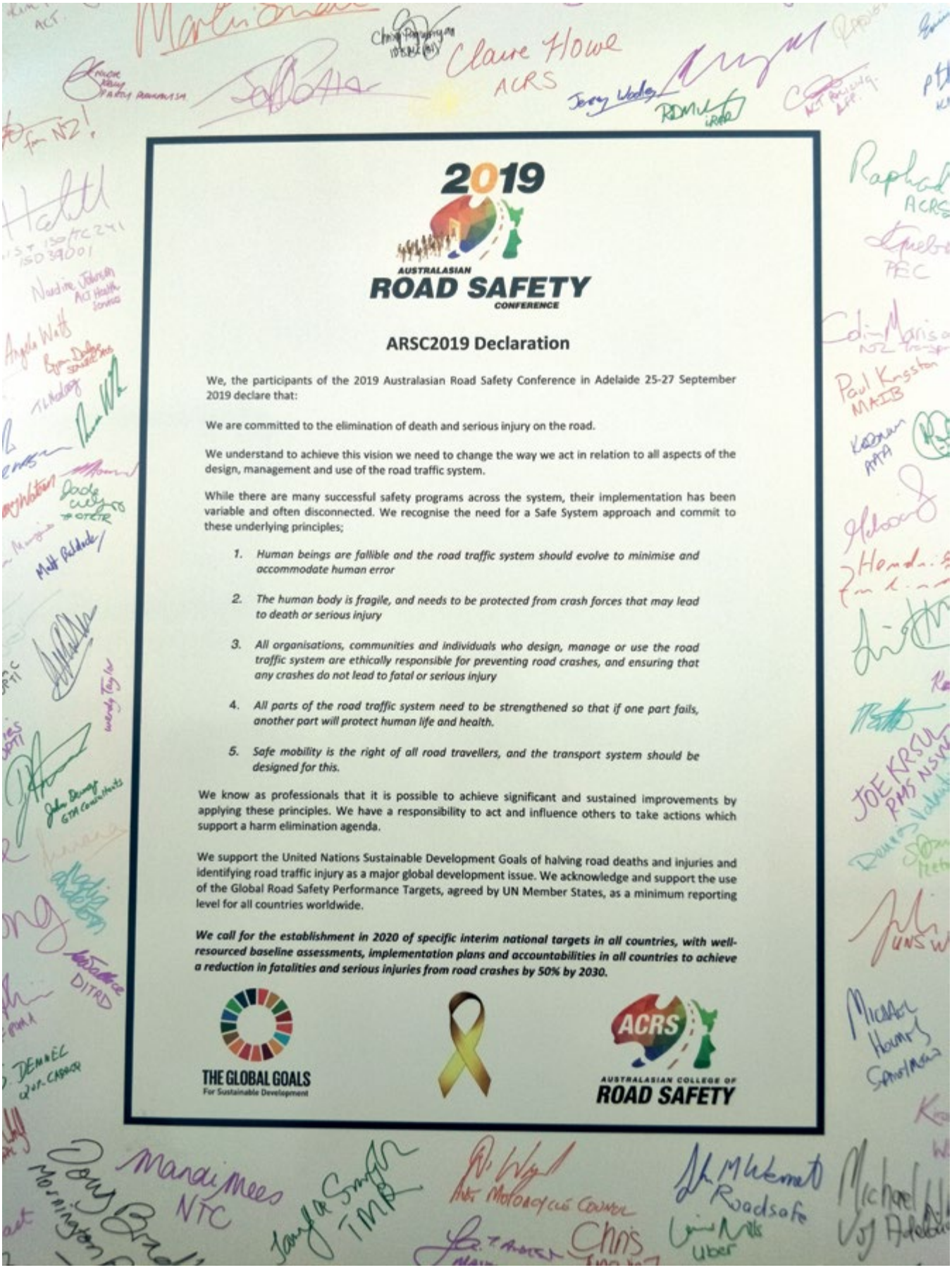
And lastly delegates are encouraged to drop in to the College's exhibition booth and come and learn more. Delegates are also encouraged to sign the ARSC2019 Declaration which will be presented to the WHO in Stockholm in February at the 3rd high level Ministerial conference on road safety, and is the chance for all delegates to show support for local, regional, national, Australasian and international efforts to combat road trauma.

Thanks everyone & I look forward to catching up with you during this event. Enjoy the conference!

Below is a photo of the signed ARSC2019 Declaration mentioned above – it is now safe on its way travelling back to Canberra, filled with hundreds of signatures showing the support of those at the conference. I'll look forward to keeping you updated with the further travels of our Declaration in future CEO's Reports, and until then…

Stay safe, and best wishes,

Claire Howe
Chief Executive Officer – ACRS



2019

AUSTRALASIAN ROAD SAFETY CONFERENCE

ARSC2019 Declaration

We, the participants of the 2019 Australasian Road Safety Conference in Adelaide 25-27 September 2019 declare that:

We are committed to the elimination of death and serious injury on the road.

We understand to achieve this vision we need to change the way we act in relation to all aspects of the design, management and use of the road traffic system.

While there are many successful safety programs across the system, their implementation has been variable and often disconnected. We recognise the need for a Safe System approach and commit to these underlying principles;

1. *Human beings are fallible and the road traffic system should evolve to minimise and accommodate human error*
2. *The human body is fragile, and needs to be protected from crash forces that may lead to death or serious injury*
3. *All organisations, communities and individuals who design, manage or use the road traffic system are ethically responsible for preventing road crashes, and ensuring that any crashes do not lead to fatal or serious injury*
4. *All parts of the road traffic system need to be strengthened so that if one part fails, another part will protect human life and health.*
5. *Safe mobility is the right of all road travellers, and the transport system should be designed for this.*

We know as professionals that it is possible to achieve significant and sustained improvements by applying these principles. We have a responsibility to act and influence others to take actions which support a harm elimination agenda.

We support the United Nations Sustainable Development Goals of halving road deaths and injuries and identifying road traffic injury as a major global development issue. We acknowledge and support the use of the Global Road Safety Performance Targets, agreed by UN Member States, as a minimum reporting level for all countries worldwide.

We call for the establishment in 2020 of specific interim national targets in all countries, with well-resourced baseline assessments, implementation plans and accountabilities in all countries to achieve a reduction in fatalities and serious injuries from road crashes by 50% by 2030.

THE GLOBAL GOALS For Sustainable Development

ACRS AUSTRALASIAN COLLEGE OF ROAD SAFETY

ACRS Chapter reports

Chapter reports were sought from all Chapter Representatives. We greatly appreciate the reports we received from ACT, SA, NT and NZ.

Australian Capital Territory (ACT) and Region

The last few months have been active for the Chapter.

A workshop on Wildlife crashes was held on 24 July 2019 and a forum on the regulatory framework for the introduction of Electric Transport Personal Vehicles on 3 September 2019.

Wild life collisions in ACT and surrounding area

The project was initiated originally by the Royal Australasian College of Surgeons and ACT Health because of their concerns about the number and seriousness of casualties presenting at ACT Emergency departments resulting from wildlife crashes on ACT and nearby NSW roads.

In scoping the project, the committee had faced a lack of substantive data on wildlife crashes and the relationship between road safety and hospital /medical data. Data collected by insurers also appeared limited because it related only to Compulsory Third Party claims.

As a consequence, road safety authorities and other managers of the road network had been uncertain about the priority that should be given to wildlife crashes and the types of interventions that would provide cost effective positive outcomes.

A workshop was held on 24 July 2019. Over 40 delegates representing a wide range of authorities (road safety, health, , parks & conservation), the transport industry, local government, road users (eg motorists, cyclists and motorcyclists) attended.

Presentations on data were delivered by representatives of ACT Health, ACT Road Safety, ACT Parks & Conservation, Insurance Australia Group (IAG) Limited, and NSW local government.

Other organisations were given the opportunity to make short presentations including Pedal Power ACT, the University of Sydney, southern NSW local government representatives and animal rescue bodies.

Some of the more important information to come out of the discussions were:

- Wildlife related cases at Canberra Emergency departments doubled in four years to 33 in *2018*
- Wildlife admissions represent 4 per cent of trauma cases, but their impact is costly
- There have been 13 Helicopter retrievals; 5 ICU admissions (25 ICU bed days); 192 bed days; 1 death; 1 life-long care; 49 operations
- It could well be that for every emergency trauma admission, five other cases could be admitted to hospital.
- Hospitals do not always know the underlying cause of the crash
- ACT Crash Data statistics for 2017 show 219 wildlife crashes with only eight serious injuries.
- Call outs for ACT rangers to attend animals killed/ injured in road crashes has doubled in recent years to 4225 in 2018. This represents an attendance rate of 9.5 for every 1000 vehicles registered.
- IAG estimates the total annual insurance cost across Australia is around $200million
- Vulnerable road users do not report (Pedal Power Survey)
- Research interest is in: road attributes, food availability, kangaroo density, are fences and underpasses effective, fence funnelling effects, and the effects of population demographic changes. Research has shown that most crashes are close to the kangaroos' core habitat, most are male, the number of incidents on roads with a speed limit over 60km/h is growing
- The Pedal Power Survey showed: 25% of collisions/ near misses caused injuries; 42% self-managed injuries with over the counter medication; small number visited a GP
- Wild horses and deer are becoming an issue in some rural areas
- In NSW and elsewhere the issue is largely rural; in Canberra it is literally in our front yards.

General conclusions:

- Wildlife crashes appear to be more extensive than previously thought. The numbers have been increasing substantially in recent years. It is important to identify better the number and severity of injury crashes.
- A need exists to improve the data collections particularly within the transport sector and between it and health data.

- Research is required to better understand the factors that lead up to these crashes and to identify cost effective countermeasures. This might initially include a review of overseas literature and measures taken to assess if any are transferable to Australia. Some may be able to be funded under national research programs such as Austroads.

Where to from here:

- Workshop groups summarised their ideas and the Chapter has produced a summary for distribution which will be uploaded on ACRS website
- Important connections will enable organisations to work closely together in future
- Important that Health and Surgeons be involved
- A working group is being set up to continue the investigations (contact details will be advised on the ACRS website).

Our thanks go to Joanne Wilson Ridley & Eric Chalmers for their efforts in bringing this successful workshop together and to other management committee members for their assistance and perseverance over the past couple of years.

Electrical Personal Transport Vehicles

The Chapter managed a Road Safety Forum for the ACT Justice and Community Safety Directorate (JACS) as part of the ACT Government's development of regulations for the use of electric passenger transport vehicles.

Electric scooters and similar devices are quickly becoming more appealing as viable and sustainable transportation options for commuters. As part of the Road Safety Action Plan 2016-20 the ACT Government announced it was committed to exploring options for recognising the role of sustainable transport for road safety.

The ACT Government believes that E-Scooters and similar devices have the potential to provide an innovative, zero-emission transport options for people who would otherwise drive. By regulating the safe use of electric scooters and similar personal transportation devices, the Government believes there is the potential to decrease the number of cars on the road. Furthermore, this has the potential to actively work towards the ACT Government's target of net zero greenhouse gas emissions by 2045.

In recognition of the potential benefits on offer from allowing the use of E-Scooters and similar devices in the ACT the views of the ACT community were sought between the period 25 June 2019 and 19 July 2019.

In addition to the survey, a Forum was held to release the outcomes of the initial community consultation and further discuss issues and options arising from it. The Forum, held on 3 September2019 included key ACT stakeholders, industry manufacturers and suppliers, external road safety experts and regulatory organisations. the Forum. Forty-five representatives attended.

Although the National Transport Commission has a review under way it will not be complete until around November 2020. States and Territories have been acting to meet community requirements. Queensland has introduced regulations and other states have either introduced trial arrangements or are examining their options.

Professor Narelle Howarth of the Centre for Accident Research & Road Safety-Queensland (CARRS-Q) who has been reviewing the introduction of similar schemes in Queensland & elsewhere, and Tim Davern who is managing a national review of possible regulations for personal motorised vehicles for the National Transport Commission (NTC), were invited to make presentations.

ACT Consultation

The ACT public consultation process concentrated on:

- informing the public about the new devices and
- seeking responses to the key issues of location, speed, and restrictions as the main factors that would ensure an acceptable and safe introduction and long-term safe use of these devices.

The public responses showed strong support for E-scooters and similar devices as a whole.

- Location: Community largely supportive of e-scooters and similar devices being ridden around Canberra: Most supportive of shared paths – 89%; Lowest support – high pedestrian areas – 57% not supportive
- Speed: Although 25km/h has received the highest support of 35% - on the flipside of that almost 50% supportive of lower speeds, particularly in areas of high pedestrian use
- Restrictions:
  - In terms of age, 16 years is the preferred option followed by 12 years of age with adult supervision.
  - Support also exists for compulsory helmet wearing, less so padding, drug and alcohol restrictions and the need for suitable infrastructure.

Professor Haworth

Professor Horwath focussed her presentation on a few areas which she considered central to the safe and practical introduction of personal motorised devices: definitions; known reasons for use; developments in Australia and elsewhere; and data on the safety of Personal Mobility Devices (PMDs).

Definitions

- Consistency in definition is important establishing where vehicles sit in the regulatory framework
- Flexibility is also important in the longer term to enable the introduction of new PMDs that have not been conceived at present.

- Queensland has established a new generic grouping of "Rideables" to capture current and future product developments.

Data

Professor Haworth advised limited safety data is available following the recent introduction of E-Scooters in Australia. CARRS Q has established a data base which is still in its infancy. A four day observation study had been undertaken in Brisbane early in 2019.

Some of the initial indications from Brisbane and overseas are:

- Falls most common crash type
- Head injuries, upper limb fractures and lower limbs
- Toe and heel injuries
- Risk of injury in Brisbane seems to be very roughly double that for bicycles
- Little information on pedestrian injuries given most jurisdictions ride on road
- Small wheels and electronic control systems are risk factors
- Not wearing helmets, travelling at more than 30km/h and alcohol consumption were identified as significant factors in E-scooter accidents in Queensland
- Almost half of the shared scooters were ridden illegally (no helmets, riding on the road or doubling a passenger), compared to around 20% noncompliance for shared bicycles and less under 5% for private e scooters and private bicycles
- An interesting observation was that E-Scooter trips were less than a km, indicating the devices are being used in lieu of walking
- In relation to the use of helmets, it was noted that E-bike helmets were sometimes 'borrowed' from shard bicycle operators for use on E-scooters. This observation underscores the need to ensure the availability of helmets for these devices
- Almost all shared and private e scooter activity was undertaken on footpaths whereas for shared bicycles the share was fairly equal and for private bicycle use it was predominantly on roadways. An extension of such observations to a wider range of locations and timeframes would provide a more extensive perspective, e.g. observations over a weekend.

National Transport Commission

NTC is reviewing regulatory framework for personal mobility devices in the context of Austroads considerations under its ongoing work programs, Queensland and South Australian regulations, and Commonwealth considerations. The Commission is looking to develop a nationally consistent set of rules that can also apply to other vehicles with similar characteristics.

- Consistency and regulations easy for use by all road users is important for industry and in avoiding cross border disparities. The NTC anticipates having a set of regulations that can be incorporated into the model Australian Road Rules (ARRs).
- NTC had a national workshop in November 2018 and released an Issues Paper in January 2019.
- A Regulatory Impact Statement (RIS) will be released in October 2019 for comment with an 8- week timeline. The NTC encourages everyone to provide comment. PMDs and mobility devices are now being considered separately in the project.
- The NTC approval processes will see a decision on the final RIS being lodged with the Transport and Infrastructure Official Committee (TISOC) in August 2020; and
- a decision taken by the Transport and Infrastructure Council (TIC) in November 2020.

The preferred options likely to be included in the NTC Draft RIS are:

- The regulations apply to pedestrian infrastructure, bicycle paths, and local roads with speed limits less than 50km/h (Option 3); and
- Speed limits be designated as 10km/h on footpath or shared path; and 25km/h on bicycle infrastructure and roads (Speed Option 1).

Conclusions

Overall the Forum appeared to be of the view that sufficient information is available for the ACT Government to develop regulations that meet the ACT's needs, and at the same time, will be consistent with national draft regulations being proposed by NTC.

The ACT Government will consider the issues raised at te Forum and will work towards introducing appropriate regulations by the end of 2019. It will also negotiate separately with prospective commercial operators on the conditions of operating these vehicles in the ACT.

The likely regulatory outcome would be that electric personal transport vehicles might need to comply with the same basic rules as bicycles, operations may be restricted to low speed roads, with speeds regulated for specific areas, compulsory helmets and requirements for braking, lighting similar to bicycles.

The Forum demonstrated that in Australia and New Zealand there is a commonality in the regulations introduced or being considered. This means that in Australia there should be scope for consistent regulation. The Queensland and the proposed NTC frameworks are very similar, as are the provisions set down in South Australia for its trials.

Some definitional differences may occur as well as speed limit differences on shared paths and footpaths. These are not insurmountable and should be able to be addressed in the NTC process – e.g. NTC includes requirement for effective

braking systems; and speed limits differences on shared paths or in high use pedestrian precincts (10, 15, or 25km/h).

ACT Chapter Chair and Secretary
Mr Eric Chalmers & Mr Keith Wheatley

South Australia (SA)

Motorcycle Safety

Over 90 people attended a lunchtime seminar on 19th June featuring three speakers. Matthew Baldock (CASR – University of Adelaide) presented on the recent report: *Recommendations for a Graduated Licensing System for Motorcyclists in South Australia*.

Amit Dua (Department of Planning, Transport and Infrastructure) provided an update on the latest in infrastructure safety improvements addressing motorcycle safety hazards in South Australia. These included removal of roadside hazards, shoulder sealing, improving delineation, replacing fixed guide posts and guard rail delineators with flexible ones, hazard boards, adding motorcycle safety barrier to W beam and centerline audio-tactile line marking. Treatments have been applied to motorcycle 'Black Lengths'.

Graeme Rawlins (President, Motorcycle Riders Association of SA) spoke about the association's views on legislation, riders' attitudes towards perceiving hazards and taking responsibility, particularly where the context is 'when safe to do so'. Graeme also spoke about road surface defects, signs and areas for future research.

Thank you to the Department of Planning, Transport and Infrastructure for providing the venue.

ARSC2019

It was an honour to be the host chapter for this very successful conference. Many thanks to the South Australian based sponsors, including Platinum Sponsor, the Department of Planning, Transport and Infrastructure. Thank you to chapter members who contributed to organising the conference over the months leading up, and to those who attended.

Next Seminar – Road Safety and Urban Planning– Lunchtime Wednesday 27 November 2019

The Chapter committee is putting together a program of two or three speakers that will make for an engaging seminar on the road safety opportunities from modern urban planning thinking. Further information closer to the date. We look forward to seeing members and guests there.

SA Chapter Chair and Secretary
Jamie MacKenzie and Phil Blake

Northern Territory (NT)

The Northern Territory chapter met for the first time 12 June 2009. Attendees were drawn from a both government and non-government industry and community groups. As this is the first time for an ACRS chapter has been established in the NT a decision was made to elect a Chapter Chair and to establish the purpose and directions of sister Chapters and the National committee. I am proud to have been nominated to undertake the Chapter Chair and look forward to progressing the ACRS aim in the Northern Territory.

No events have been held to date with the proposed initial actions to identify issues and strategies for the Northern Territory.

The next meeting is scheduled for this month with the first action item for the chair to deliver a presentation of the state of road safety in the NT.

We look forward to working with other chapters in the coming future.

NT Chapter Chair
Mark Casey

New Zealand (NZ)

The New Zealand Chapter has a new governance group with the appointment of Dr Rebecca Brookland (University of Otago) and Mr Paul Durdin (Abley Ltd) as Co-chairs. Robyn Gardener will take on the role of Treasurer/Secretary.

We would like to acknowledge the dedication of Mr Paul Graham (NZTA) to road safety in NZ and his work as the Chapter Chair. While Paul vacates the role of Chair he is staying on as a committee member, so his wealth of knowledge is not lost to us.

We look forward to growing the New Zealand chapter membership and working together to advance road safety.

NZ Chapter Chairs
Dr Rebecca Brookland and Mr Paul Durdin

ACRS News

Prestigious ACRS Fellowship awarded to Professor Michael Regan

Congratulations to leading road safety advocate Professor Michael (Mike) Regan who was presented with the prestigious 2019 ACRS Fellowship at the ACRS Award Ceremony at the Adelaide Convention Centre. The award recognises Professor Regan's global impact and leadership in transport human factors and road safety.

Above left to right: **ACRS President Mr Martin Small; Professor Michael (Mike) Regan; Mr Llew O'Brien, Federal Member for Wide Bay, QLD**

The award ceremony took place in front of 500 of Australasia's foremost road safety professionals and advocates, and is deserved recognition of Professor Regan's outstanding contribution to research, education and policy, particularly in the areas of driver distraction and inattention, and driver interaction with connected, automated and intelligent transport systems.

The award was presented by Mr Llew O'Brien, Federal Member for Wide Bay, QLD, and ACRS President Mr Martin Small, during the 2019 Australasian Road Safety Conference (ARSC2019).

Mr O'Brien said "I commend Professor Regan for his tireless work in helping to make the roads a safer place for all motorists and everything he has done and will continue to do in this space into the future."

"Highlighting awareness of initiatives that may help save lives is something that should be applauded", he said.

In presenting the award, ACRS President Mr Martin Small said "Our success in eliminating fatal and serious injury in road traffic by 2050 will depend upon our acceptance and our shaping of road traffic technology and systems. Ahead of this crucial time, Professor Regan's body of work has re-oriented our focus on human capability towards those essential human machine interface issues which we must grapple with, reminding the world that we must always place humans at the very centre of our safety thought and action. I am delighted to welcome Mike as a Fellow of the Australasian College of Road Safety."

Professor Regan has BSc (Hons) and PhD degrees in Psychology and Human Factors from the Australian National University, and is currently a Professor of Human Factors at the Research Centre for Integrated Transport Innovation (rCITI) at the University of New South Wales.

Professor Regan has made outstanding contributions to road safety as an academic/researcher, research leader and policy maker. He has designed and led around 150 research projects in road safety in Australia and Europe, many of them large-scale projects across various transport user classes. His research topics include driver distraction and inattention, driver interaction with connected, automated and intelligent vehicles, naturalistic driving studies, field operational testing of vehicle advanced driver assistance systems, driver education, training and licensing, human error in crash causation, user-centred design and evaluation of the vehicle human-machine interface, user-centred design and evaluation of road and traffic environments, and public and user acceptance of automated and driverless vehicles.

Other Notable Contributions by Professor Regan:

- Author/co-author of 340 research reports, articles and papers
- Sits on, or has sat on, the editorial boards of five peer-reviewed journals
- Given around 200 invited presentations on road safety-related topics in Australia and overseas
- Sits on, or has sat on, numerous local and international project Advisory, Steering and Expert committees
- Creator and founding co-chair of the biannual International Conference on Driver Distraction and Inattention
- Engages with the community via television, print and radio interviews on road safety-topics
- Called on to provide information and technical advice to State, Federal and international government road safety-related agencies, to Parliamentary road safety

inquiries, to the automotive industry, to lobby groups, to peak professional bodies, and to the Victorian State Coroner.

Through research and other contributions, Mike has supported government and industry in Australia, Europe and the US, and has trained, taught and nurtured the next generations of road safety researchers and professionals. The ACRS and members of the road safety community across Australasia congratulate Professor Regan on his outstanding contributions and 2019 ACRS Fellowship win.

About the ACRS Fellowship Award

The prestigious ACRS Fellowship is recognised as the Australasian road safety community's highest honour, recognising an individual for their outstanding commitment and effectiveness in their efforts to reduce road trauma. The Australasian College of Road Safety first instituted the award of College Fellow in 1991.

Fellows must be acknowledged by colleagues and co-workers as outstanding by virtue of contributions to road safety rather than their position. The contributions must be of such a nature that they have led to substantial growth and improvement in an important institution or organisation, body of knowledge or aspect of thought and practice associated with road safety. The award recipient is presented with a plaque and citation – there is no financial reward – but it is the College's highest honour.

About the Australasian College of Road Safety (ACRS)

The Australasian College of Road Safety (ACRS) is the region's peak membership association for road safety professionals, advocates, and members of the public who are focused on saving lives and serious injuries on our roads. The College provides an inclusive, collaborative environment promoting communication, networking, professionalism and advocacy across all spheres of road safety including policy, advocacy, research, innovation, technologies, and management. ACRS membership includes experts from all areas of road safety including policy makers, academics, community organisations, researchers, federal, state and local government agencies, private companies and members of the public.

Radar-based intersection collision avoidance system takes out top road safety award

A Queensland-based crash avoidance system has taken out one of Australasia's premier road safety awards, the 3M-ACRS Diamond Road Safety Award. The 3M-ACRS Diamond Road Safety Award recognises exemplary innovation and effectiveness in saving lives and injuries on roads.

The winning project, titled **'Hold the Red: Radar-based intersection collision avoidance system'**, was led by Peter Kolesnik, Director of Road Safety Programs at the Queensland Department of Transport and Main Roads (TMR). Team members on the project were Allan Hales, Manu Hingorani, Connor Broe, Denis Floyd, and Matt Baylis.

Above left to right: **Mr Andrew King, Group Business Manager for 3M Transportation Safety Division and 3M Commercial Solutions Division, Australia and New Zealand; Peter Kolesnik, Director of Road Safety Programs at the Queensland Department of Transport and Main Roads (TMR); ACRS President Mr Martin Small**

The 3M-ACRS Diamond Road Safety Award was presented by Mr Llew O'Brien, Federal Member for Wide Bay, QLD, along with Mr Martin Small, President of the Australasian College of Road Safety (ACRS), and Mr Andrew King, Group Business Manager for 3M Transportation Safety Division and 3M Commercial Solutions Division, Australia and New Zealand. The award ceremony was attended by over 500 of Australasia's foremost road safety professionals and advocates attending the ARSC2019 Conference Gala Dinner and Awards ceremony at the Adelaide Convention Centre.

Mr O'Brien congratulated all of this year's award winners for their contribution to improving road safety throughout Australia. "Thank you to everybody who has organised events and campaigns to focus the nation's attention on this important issue", he said.

"Every life lost on our roads is a tragedy, especially for the victim's family and friends, but it also has a ripple effect on local communities" Mr O'Brien said. "Road safety should be a priority for all of us and we can all do our part to help make Australia's roads safer."

ACRS President, Mr Martin Small, said "The Australasian College of Road Safety is delighted to continue our association with 3M in this highly sought after award. Congratulations to this year's winner, Peter Kolesnik and his team at Queensland Transport and Main Roads, for their well-researched application of a proven system to protect the life and health of people in our road traffic system."

3M representative Mr Andrew King said "3M is proud to again support this award, now in its 9th year and congratulates Peter and his team at TMR Queensland for the win. Through collaboration, innovation and team work this program shows what can be achieved through new technology in road infrastructure to assist in reducing road trauma on our roads. A well deserved 3M-ACRS Diamond Road safety award winner that could be replicated globally in our target toward zero."

Hold the Red (HTR) is an intelligent crash avoidance system that is installed into the Traffic Controller Cabinet at signalised intersections using a virtual loop card. The system uses radar to track each vehicle approaching an intersection up to 150m from the stop bar. This range provides the advantage of using radar over other alternatives such as existing induction loops as the radar system can dynamically track the speed of vehicles and predict when a vehicle approaching an intersection will not be able to stop in time. When such a vehicle is detected, HTR instructs the signal controls to extend the all-red phase by an extra two seconds. Law-abiding drivers in cross traffic lanes do not enter the intersection, reducing the chances they will enter into a potentially hazardous situation.

The Department of Transport and Main Roads (TMR), in conjunction with the Queensland Police Service (QPS), are trialling HTR at four intersections in South East Queensland. Installation at these sites was carried out between August and October 2018.

Queensland University of Technology Centre for Accident Research and Road Safety - Queensland (CARRS-Q) is conducting an independent evaluation of the functionality and road safety benefits of HTR. As at 27 May 2019, HTR had been activated approximately 14 times per day since installation across all four sites, with 3514 total activations. HTR has improved the safety of vehicles and pedestrians at each intersection where it is installed by reducing the risks of a collision due to red light running. There have been no recorded fatalities due to red light running at these intersections since installation.

Finalists for the 3M-ACRS Diamond Road Safety Award came from many areas including local and state government groups, police, not-for-profit organisations, industry associations and private companies.

Judges of the award evaluated all the entries in terms of problem solving, innovation in technology and thinking, and the benefits in reducing trauma. Cost-effectiveness and transferability to other areas were other key criteria.

Highly Commended Winners for 2019:

- **'PrepL: Innovation in Novice Driver Learning and Assessment'** Adam Higgins, Director, Project Delivery - Queensland Department of Transport and Main Roads; Team Members: Nadine Dumont and Leanne Edmonds
- **'Raised entre Road Tactile Road Markings'** Martin McLachlan, Office in Charge Mansfield Highway Patrol, Victoria Police; Team Member: Nathan Matthews (Vic Roads)
- **'ARILITY: Augmented Reality Road Safety Learning for Schools'** David Gribble, Chief Executive Officer, Constable Care Child Safety Foundation; Team Member: Ian Sloan

As the winning team leader, Peter Kolesnik will travel to the USA to visit 3M Global Headquarters in Minnesota. The ACRS and members of the road safety community across Australasia congratulate Peter Kolesnik and his team on their outstanding contributions and their 2019 3M-ACRS Diamond Road Safety Award win.

About 3M

The Transportation Safety Division at 3M is dedicated to improving traffic safety and mobility so motorists can arrive at their destinations faster and safer. 3M's high performance materials combine with innovative systems and services to help you bring the best roadway systems into reality. 3M have been your partner for over 75 years, and continue to bring innovation to the transportation safety industry.

Inaugural ACRS Young Leaders Oration Award goes to Dr Oscar Oviedo-Trespalacios

Congratulations to Research Fellow Dr Oscar Oviedo-Trespalacios who was presented with the inaugural 2019 ACRS Young Leaders Oration Award at the ACRS Award Ceremony at the Adelaide Convention Centre. The award recognises Dr Oviedo-Trespalacios's inspiring work and potential for future leadership in the field of road safety.

Above left to right: **Mr Llew O'Brien, Federal Member for Wide Bay, QLD; Dr Oscar OviedoTrespalacios; ACRS President Mr Martin Small**

The award ceremony took place in front of 500 of Australasia's foremost road safety professionals and advocates, and is deserved recognition of Dr Oviedo-Trespalacios's growing national and international reputation in distracted driver research.

The award was presented by Mr Llew O'Brien, Federal Member for Wide Bay, QLD, along with Mr Martin Small, President of the Australasian College of Road Safety (ACRS), during the 2019 Australasian Road Safety Conference (ARSC2019).

Mr O'Brien congratulated Dr Oviedo-Trespalacios for his contribution to research in the road safety field. "The work Dr Oviedo-Trespalacios is doing in this space is instrumental in helping to save lives on our roads" he said.

"There is no room for complacency when it comes to road safety" said Mr O'Brien. "We must push ahead with practical measures and infrastructure funding and research to drive road deaths towards zero."

Mr Martin Small said "The countdown is on to reach zero by 2050 and to get there, our profession needs to nourish the capability we have, foster new talent, and reflect the society that we live in. The Young Leader Oration represents a commitment from the Australasian College of Road Safety to a stronger and more diverse road safety workforce. The work to date of Dr Oviedo-Trespalacios has won the respect of the College Fellows, and as the inaugural winner of the College's Young Leader Oration Award he has a strong future ahead of him. I hope this award helps encourage a new wave of people entering road safety, and I'm looking forward to what Oscar has to say on the final day of the Conference."

Dr Oscar Oviedo-Trespalacios is a Research Fellow at the Centre for Accident Research and Road Safety-Queensland (CARRS-Q). He has researched driver behaviour safety issues such as risky driving behavior in international research projects spanning more than 25 countries.

Dr Oviedo-Trespalacios specialises in the behavioural adaptation of road users (drivers, cyclists and pedestrians) to technological change in transport systems, including the mis-use of technology such as mobile phones and advanced driving-assistance systems (ADAS). "We are making driving easier", he says. "We are freeing capacity for drivers to do other activities. These technologies are giving drivers the illusion of safety. As road safety practitioners, we always need to think ahead and consider the potential unintended consequences. We need to understand that technology alone will not increase road safety. We always need to consider the humans in the system."

Dr Oviedo-Trespalacios is among the 100 most published authors worldwide in the area of driver behaviour and cognitive ergonomics, and ranked 7th worldwide based on his impact on the field. He regularly publishes in major international journals and his research is widely reported in Australian and international media, including the ABC, the Independent, Men's Health Magazine, and the Washington Post.

For his win, Dr Oviedo-Trespalacios receives a plaque and the opportunity to present a 10-minute oration on any subject during a plenary session at the 2019 Australasian Road Safety Conference (ARSC2019). **The ACRS and members of the road safety community across Australasia congratulate Dr Oviedo-Trespalacios on his outstanding contributions and his 2019 ACRS Young Leaders Oration Award win.**

About the ACRS Young Leaders Oration Award

2019 is the first year that ACRS has offered the Young Leaders Oration Award. Nominations are sought from road safety professionals throughout Australia, New Zealand and the Pacific. Nominees must be 40 years or younger, must demonstrate active involvement in road safety, must show the potential for future leadership, and must be performing inspiring work. Winners receive a prestigious ACRS plaque in recognition of their work, plus the opportunity to make a presentation of their choosing to hundreds of professionals in the road safety field.

Above left to right: **ARSC2019 Paper Award winners Ben Beck, Elisa Ryan, Giulio Ponte with Matthew Baldock**

CONGRATULATIONS TO THE ARSC2019 PAPER AWARD WINNERS!

Peter Vulcan Award for Best Research Paper
Ben Beck
Monash University
"Single-bicycle crashes driving increase in serious injury rates in cyclists"

Road Safety Practitioners Award
George Vaeau
Accident Compensation Corporation
"Developing the Drive Community toolkit: Working with communitybased groups to support driver licensing education programmes"

Best Paper by a New Researcher Award
Long Truong
La Trobe University
"Exploring the road safety impacts of public transport: A case study of Melbourne"

Road Safety Poster Award
Danilo Messias
VicRoads
"Accelerating the supply of safer vehicles through Government fleet"

Conference Theme Award
Francis Taylor
Department of Transport
"Stop, Ask, Listen and Collaborate: Working Towards Zero with Local Government"

Best Paper by a New Practitioner Award
Elisa Ryan
Glenorchy City Council
" Full Gear – Community Youth Road Safety Program "

Best Paper with Implications for Improving Workplace Road Safety
Michael Holmes
Transport for NSW
"A Review on International Best Practices to Improve Heavy Vehicle Safety in Urban Environments"

Highly commended:
Marilyn Johnson
Monash University
"Truck drivers on bicycles: Insights from the first year of vulnerable road user training for heavy vehicle drivers"

People's Choice Award
Giulio Ponte
Centre for Automotive Safety Research
"Exploring the prevalence of in-vehicle distraction in moving traffic: A pilot study"

Diary

6-10 October 2019
26th World Road Congress
www.piarcabudhabi2019.org
Abu Dhabi, United Arab Emirates

18-20 Nov 2019
8th International Cycling Safety Conference
https://www.icsc2019.com/
Brisbane, Australia

19-20 February 2020
3rd Global Ministerial Conference on Road Safety
https://www.roadsafetysweden.com/
Stockholm, Sweden

16-18 September 2020
Australasian Road Safety Conference 2020
www.australasianroadsafetyconference.com.au
Melbourne, Australia

Peer-reviewed Papers

Original Road Safety Research

Pre-injury alcohol use and road traffic injury among patients at Mulago National Referral Hospital, Kampala, Uganda: Cross-sectional study

Claire Biribawa[1], Olive Kobusingye[1], Possy Mugyenyi[1], Ezekiel Baguma[2], Emmanuel Bua[2], Phoebe Hilda Alitubeera[1] and Nazarius Mbona Tumwesigye[3]

[1] Department of Disease control and Environmental Health, Makerere University College of Health Sciences, School of Public Health, P.O Box 7072, Kampala, Uganda
[2] Department of Surgery, College of Health Sciences, Makerere University, P.O Box 7072, Kampala, Uganda
[3] Department of Epidemiology and Biostatistics, Makerere University College of Health Sciences, School of Public Health, P.O Box 7072, Kampala, Uganda

Corresponding author: Claire Biribawa, Department of Disease control and Environmental Health, Makerere University College of Health Sciences, School of Public Health, P.O Box 7072, Kampala, Uganda.
Email: biribawaclaire@musph.ac.ug, Tel: +256777507827 / +256759027400

Key Findings

- Prevalence of pre-injury alcohol use was 29.7% among road traffic injured patients received at Mulago National Referral Hospital, Kampala Uganda
- Pedestrians were more likely to have used alcohol prior to injury compared to other road users, Prevalence ratio: 2.56 [CI: 1.20 – 5.48]
- Pre-injury alcohol use was associated with mortality at the emergency department, Prevalence ratio: 2.33[1.39 – 3.90]

Abstract

Background: Uganda has a high rate of road traffic injuries (RTI). Alcohol use increases traffic injury risk and severity through impairment of road-use skills and hazard perception. Few studies have examined this problem in Uganda. We therefore assessed the prevalence and determinants of pre-injury alcohol use among road traffic injured patients at Mulago National Referral Hospital, Kampala Uganda. **Methods**: We enrolled 330 eligible adult RTI patients consecutively in a cross-sectional study, at the emergency department in Mulago National Referral Hospital from March-May, 2016. We assessed pre-injury alcohol use using BACtrack professional Breathalyzer, alcohol intoxication assessment tool and alcohol use self-report covering the period of 6 hours before the injury. We assessed injury severity using Glasgow Coma Scale and Kampala Trauma Score. We estimated prevalence ratios [PR] using modified Poisson regression. **Results**: Prevalence of pre-injury alcohol use among injured patients was 29.7%. Pedestrians (44%) had the greatest percentage of alcohol use when compared to other road users. Pre-injury alcohol use was associated with mortality at the Emergency Department, PR: 2.33 [1.39 – 3.9]. **Conclusion and recommendations**: Pre-injury alcohol use is high among pedestrians and yet prevention efforts target mostly motorists. Pre-injury alcohol use also resulted into increased mortality at Emergency Department. We recommend prevention efforts to not only target motorists but also pedestrians.

Keywords

Alcohol, road traffic injuries, traffic deaths, pedestrians

Introduction

Road traffic injuries (RTI) are a major public health concern and one of the leading causes of death worldwide. Globally about 1.35 million road traffic deaths (RTDs) are registered annually. The incidence of RTDs is highest in the African region at 26.6 per 100,000 population despite the fact that this region has less than 1% of the world's vehicles (WHO, 2018). Uganda faces a severe RTI epidemic (WHO, 2013). The World Health Organization estimates Uganda's RTD rate to be 29 per 100,000. The 2013 annual crime and road safety report from Uganda Police indicated that more than 40% of the road traffic deaths involved vulnerable road users and more than half (52.5%) of the road traffic crashes reported nationally occurred in Kampala Metropolitan Area (Uganda Police, 2013).

Impairment by alcohol is an important risk factor for RTI (NHTSA, 2015), their severity and preclinical mortality (Stubig , Petri , Zeckey, Brand, Muller, & Otte, 2014). Alcohol use increases the chance that any road user will be involved in a traffic crash through impairment of processes required for safe road use which include judgment, vision, motor skills and hazard perception (WHO, 2007; Ogden & Moskowitz, 2004). Alcohol use also increases the possibility of involvement in high risk behaviors like speeding, violating traffic rules, non-use of protective equipment like helmets, seatbelts, among others (Aetukumana , Onumbu, & John, 2010; Gururaj, 2004). In addition, alcohol consumption has been reported to reduce the body's ability to recover from injury and increases the timeframe to recovery (Jung, et al., 2010)

In Uganda traffic fatalities caused under the influence of alcohol/drugs use were estimated to be 40% (Uganda Police, 2012) and previous research has shown alcohol to be a likely contributing factor to RTI (Kobusingye, Guwatudde, & Lett, 2001). Enforcement measures are inadequate (WHO, 2004; Galukande, Jombwe, Fualal, & Gakwaya, 2009; Uganda Police, 2013) though the Uganda Traffic Police Force engages in measures like random breath testing, mounting sobriety check points and suspending driving licenses to deter motorists from driving under the influence of alcohol (Uganda Police, 2013). There is limited public awareness on the risk of RTI posed by alcohol use to all road users (WHO, 2004; Galukande, Jombwe, Fualal, & Gakwaya, 2009; Uganda Police, 2013).

With the robust urbanization fuelling increased population and automobiles in Kampala, the burden of RTI is bound to increase if nothing is done to mitigate key risk factors like alcohol use (WHO, 2013). Unfortunately there is a paucity of information on the burden of alcohol related RTI and their risk factors. We therefore assessed the prevalence and factors associated with pre-injury alcohol use among RTI patients at the Emergency Department (ED) in Mulago National Referral Hospital (MNRH) Kampala, Uganda.

Methods

Study area and setting

This study was carried out in Kampala District, which is the capital city of Uganda (Figure 1). Kampala District has a population of approximately 1.75 million residents; and an estimated daily work force of 4.5 million (KCCA, 2014). Due to this large population and poor road infrastructure, road traffic crashes are more prevalent in Kampala than in any other part of the country (Uganda Police, 2013). This study was conducted at MNRH in Kampala because it receives about 95% of all the RTI that occur in Kampala District.

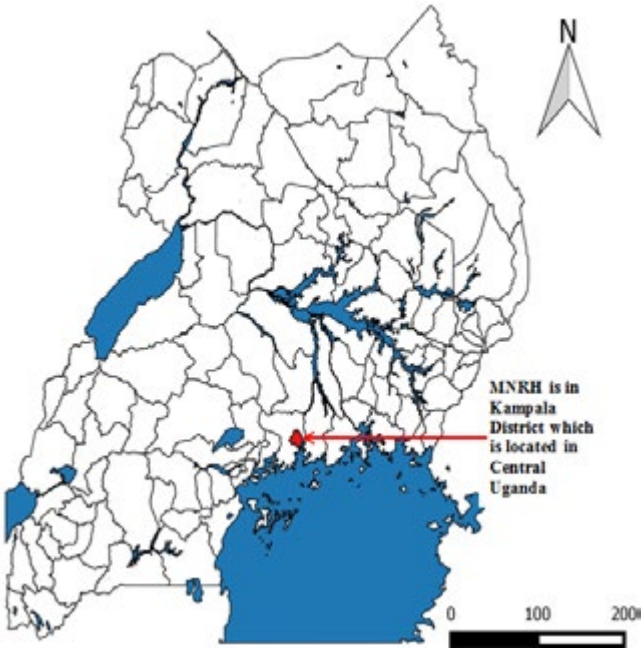


Figure 1: Map of Uganda showing Kampala District

Study design, tools and procedures

We conducted a cross-sectional study among adult RTI patients admitted at the emergency department (ED) of MNRH between March and May 2016. We calculated the sample size based on Kish Leslie's formula (Kish, 1965), which generated a sample size of 330 respondents. We used consecutive sampling, which is a non-probability sampling technique to select respondents and all subjects meeting the inclusion criteria were selected till the required sample size was achieved. We included only adult RTI patients (above 18 years of age) who arrived at the ED within 6 hours after a traffic crash. We excluded patients RTI patients from whom we were unable to get informed consent from either the patient or the caretaker of the patient.

The respondents were assessed for pre-injury alcohol use through 3 parameters. These included; clinical assessment using observation assessment of alcohol intoxication tool (WHO, 2001), alcohol use self-report covering the period of 6 hours before injury event and Breath Alcohol

Concentration level greater than 0.00% at the time of arrival to the ED using BACtrack S80 professional Breathalyser. A patient was defined as having had pre-injury alcohol use if they tested positive for any two of the used parameters after assessments. Pre-injury alcohol use was categorized into a binary outcome variable.

A structured questionnaire was used to collect information on the following variables: age, gender, religion, education status, marital status, time injury occurred, day of the week, nature of injury sustained, ED disposition (Treated and sent home, admitted to hospital inpatient or died at ED) and perceptions of alcohol use as a RTI risk factor (Yes, No or Unsure). We assessed severity of head injuries using the Glasgow Coma Scale (GCS) (Teasdale, Maas, Lecky, Manley, Stocchetti, & Murray, 2014). The severity of injury was also determined using the Kampala Trauma Score (KTS) (Weeks , et al., 2015) whose validity and reliability for use is described elsewhere (Mutooro , Mutakooha, & Kyamanywa , 2010). KTS is scored based on age, number of serious injuries, systolic blood pressure, respiratory rate and neurologic status on presentation. Mild injuries have a KTS of 9-10, moderate injuries have KTS of 7-8 and severe injuries have a KTS of 6 or less (MacLeod , Kobusingye , Frost , Lett , Kirya , & Schulman, 2003).

Statistical analysis

The data was imported to Stata version 12 for analysis. Descriptive analysis was done to obtain frequency distributions of the socio-demographic characteristics and nature of injuries sustained. Participants' characteristics were summarized and stratified by pre-injury alcohol use. We conducted bivariate level regression using modified Poisson regression to check for associations and relationships between independent variables and pre-injury alcohol use. Multivariable level regression analysis using modified Poisson regression was run to determine the adjusted effect of the independent factors with pre-injury alcohol use as the outcome variable. All variables that had a P-value of less than 0.2 at bivariate level were considered for multivariable level analysis. Forward elimination method was used to obtain a statistical model which indicated factors associated with pre-injury alcohol use. The multivariable model was adjusted for sex, level of education, religion, the time RTI occurred and day of week RTI occurred.

The relationship between nature and type of injury, severity and ED disposition with pre-injury alcohol use was assessed using Modified Poisson regression. This model adjusted for sex, age and type road user. We calculated prevalence risk ratios to measure the strength of association. All statistical tests were two-sided using a 95% confidence interval.

Ethical considerations

The Higher Degree and Ethics Committee approved this study prior to its commencement. Administrative clearance to implement the study was also obtained from Mulago National Hospital Ethical committee.

Results

Descriptive analysis of the respondents' characteristics

Twenty nine percent (29.7%) of the respondents had used alcohol prior to the RTI event. The mean BAC among those that tested positive using the Breathalyzer was 0.05% (S.D ±0.053) with a median of 0.04% (IQR: 0.07).

The mean age of the respondents was 30.2 years (±9.63) with a median of 28 (IQR: 10). Most of the injured patients were males 80% (264) compared to 20% (66) who were females. 75% of the adult patients with RTI were below 34 years of age. The highest proportion, 32.4% (107/330) of respondents were pedestrians followed by motorcyclists at 31.5% (104/330). The highest proportion of RTI patients, 40.6% (134/330) were injured in the morning /afternoon (7:00am – 4:59pm) and only 26.4% (87/330) in the night (11:00pm to 6:59am). The highest percentage of RTI patients were registered over the weekend days (Friday, Saturday and Sunday), though high numbers of RTI were also registered on Monday (Table 1).

Factors associated with Pre-injury alcohol use

Bivariate level

Factors independently associated with pre-injury alcohol use included level of education, religion, type of road user and time the injury incident occurred as seen in Table 2. Those that attained O-level and A-level education were less likely to have used alcohol at the time the injury incident occurred compared to those with no formal education (UPR: 0.48, CI: 0.28 – 0.82, UPR: 0.32, CI: 0.12 – 0.87 respectively).

Muslims and Pentecostals were less likely to have used alcohol at the time the injury event occurred when compared to Catholics and this was statistically significant (UPR: 0.31, CI: 0.16 – 0.60, UPR: 0.22, CI: 0.09 – 0.59) respectively.

Pedestrians had the greatest percentage of alcohol use (44%) when compared to other road users. The prevalence of alcohol use among pedestrians was 2.56 times that of vehicle occupants. The prevalence of the alcohol use among adult patients that were injured at night was 3.74 times that of the patients who were injured in the morning (UPR: 3.74, CI: 2.40- 5.75) as seen in Table 2.

Multivariable level

Multivariable models were built to analyze the correlates of pre-injury alcohol use among patients presenting to the ED with RTI. The factors that were statistically significant at multivariable level analysis included sex, level of education, religion and time the injury incident occurred. Pre-injury alcohol use was 38% less among females compared males (APR: 0.62, CI: 0.42 – 0.92) after adjusting for, level of education, religion, day of the week, time the injury event occurred and their perception towards alcohol use as seen in Table 2.

Table 1: Descriptive characteristics of the patients with RTI in MNRH, Kampala Uganda, 2016

	Frequency	Percentage
Sex		
Male	264	80
Female	66	20
Age group		
18 – 24	97	29.4
25 – 34	151	45.8
35 – 44	51	15.4
Above 45	31	9.4
Marital status		
Single	126	38.2
Married/ living together	180	55.5
Divorced/ Widowed	24	7.3
Level of education		
No education	48	14.5
Primary	122	37.0
O-level	95	28.8
A-level	31	9.4
Higher education	34	10.3
Religion		
Catholics	138	41.8
Anglican/Protestant	88	26.7
Moslem	62	18.8
Pentecostal	42	12.7
Type of road user		
Vehicle occupants	35	10.6
Bicyclist	10	3.0
Passenger on motorcycle	74	22.4
Motorcyclist	104	31.5
Pedestrians	107	32.4
Time the injury occurred		
Morning [7am – 5pm]	134	40.6
Evening [5pm – 11pm]	109	33.0
Night [11pm – 7am]	87	26.4
Day of the week injury occurred		
Monday	59	17.9
Tuesday	19	5.8
Wednesday	43	13.0
Thursday	39	11.8
Friday	54	16.4
Saturday	54	16.4
Sunday	62	18.8

The prevalence of alcohol use among patients who had attained A-level education was 62% less than that of patients who did not have any formal education and it was statistically significant (APR: 0.38, CI: 0.19 – 0.97) after controlling for, sex, religion, day of the week injury occurred, time the injury event occurred and their perception towards alcohol use.

Muslims and Pentecostals were less likely to have used alcohol at the time the injury event occurred when compared to Catholics after adjusting for sex, level of education, day of the week the injury occurred, time the injury event occurred and their perception towards alcohol use (ARR: 0.25, CI: 0.13 – 0.46, ARR: 0.34, CI: 0.14 – 0.83). Prevalence of pre-injury alcohol use among respondents injured at night was 3.30 times that of those injured in the morning after adjusting for sex, level of education, day of the week, religion and their perception towards alcohol use as seen in Table 2 (APR: 3.30, CI: 2.19 - 4.97).

Nature and severity of road traffic injuries and association with pre-injury alcohol use

Patients who did not sustain head injuries were less likely to have used alcohol prior to the injury incident after adjusting for sex, age and road user type (APR: 0.50, CI: 0.36 – 0.69). Considering head injury severity using GCS, the prevalence of alcohol use among those that sustained severe head injuries was 47% more when compared to those that had sustained mild injuries (APR: APR: 1.47, CI: 0.96 – 2.26) although it was not statistically significant (Table 3).

Based on the KTS, those that had moderate injuries were more likely have previously used alcohol close to the time the injury incident occurred when compared to those that had mild injuries (APR: 2.33, CI: 1.64 – 3.34).

It is also important to note that pre-injury alcohol use was more than twice as likely among patients who died at the ED when compared with those who were treated and sent home (APR: 2.33[1.39 - 3.9]), as seen in Table 3.

Table 2: Determinants of pre-injury alcohol use among RTI patients

	Alcohol use			
	Yes n [%]	**No n [%]**	**Unadjusted PR[CI]**	**Adjusted PR [CI]**
Sex				
Male	84 [31.8]	180[68.1]	1.00	1
Female	14[21.2]	52[78.8]	0.67[0.41– 1.10]	0.62[0.42 – 0.92]
Marital status				
Single	37[29.4]	89[70.6]	1.00	
Married/ living together	50[27.8]	130[72.2]	0.94[0.66 – 1.36]	
Divorced/ Widowed	11[45.8]	13[54.2]	1.56[0.93 – 2.60]	
Level of education				
No education	19[39.6]	29[60.4]	1	1
Primary	46[37.7]	76[62.3]	0.95[0.63 – 1.45]	0.83[0.56– 1.25]
O-level	18[18.9]	77[81.1]	0.48[0.28 – 0.82]	0.58[0.35 – 0.94]
A-level	4[12.9]	27[87.1]	0.32[0.12 – 0.87]	0.38[0.15 – 0.94]
Tertiary Education	11[32.4]	23[67.6]	0.82[0.45 – 1.49]	1.09[0.62 – 1.92]
Religion				
Catholics	58[42.0]	80[58.0]	1	1
Anglican/Protestant	28[31.8]	60[68.2]	0.75[0.53 – 1.10]	0.76[0.55 – 1.04]
Moslem	8[12.9]	54[87.1]	0.31[0.16 – 0.60]	0.25[0.13 – 0.46]
Pentecostal	4[9.5]	38[90.5]	0.22[0.09 – 0.59]	0.34[0.14 – 0.82]
Type of road user				
Vehicle occupants	6 [17.1]	29[82.9]	1	
Bicyclist	1[10.0]	9[90.0]	0.58[0.08 – 4.31]	
Passenger on motorcycle	12[16.2]	62[83.8]	0.94[0.39 – 2.32]	
Motorcyclist	32[30.8]	72[69.2]	1.79[0.82 – 3.93]	
Pedestrians	47[43.9]	60[56.1]	2.56[1.20 – 5.48]	
Time the injury occurred				
Morning [7am – 5pm]	21[15.7]	113[84.3]	1	1
Evening [5pm – 11pm]	26[23.9]	83[76.1]	1.52[0.91 – 2.55]	1.25[0.80 – 1.96]
Night [11pm – 7am]	51[58.6]	36[41.4]	3.74[2.40 – 5.75]	3.30 [2.19 – 4.97]
Day of the week injury occurred				
Monday	11[18.6]	48[81.4]	1	1
Tuesday	6[31.6]	13[68.4]	1.69[0.72 – 3.97]	1.59[0.76 – 3.34]
Wednesday	13[30.2]	30[69.8]	1.62[0.80 – 3.27]	1.63[0.94 – 2.82]
Thursday	14[35.9]	25[64.1]	1.92[0.97 – 3.80]	1.70[0.94 – 3.10]
Friday	18[33.3]	36[66.7]	1.78[0.92 – 3.44]	1.61[0.97 – 2.66]
Saturday	20[37.0]	34[63.0]	1.98[1.05 – 3.76]	1.63[0.97 – 2.75]
Sunday	16[25.8]	46[74.2]	1.38[0.70 – 2.73]	1.17[0.65 – 2.09]
Perceived alcohol as a RTI risk				
Yes	42[19.8]	170[80.2]	1	1
No	30[56.6]	23[43.4]	2.86[1.99 – 4.09]	2.60[1.83 – 3.69]
Unsure	26[40.0]	39[60.0]	2.02[1.34 – 3.02]	2.14[1.51 – 3.04]

Table 3: Pre-injury alcohol use with type and injury severity among patients with RTI at MNRH, Kampala Uganda, 2016

Characteristics	**Alcohol use**			
	Yes n [%]	**No n [%]**	**Unadjusted PR[CI]**	**Adjusted PR[CI]**
Number of serious injuries				
None	8 [22.2]	28[77.8]	1	1
One injury	52[26.4]	145[73.6]	1.25 [0.61 – 2.54]	1.15 [0.56 – 2.34]
More than one	38[39.2]	60[60.8]	1.96 [0.96 – 4.00]	1.67 [0.82 – 3.39]
Types of injuries				
Fractures				
Yes	57[32.2]	120[67.8]	1	1
No	41[26.8]	112[73.2]	1.12 [0.79 – 1.60]	1.14[0.82 – 1.60]
Concussion/closed head injury				
Yes	50[45.5]	60[54.5]	1	1
No	48[21.8]	172[78.2]	0.48 [0.34 – 0.67]	0.50[0.36 – 0.69]
Open head injury				
Yes	18[37.5]	30[62.5]	1	1
No	80[28.3]	202[71.6]	0.69 [0.46 – 1.05]	0.73[0.49 – 1.07]
Organ system injury				
Yes	8[57.1]	6[42.9]	1	1
No	90[28.5]	226[71.5]	0.54 [0.31 – 0.94]	0.64[0.38 – 1.1]
Injury severity using GCS				
Mild [13 & Above]	68[25.2]	202[74.8]	1	1
Moderate [9-12]	20[54.1]	17[45.9]	2.15[1.49 – 3.08]	1.69[1.12 – 2.55]
Severe [3-8]	10[43.5]	13[56.5]	1.72[1.04 - 2.87]	1.47 [0.96 – 2.26]
Injury severity using KTS				
Mild	18 [13.8]	112 [86.2]	1	1
Moderate	48 [35.3]	88 [64.7]	2.54[1.57 – 4.14]	2.33 [1.64 – 3.31]
Severe	32 [50.0]	32 [50.0]	3.61[2.20 – 5.92]	1.87[0.95 – 3.7]
Patient disposition at ED				
Treated & sent home	21[23.3]	69[76.7]	1	1
Admitted	70[30.4]	160 [69.6]	1.30[0.85 – 1.99]	1.26 [0.813 – 1.95]
Died in ED	7[70.0]	3[30.0]	3.00[1.72 – 5.22]	2.33[1.39 – 3.9]

Adjusted for Age , Sex and Road user type

Discussion

To date, studies looking at alcohol related RTI regardless of road user types are fairly limited. This study underscored the magnitude of alcohol- related road traffic injuries, associated factors, nature and severity of these injuries in Uganda, a sub-Saharan low-income African country.

Prevalence of alcohol use among road traffic injured victims

The prevalence of pre-injury alcohol use among all road users in this study was similar to that of commercial motorcyclists; 29.8% who reported to hospitals in Kampala with RTI (Tumwesigye, Atuyambe, & Kobusingye, 2015). Some studies have however reported higher levels of alcohol related RTI; 43% of motorcyclists and riders with RTI at a hospital in Taiwan were reported to have used alcohol prior to the injury incident (Liu, Liang, Rau, Shiun-Yuan ,

& Hsieh, 2015) while 42% of the motorcycle drivers tested positive for alcohol use (Peek-Asa & Kraus, 1996). Other studies show a range of 2% - 40% prevalence of alcohol or drugs use prior to the injury incident (Dasa, Gjerdeb, Gopalan, & Norman, 2012; Bogstrand, Hallvard , Norman, Rossow, & Ekeberg, 2012; Odero, Alcohol-related road traffic injuries in Eldoret, Kenya, 1998).

Alcohol use was high among pedestrians and motorcyclists. This study indicated that 44% of the pedestrians and 30.8% of the motorcyclists had used alcohol prior to the injury event. These results were higher than that from a survey of hospitalized RTI patients carried out in Kenya which revealed that only 20% of the pedestrian had used alcohol at the time of the traffic crash (Natulya & Reich, 2002). Most interventions have focused on car drivers leaving out the pedestrians and motorcyclists, whose road use skills are also impaired with alcohol use in addition to being highly vulnerable on the road.

Determinants of alcohol use among road traffic injured victims

Socio-demographic characteristics

Education was related to pre-injury alcohol use whereby those who attained O-level and A-level education were less likely to have used alcohol at the time of injury incident compared to those that had no formal education. This was similar to a study that reported highest levels of alcohol use among those with low levels of education (Van Heerden & Parry, 2001). This may give an impression that with education, there is better awareness of the risk factors for alcohol related RTI.

Religion was related to alcohol consumption, as expected, Muslims and Pentecostals were less likely to have used alcohol when compared to Catholics. In Uganda, Moslem and Pentecostal religions strongly prohibit alcohol use among their adherents. The most widespread prohibitions in the world on alcohol consumption are religious in nature with some religions regarding drinking alcohol as incompatible with leading a holy life (Room, et al., 2002). Religion thus offers a potential but unexplored strategy for reducing alcohol-related RTI (Davis , Quimby, Odero, Gururaj, & Hijar, 2003). This could be in the form of education campaigns to encourage religions to advocate alcohol use moderation among their adherents.

Alcohol use prior to the road traffic injury incident was noted more among males and those aged 35 – 45 years. Another study also showed that males were more likely to use alcohol than females prior to RTI (Liu, Liang, Rau, Shiun-Yuan , & Hsieh, 2015). This actually reflects the existing gender differences in alcohol consumption patterns in Africa (Davis , Quimby, Odero, Gururaj, & Hijar, 2003) where males are more likely to drink than females. Alcohol use was more frequent among those that were unmarried, separated, divorced or widowed when compared to those who were married. This is similar to another study that found that those who were not married were more likely to consume alcohol than those who were married (Heydaria, et al., 2016).

Type of road user

Pedestrians had the greatest percentage of alcohol use when compared to other road users. This is in line with other studies that found a higher alcohol use among pedestrians than other types of road users (Dasa, Gjerdeb, Gopalan, & Norman, 2012). High prevalence of alcohol use among pedestrians may indicate impairment in road use skills and practicing of safety precautions (Chalya, et al., 2012). In addition, the absence of pedestrian road safety features just increases the vulnerability of already impaired pedestrians (Museru & Leshabari, Road traffic accidents in Tanzania: a 10-year epidemiological appraisal., 2002; Museru , Leshabari, Grob, & Lisokotola, 1998).

To address alcohol-related RTI, it is important to establish the locations where impaired walking frequently occurs, the time of day and day of week when impaired walking are most likely to occur so as to put in place viable interventions. In Uganda, there is no enforceable legislation on legal BAC limit for pedestrians and its introduction and suitability requires careful consideration. Some countries have harnessed the prevention of drunk walking among pedestrians through protective custody legislations. For example, the Public intoxication act in South Australia provides rights to the police to detain without arrest any intoxicated pedestrian for reasons of their own safety (Holubowycz, 1995).

Time of injury event and day of the week

Time was strongly linked to alcohol use among RTI adult patients, with a strong association for those whose injury occurred at night (11:00pm – 7:00am). This was anticipated because alcohol in the Ugandan setting is consumed during night hours. This relates to another study that found alcohol intoxication to be more frequent among those injured in the night (Liu, Liang, Rau, Shiun-Yuan , & Hsieh, 2015). Since most of the alcohol consumption is done at night, alcohol related RTI are bound to be more common during that time.

There was no statistically significant association between alcohol use among adult patients with RTI and the day of the week. This is important information to enforcers who usually target only weekends. Contrarily, a study by Odero, et al., 1997 found a greater incidence of traffic injuries during weekends, compared to mid-week days (Odero, Garner, & Zwi, 1997; Odero & Zwi, 1995). Knowing the time and day of injury is therefore important in order to target prevention strategies (Chalya, et al., 2012).

Nature and severity of injury

The important role of alcohol use towards the outcomes of injuries sustained emerged in our study. Patients consuming alcohol before the injury event were more likely to suffer injuries to the head compared to those that had not consumed alcohol. This was similar to another study which found that patients with RTI and had used alcohol had more severe head injuries compared to those that did not (Odero, Garner, & Zwi, 1997). Alcohol impairment is linked to negligence in the use of protective equipment like helmets among motorcyclists and seat belts among occupants of vehicles

posing an increased risk of severe trauma and head injuries (Odero, 1998). A plausible explanation for this is that alcohol impairment causes poor hazard perception, limited use of protective equipment and poor defensive mechanisms to counter the energy transfer from the impacting vehicle thus increasing injury severity.

Based on KTS, those that had moderate injuries were more likely to have used alcohol at the time the injury incident occurred when compared to those that had sustained mild injuries. There was however no statistically significant association for those that sustained severe injuries. Findings from other studies revealed that those that had used alcohol were more likely to sustain less severe injuries compared to those that did not (Liu, Liang, Rau, Shiun-Yuan , & Hsieh, 2015) and higher BAC levels led to less severe injuries (Mann, Desapriya, Fujiwara, & Pike, 2011). Pre-injury alcohol use was however associated with death at the ED when compared to those who were treated and sent home.

Limitations of the study

Social desirability bias and poor recall could have occurred since the study involved obtaining self-reported information from respondents. In addition, it is possible that there were other uncontrolled factors that may have contributed to RTI in the pre-injury alcohol group. The level of alcohol impairment for patients coded into the pre-injury alcohol group could vary greatly to even include those that could unlikely be impaired by their pre-injury alcohol consumption. We recommend more rigorous studydesigns when assessing alcohol use based on Blood Alcohol Content to address these concerns.

Road users with RTI that did not seek hospital care from MNRH and those that resulted into fatality at the scene of the traffic crash were not captured in the study. This implies that the alcohol related RTI could realistically be higher than what is indicated. In addition, the relationship between alcohol use and injury severity may be stronger or weaker. This is due to the limited number of patients who were included in this study.

We cannot infer from the current data that alcohol use caused the RTI. Alcohol impaired motorists who may have caused road traffic crashes were not captured in this study. As such, RTI could have potentially been alcohol-related even if they themselves were not consumers of alcohol. The sample size was too small to allow separate examination of drivers and passengers, who may have had widely differing patterns of alcohol use and injury Regardless of these limitations, the prevalence of pre-injury alcohol use among patients with RTI indicated in this study still serves to highlight on the burden in Kampala, Uganda.

Conclusions

The prevalence of pre-injury alcohol use was high among pedestrians with RTI and those injured at night (11:00pm – 6:59am). Prevention efforts should not only target motorists but also pedestrians. Mortality at the Emergency Department was associated with pre-injury alcohol use. Pre-injury alcohol use and associated RTI should therefore be prioritized in road traffic injury control in Uganda.

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Competing interests

All authors declare no competing interests

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Road Safety Evidence Review

Simulators, driver education and disadvantaged groups: A scoping review

Lyndel Bates[1], Grégoire S. Larue[2], Ashleigh J. Filtness[3] and Alana Hawkins[2]

[1] School of Criminology and Criminal Justice and Griffith Criminology Institute, Griffith University, Brisbane, Australia
[2] Centre for Accident Research and Road Safety – Queensland (CARRS-Q), Institute for Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Australia
[3] Design School, Loughborough University, Loughborough, United Kingdom

Corresponding Author: Lyndel Bates, Griffith University, Mt Gravatt Campus, 175 Messines Ridge Road, Mt Gravatt, QLD 4122, Australia, L.Bates@griffith.edu.au, 61 7 3735 1429

Key Findings

- Simulators are a tool used to deliver driver education programs rather than being driver education in itself.
- There is no guidance within the literature regarding which driving skills should be targeted with the simulator, the length of this intervention or how it should be incorporated within programs for disadvantaged groups.
- A driver education program for indigenous populations that incorporates a driving simulator could not be found within the literature.
- There is a need for more research within this area.

Abstract

This paper examines simulators to deliver driver education programs for two very different populations (a) those who have specific impairments or intellectual disabilities and (b) those who may suffer disadvantage associated with their ethnicity. To do this we addressed two research questions (a) What role, if any, can simulation play as an education and/or training intervention for individuals disadvantaged because of individually-orientated concerns such as intellectual impairment or ADHD? (b) What role, if any, can simulation play as an education and/or training intervention for those who are disadvantaged because of their indigenous ethnicity? Technological developments have enabled the incorporation of driving simulators into driver education programs. A review of major databases using keywords identified 2,420 records. After duplicates were removed and screening occurred, thirteen studies were included in the review. The disadvantaged populations for the driver education initiatives that incorporated a simulator were very specific (e.g. intellectual disabilities) with no interventions for those disadvantaged because of ethnicity. A second search identified six papers that discussed interventions for indigenous populations. None of these interventions had a simulator component. The review highlights the need for high quality empirical research in the area of simulators, driver education and disadvantaged groups in order to inform policy development within this area. While there are some preliminary results indicating potential benefits, there is limited research evidence for an initiative of this type making it difficult to develop evidence based policy and practice. Therefore, when these types of initiatives are introduced, they need to be evaluated.

Keywords

driver education and training, novice drivers, driver simulators, young drivers, teen drivers, indigenous

Introduction and literature review

Young drivers experience the highest rate of crashes when compared with all other age groups of drivers (Williams, 2003) with several reasons for this including inexperience, social and situational factors, exposure factors and attributes related to the young driver themselves such as demographic, personality and developmental factors (Bates, Davey, Watson, King & Armstrong, 2014; Shope, 2006). There are many types of disadvantage that may affect young people that would like to obtain a licence. There are disadvantages, such as intellectual impairment or attention-deficit-hyperactivity disorder (ADHD), that are more individually orientated. In contrast, there are people who are disadvantaged because of their association with ethnic minority groups. Evidence suggests that young drivers with ADHD (Curry, Yerys, Metzger, Carey, & Power, 2019; Jerome, Segal, & Habinski, 2006), a mental disability (Brooks, Mossey, Tyler, & Collins, 2014) or a member of minority ethnic group such as indigenous Australians

(Cercarelli, 1994; Cercarelli & Knuiman, 2002; Clapham, Senserrick, Ivers, Lyford, & Stevenson, 2008), indigenous Canadians (Desapriya, Fujiwara, Verma, Babul, & Pike, 2011) and Maoris (Sargent et al., 2004) have an increased risk of crashing or other negative driving outcome.

A meta-analysis, that included studies conducted with samples of young drivers and drivers more broadly, identified that individuals with ADHD were 1.54 times more likely to experience a negative driving outcome. This included offences and as well as crashes (Jerome et al., 2006). A more recent study suggested that the risk of crashing for drivers with ADHD was lower at 1.23 times more likely once exposure was controlled for (Vaa, 2014). There appear to be a range of reasons for this increased risk including that drivers with this condition were more likely to be distracted while driving (Reimer, Mehler, D'Ambrosio, & Fried, 2010), engage in speeding behaviours (Vaa, 2014) and participate in unsafe driving behaviours more generally (Rosenbloom & Wultz, 2011).

Very little research in the field of driver education has been undertaken with individuals who have an intellectual disability since the 1970s (Brooks et al., 2014). It is therefore difficult to identify if these individuals have higher crash rates. Brooks et al. (2014) conducted exploratory research with four students aged in their early twenties who had intellectual disabilities (average IQ of 71.5). The results of their study were inconclusive with half of the participants demonstrating some improvement and half failing to demonstrate improvement.

As noted above, individuals from minority ethnic groups also have higher crash rates with indigenous Australians more likely to crash than non-Indigenous Australians (Clapham, Senserrick, Ivers, & Lyford, 2008) and indigenous Canadians more likely to crash when compared with the general population (Desapriya et al., 2011). Although, given that some jurisdictions such as New Zealand do not include ethnicity on traffic crash reports, it is sometimes difficult to identify if these groups are over-represented (Sargent et al., 2004) and the reasons for the over-representation. In these situations, it may be possible to obtain ethnicity information from other sources. For instance, Sargent et al. (2004) linked health records (which contained ethnicity) with police traffic reports in order to study the factors associated with fatal and non-fatal crashes that involve Maori. It is possible that some of the reasons for the over-representation of minority groups such as African-Americans are less likely to wear seatbelts than white Americans and they are more likely to drink and drive (Juarez, Schlundt, Goldzweig, & Stinson, 2006). Research suggests that Maori youth are unaware of the penalty regime for driving offences indicating that there is little deterrence effect of this measure (McDowell, Begg, Connor, & Broughton, 2011).

Driver education

One countermeasure aimed at reducing crash rates for novice drivers is driver education and training (Bates, Watson & King, 2006). Training refers to programs which aim to develop a person's skills required for driving. Education is a broader concept which may incorporate skills development but is also aims to provide other abilities that will enhance driving safety such as hazard perceptions skills (Langford, 2002). In order to increase young driver safety, driver education and training needs to address the various factors linked to crashes (Mayhew, 2007). In addition, individuals must be motivated to use what they have learnt and the education and training must be tailored to the group receiving it (Mayhew & Simpson, 2002). There are many different types of driver education and training including school-based driver training, resilience training, procedural skills training, hazard perception skills training and education, situation awareness training and insight training with research suggesting that effectiveness of each is varied (Beanland, Goode, Salmon, & Lenne, 2013).

The research evidence suggests that traditional, skills-based driver training has not reduced post-licence crashes or decreased the number of traffic offences (Elvik, 2010; Mayhew, 2007). For instance, improving the training of drivers in avoiding slippery road crashes through skid training in Finland did not result in a decrease of these events (Katila, Keskinen, Hatakka, & Laapotti, 2004). One possible reason for this is that the training made the drivers over-confident in their abilities.

Research has also considered the other effects of driver education apart from crashes. An evaluation of a one day program focussed on attitudes and risk perceptions as drivers, pre-drivers and passengers delivered within a school context within Australia suggested that those young people who completed the program reported riskier attitudes towards driving from the pre-program measurement to immediately after completing the program and then at the 6 week follow up period (Glendon, McNally, Jarvis, Chalmers, & Salisbury, 2014). Driver education may increase crash risk for novice drivers if it encourages them to obtain their licence at a younger age (Senserrick, 2007; Williams, 2006) or to progress through the licensing system at a faster rate. In New Zealand, young drivers who complete a driver education course progress through the graduated driver licensing system at a faster rate and obtain a full licence earlier. Research has shown that these drivers, who completed a driver education course and obtained their full licence sooner than those who did not complete a driver education course, have a higher involvement in crashes (Lewis-Evans, 2010) and have a higher risk of receiving a traffic offence within their first years of driving (Begg & Brookland, 2015).

However, there are some promising developments in the area of driver education. For instance, a large cohort study of young drivers in the Australian state of New South Wales identified that individuals who participated in a resilience-focused education program experienced reduced crash risk (Senserrick et al., 2009). This resilience-focused program included driver education issues as well as reduced risk taking more broadly. Approximately 500 students from a range of schools met at an off-site location for a 1 day seminar. This seminar is supported by range of additional activities including further workshops for students, fact

sheets for parents and professional development sessions for teachers, health workers and community members. The specific additional activities undertaken depends on the school (Senserrick et al., 2009). Another education program which appears promising involves a three part program. The first part involves a mock crash while the second and final parts are facilitated classroom sessions. The entire program takes approximately 3 hours with the second and third parts delivered by trained teachers employed by the organisation delivering the driver education program and accompanied by the students' regular classroom teachers. An evaluation of the program indicated that participants had stronger intentions to speak up as a passenger to attempt to prevent a driver speeding. It was not possible to evaluate the effect of the program on crashes and offences due to resourcing constraints (Lewis, Fleiter, & Smith, 2015).

Driving simulators

Driving simulators have strong potential for enhancing driver education programs due to the flexibility and control they offer. This is beneficial because it allows the trainer to specify the environment exposing the learner to a wide variety of situations in a shorter period of time than would be needed to experience the same situations on-road (Kappe, van Emmerik, van Winsum, & Rozendom, 2003).They are also able to expose novice drivers to situations that are high risk and train them to more effectively manage these situations (Fisher, Glaser, Laurie, Pollatsek, & Brock, 1998; Fisher et al., 2002; Regan, Deery, & Triggs, 1998). There is evidence to suggest that using driving simulators to educate novice drivers can reduce crash rates (Allen, Park, Cook, & Fiorentino, 2007).

Education incorporating a driving simulator improves a range of driving skills (Bates, Filtness & Watson, 2018). The use of simulator education and training does appear to improve hazard perception skills (e.g. Carpentier, Wang, Jongen, Hermans, & Brijs, 2012; Chapman, Underwood, & Roberts, 2002; Fisher, Young, Zhang, Knodler, & Samuel, 2017; Pradhan, Fisher, & Pollatsek, 2006; Regan, Triggs, & Godley, 2000a, 2000b; Thomas et al., 2011). This education and training appears effective after four days (Pradhan et al., 2006) and four weeks (Carpentier et al., 2012; Regan et al., 2000b). A longer term follow up does not appear to have been conducted. Likewise, individuals who completed visual scanning education and training within a simulator took shorter glances away from the road when compared with drivers who did not receive this intervention (Thomas et al., 2011). Additionally, attentional control and decision making skills can also be trained with the use of simulation (Gopher, 1996; Regan et al., 1998).

Another benefit of driving simulators is they are able to provide an indication of whether a young person is likely to pass a driving test (de Winter et al., 2009). They are also able to assist in the prediction of offending behaviour after a driving test is passed (de Winter, 2013). In other cases, simulator education and training appears to be ineffective. Although there is limited research conducted to explore the role of simulators in the education of people who are not young drivers, one study identified that educating and training older drivers with a simulator failed to improve their visual attention (Haeger, Bock, Memmert, & Huttermann, 2018) indicating that we need to develop a greater understanding of when driver education is enhanced by a driving simulator.

Thus, a body of research suggests that there may be benefits of augmenting driving education with a simulator for some groups of drivers. However, the current evidence is not sufficient to give clear guidance on the safety benefits of the use of simulators as an educational tool across all driver groups. This most likely depends on whether the skills that these groups lack are able to be improved through the use of driving simulators. Thus this paper identifies disadvantaged groups known, or assumed to be, at an increased risk of crashing and analyses the extent to which simulators might be useful in assisting these groups. This paper addresses two research questions: (a) What role, if any, can simulation play as an education and/or training intervention for individuals disadvantaged because of individually-orientated concerns such as intellectual impairment or ADHD? (b) What role, if any, can simulation play as an education and/or training intervention for those who are disadvantaged because of their indigenous ethnicity?

Method

Review Methodology

A scoping review is a form of systematic literature review used to assess evidence in emerging fields of study and thus inform practice, policy, education and research (Peterson, Pearce, Ferguson, & Langford, 2017). This scoping review process was informed by the methods of Arksey and O'Malley (2005) and Levac, Colquhoun, and O'Brien (2010). This approach conformed to the structure of defining the research question, identifying relevant studies, study selection and charting the data. This methodology has been used previously (e.g. A. Bates, Matthews, Simpson, & Bates, 2016; L. Bates, Rodwell, & Matthews, 2019; Jones, Simpson, Briggs, & Dorsett, 2016).

Identifying the research question

It was first necessary to define the terms disadvantage, driving simulator and driver education. It is plausible to consider all novice and/or young drivers as disadvantaged due to lack of experience and increased crash risk. The research team decided that the target population of interest would include only those who were deemed within a study as being disadvantaged in a way other than exclusively by their youth or novice status. It also became apparent that while disadvantage is often a barrier to driver safety, appropriate driver education can also be viewed in terms of cultural suitability. Studies that addressed driver education specifically for the needs of indigenous peoples were therefore considered separately from studies with populations disadvantaged due to illness, disability or socio-economic reasons. This review does not impose a definition of driving simulator; instead all studies in which

Table 1: Search terms

Driver education	"driv* train*" OR "driv* educat*" OR "adapt* educat*" OR "adapt* intervention*" OR "driv* intervention*" OR "tutor*" OR "instruct*" OR "teach*" OR "educat*" OR "train*" OR "supervis*" OR "practic*" OR "facilitate*" OR "mentor*" OR "coach*" OR "graduated driver licensing" OR "GDL" OR "GLS"
Driving simulators	driv* simulat*" OR "driv* simulat* program*" OR "similar*" OR "video*"
AND	
Student population	"learn* driv*" OR "novice driv*" OR "pre-learner driv*" OR "newly licensed" OR "inexperience* driv*" OR "provisional driv*" OR "teen* driv*" OR "intermediate driv*" OR "probationary driv*" OR "probationary licens*" OR "learn* licens*" OR "provisional licens*"
AND	
Disadvantaged population	"indigenous" OR "disadvantaged" OR "Aboriginal" OR "Native American" OR "American Indian" OR "native" OR "minority" OR "cultural adaptation" OR "Torres Strait Islander" OR "Maori" OR "Inuit" OR "youth" OR "young people"

the original authors described their intervention as including a driving simulator where considered. However, studies were considered out of scope if the driving simulator was used as a measurement tool rather than for education. Driver education was any form of delivery, including a brief intervention or multiple sessions that were designed to help someone learn to drive.

The review was conducted to answer the following two questions: What role, if any, can simulation play as an education and/or training intervention for individuals disadvantaged because of individually-orientated concerns such as intellectual impairment or ADHD? What role, if any, can simulation play as an education and/or training intervention for those who are disadvantaged because of their indigenous ethnicity?

Identifying relevant studies

Searching was carried out using the online databases Informit, ScienceDirect, Web of Science, Psych Info, TRID, OVID, ERIC, Scopus and Australasian College of Road Safety (an expected source of information on indigenous Australians) in March 2017. As can be seen in Table 1 search terms relating to driver education or driving simulators were combined with population descriptors. Date restrictions were from January 1945 to March 2017. Only papers written in English were included. Conference abstracts were excluded as they did not provide sufficient information about the interventions.

Study selection

The study selection process is summarised in Figure 1. Title and abstract screening was conducted by one member of the research team. This screening resulted in 644 papers being removed from the review as they were not relevant to the question. The full-text papers were considered initially by one member of the research team. For papers where she was not certain of eligibility of inclusion, all members of the research team read the full texts. This was for 26 studies. Additional papers were identified from screening the reference lists and papers citing the shortlisted studies. This provided an additional nine full texts.

Studies were included if the primary focus was on driver education for a targeted population that was identified as being disadvantaged. The intervention must have also included a driving simulator component, but did not have to form the entirety of the intervention. Our initial search indicated that there were no interventions for an indigenous population that included a simulator. However, given our interest in this population, our awareness of the difficulties indigenous individuals face when obtaining a learner licence and the subsequent effects on education and employment, we decided to examine other licensing interventions targeted at indigenous peoples. Papers regarding interventions specifically for indigenous peoples were required to include a learning to drive intervention that was developed, delivered or adapted to consider the needs of indigenous students. This intervention did not need to include a simulator.

Charting the data

Information on each of the final 13 studies was extracted and tabulated. Features of interest in the studies that were used to answer the research question were: target population and barriers to their driver education identified by the study, intervention features, simulator specifications, outcomes measured and key findings.

Results

Interventions incorporating simulators

Of the seven studies identified, all but one were conducted in the United States of America. The types of disadvantaged populations was limited to intellectual disabilities,

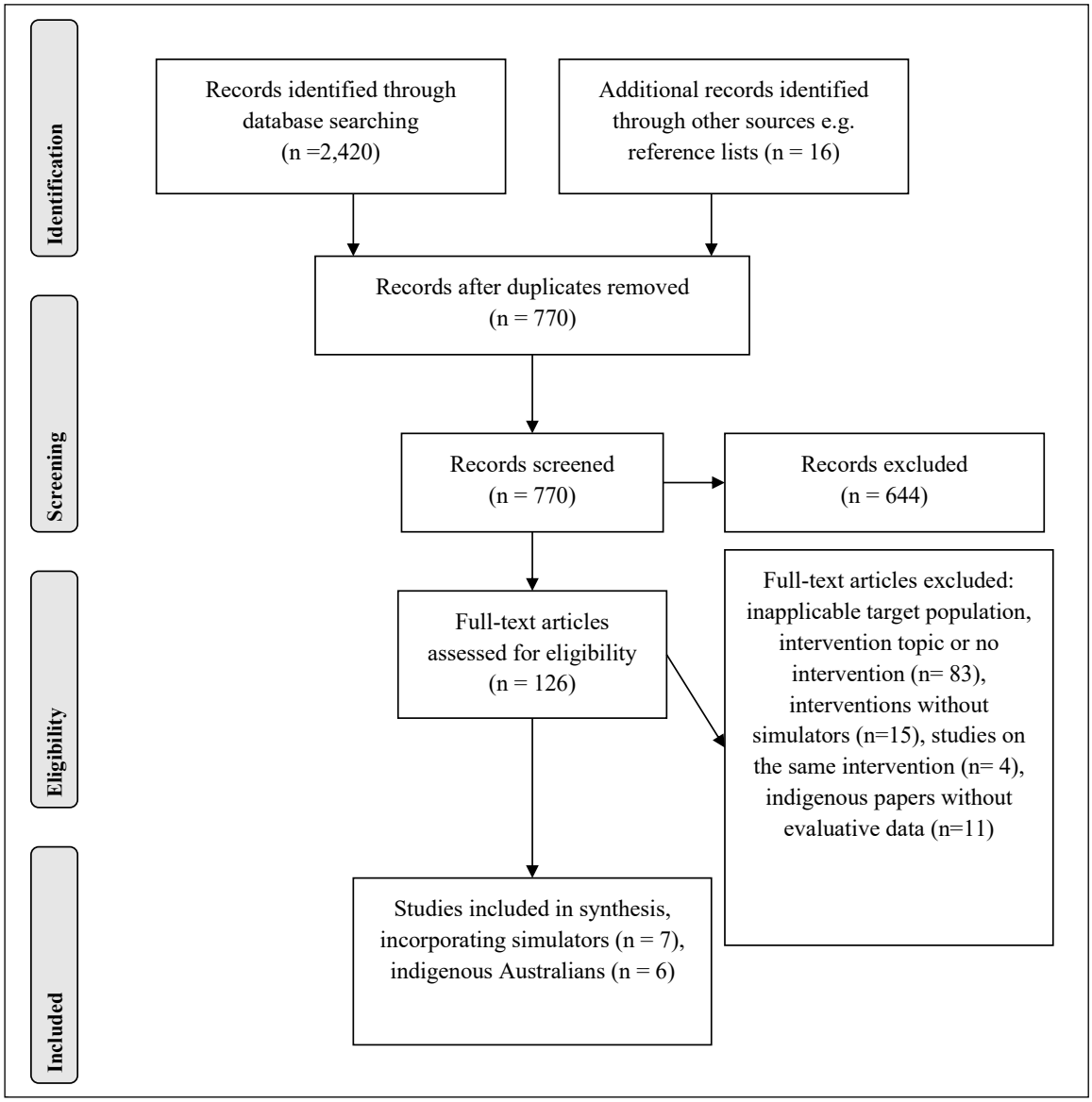

Figure 1: Literature review flow chart

attention deficit hyperactivity disorder and autism spectrum disorders. There were no studies that had an intervention with a simulator component conducted with an indigenous population. In only three studies was a comparison group used. The sample size ranged from six to 172 participants with three of the studies having less than eight participants. While all studies used a simulator within their intervention, one study also provided participants with practical education and training on a course, another provided sessions for both the young driver and their parents with a clinician and one included professional driving lessons.

Table 2 provides a summary of each study that was included within the review of interventions that had a simulator component. In all cases where information regarding the driving simulator was provided, they included the use of visual display screens. Many, but not all, included steering wheels as part of the hardware. The earliest study occurred in the 1970s (Zider, 1979). In this study the available simulator video was used without sound and had a physical instructor present to deliver appropriate instruction. This study identified that individuals were able to transfer what they had learnt in the simulator education and training to driving in a vehicle on a closed track. All subsequent studies were published from 2010 onwards. This suggests a recent increase in research interest regarding the use of driving simulators for driver education.

Two papers considered participants diagnosed with Autism Spectrum Disorder (ASD). The reasons for using a driving simulator for one study were that the simulator allowed drivers to safely focus on one skill at a time without the need to engage in other driving tasks simultaneously and driving task complexity could be introduced incrementally. Skills practised were upper body and lower body motor skills (Brooks et al., 2016). The driving simulator in the Wade et al. (2016) study was used because it could be adapted to the specific learning needs of people with ASD by providing

personalised feedback. For both studies, participants improved in simulator driving tasks after education. However, on road driving ability was not assessed. Brooks et al. (2016) found that controls and ASD participants improved equally with education. There was no control or comparison groups included in the (Wade et al., 2016) study.

Drivers with Attention Deficit Hyperactive disorder (ADHD) were considered in three studies. Simulators were used in very different ways for these studies. Fabiano et al. (2011) used sessions in the driving simulator to give the novice drivers objective feedback on their strengths and limitations. Naturalistic driving data was collected using in-car sensors pre and post-intervention and suggested a trend of reduced speeding and hard braking. Poulsen, Horswill, Wetton, Hill, and Mui Lim (2010) used the simulator as a standalone intervention and identified the benefit of being able to be delivered in a distraction-free environment that allowed for frequent rest breaks and a one-on-one relationship between student and trainer. The focus was hazard perception and participants performed significantly better on a hazard perception test than controls post intervention.

The most comprehensive study to date that has used a driving simulator as part of an intervention for disadvantaged groups was by Fabiano et al. (2016). This was an experimental study with participants diagnosed with ADHD randomly assigned to one of two different treatment groups (there was no control group). The first group completed the Supporting the Effective Entry to the Roadway (STEER) program. This program involves parents undertaking a behavioural parenting program as well as communication education and training with their adolescent. There are also driving focused interventions including parental monitoring of driving behaviours and contracts designed to encourage safe driving. The second treatment group completed the Driver Education and Driver Practice (DEDP) condition. This group completed driver education classes and supervised on-road driving practice. Both treatment groups also involved a simulator component. Participants were then followed up six and twelve months after the treatment was completed. The study examined the effect of the two treatments on parenting interactions and driving behaviour. The results indicated that the more comprehensive program, the STEER program, was effective in reducing observed negative parenting behaviour and adolescent self-reported risky driving compared to the less comprehensive intervention.

All of the studies exposed participants to the simulator in small numbers or individual sessions with the exception of the most recent study by Fabiano et al. (2016). This approach allows each participant individual time with the simulator. There is no consistency in duration of simulator programs between the studies ranging from one session of 34 minutes (Poulsen, Horswill, Wetton, Hill, & Mui Lim, 2010) to 27 sessions of 60 minutes (Brooks et al., 2014). There is also inconsistency between presenting the simulator education as a standalone intervention (Brooks et al., 2016; Poulsen, Horswill, Wetton, Hill, & Mui Lim, 2010; Wade et al., 2016; Zider, 1979) or as one component of a larger intervention incorporating other teaching methods. These other methods included motivational interviewing (Fabiano et al., 2011), facilitated driver education textbook study (Brooks et al., 2014) and a more comprehensive program that incorporated driving with a professional driving instructor on the road (Fabiano et al., 2016).

Not all studies had outcome measures and those that did varied on whether they were task-focussed or independent. For example, some studies considered education and training as successful by counting the simulator tasks which could be completed without error (Brooks et al., 2016; Brooks et al., 2014; Zider, 1979). This approach clearly demonstrates the ability to learn a specific task but it does not consider if that task is beneficial for learning to drive. Other studies measured skills which would be expected of safe driving, such as travel at or below the speed limit, hazard perception or a reduction in harsh braking episodes (Fabiano et al., 2011; Poulsen, Horswill, Wetton, Hill, & Mui Lim, 2010; Wade et al., 2016). These may be considered as safety performance indicators, for which there is independent research evidence linking such adverse behaviours to crash risk. As such it may be considered that simulator education and training interventions which enhance behaviour of these key safety areas would likely reduce novice driver crash risk. However, in order to conclude similar from studies where task error is an outcome measure it is first necessary to evaluate the education and training itself to identify which safety-related behaviours are being targeted.

While all studies cited previous research to justify their approach, only one study cited using theoretical frameworks to guide intervention design. Zider (1979) adapted two theoretical frameworks, for selecting the task to be taught and how to break the task into smaller steps to make it appropriate for people with intellectual disabilities.

Interventions targeting indigenous Australians

Although the search terms included other native peoples (such as ‘native American’, ‘American Indian’, ‘Maori’, ‘Inuit’, ‘minority’, ‘cultural adaptation’, ‘minority’ and ‘disadvantaged’), only papers related to indigenous Australians were found. An earlier review has considered reasons why it is difficult for indigenous Australians to obtain a driver licence (Cullen, Clapham, Hunter, Treacy, & Ivers, 2016). However, it did not consider interventions targeted at this group to assist them to gain a licence. The current review found six papers that discussed interventions aimed at assisting indigenous Australians to obtain a driver licence. The types of interventions varied but included learner driver mentor programs, train-the-trainer, small group activity interventions, case management and driving lessons. Most papers mentioned community ownership and responsibility for driver education as integral in making an intervention successful.

Table 3 provides further information regarding each of the papers included in the review. Two papers discussed learner driver mentoring programs (LDMP) that were made available to indigenous learner drivers and other community

Table 2: Interventions with a simulator component

1st Author, year, country	Study design features	Population targeted	Key features of intervention	Simulator features	Outcomes measured	Key findings/ results
Zider (1979) America	Quasi-experimental	Non-drivers with an IQ score between 40 and 55.	Participants (n=6) attended driving simulator sessions in pairs and took turns watching the other's education.	Link, Singer driving simulator, with car seat, gears, pedals, speedometer, steering wheel.	Trials, errors and time till success criteria met. Qualitative data.	All participants were able to demonstrate fewer errors after undergoing education and the simulator participants were able to transfer skills learnt in the simulator to the closed track.
Poulsen, Horswill, Wetton, Hill, and Mui Lim (2010) Australia	Quasi-experimental	Males with scores 1.5 SD above the normed mean on the ADHD Current Symptoms Scale for Adults.	After watching an instructional video on how to anticipate hazards, participants provided a spoken commentary of what they were paying attention to during footage of a road.	Driver point of view footage of true to life traffic interactions presented on a PC.	Reaction time in hazard perception test.	Participants who received the hazard perception training had significantly faster reaction times than a control group.
Fabiano et al. (2011) America	Feasibility study	Met DSM diagnosis criteria of ADHD via structured interview, IQ above 80, aged 16 or 17 years.	8 week parent and participant (n = 7) program featuring two 45 minute sessions per week. Parents and participants had a session alone with a clinician and then a joint session. A driving simulator was used to practise driving skills and raise awareness for the driver of their behavioural weaknesses.	Not provided	Top speed, time spent driving above 70 mph, sudden/hard braking and acceleration, Impairment Rating Scale (IRS), Driver Behaviour Questionnaire (DBQ), parent and participant satisfaction with intervention.	A trend of improvement was observed in all driving measures except sudden/hard acceleration with effect sizes ranging from 0-.30. Scores improved on the DBQ (effect size = .51).
Brooks et al. (2014) America	Pilot of program	Those meeting DSM criteria for an intellectual disability.	Three practice scenarios with visual and auditory feedback to alert to lane departures and cued stopping locations and three testing tracks that were advanced through upon successful completion of prior tracks.	Small-footprint DriveSafety CDS-250 driving simulator with adjustable driver's seat and standard automatic vehicle controls, dash board and three screens providing 110^{o} compressed field of view	Time spent per activity and track, no. of trials, lane marking and off-road contact, average speed.	Of the four participants, only one was able to complete all scenarios at all levels before study completion.

1st Author, year, country	Study design features	Population targeted	Key features of intervention	Simulator features	Outcomes measured	Key findings/ results
(Brooks et al., 2016) America	Experimental	Young adults aged 13-21 with diagnosed ASD and control	Education tasks were to turn the wheel and press the pedals to follow a static then moving target on screen.	DriveSafety CDS-250, fixed base with feedback, partial cab of a car with three monitors side by side, automatic vehicle controls.	Number of trials required to error free completion, total time to complete all levels, error size (in degrees), time to first error, total errors.	ASD and controls had non-significant differences on all measures except ASD participants requiring on average 30-35 minutes more time to complete the education.
Wade et al. (2016) America	Experimental	Adolescents aged 13-18 years diagnosed with autism spectrum disorder.	A desk-top driving simulator with advancing levels of activities to complete. Drivers using the desk-top simulator had their gaze monitored. Essential items in the visual field requiring attention were highlighted on the screen. They attended six sessions.	Virtual Reality Adaptive Driving Intervention Architecture (VIDA) that monitors gaze patterns and incorporates observer assessment. Displayed on a standard PC screen with steering wheel and three peddle controls (Logitech G27).	Trial duration and trial failures on a testing simulator task.	Both groups completed the testing tasks faster and with less errors after education (n=20). Comparisons between the two groups were not made.
Fabiano et al. (2016) America	Experimental	Adolescents aged 16-18 years diagnosed with Attention Deficit Hyperactivity Disorder	Twelve week intervention. Both groups engaged in weekly classroom instruction, practical driving lessons and three simulation exercises. One group also engaged in an eight week parent-teen intervention with a psychologist.	The simulator included a real car cabin with a steering wheel and pedals.	Parenting behaviours. Risky driving behaviours.	Those who received the additional eight weeks of parent-teen intervention had reduced negative parenting behaviours. This was maintained at the six month follow up and was waning at the 12 month follow up. The parent-teen intervention group self-reported fewer risky driving behaviours although this was not found in the naturalistic data.

Table 3: Interventions for an indigenous population

1st Author, year, country	Study design features	Population targeted	Key features of intervention	Outcomes measured	Key findings/results
McIlwraith (2001) Australia	Narrative account	Developed initially with an Aboriginal community then generalised to other communities.	Avoided computer-based activities in favour of group activities.	Uptake by communities and agencies. Participant licence test pass rates. Returning participants.	No formal statistical analyses were performed. Anecdotal reports were positive and suggested the resources aided users to get a driver licence.
McRae and Deans (2014) Australia	Qualitative interviews and quantitative survey	Young people from: lower socio-economic, rural, remote or Aboriginal communities as well as those who have unlicensed parents, are from single parent families or have other siblings of learner permit age.	Community-based programs that match novice drivers with an experienced volunteer driver who supervises a portion of their driving hours.	N/A	Thirty-two Learner Driver Mentor Programs were found to be in operation Australia wide. Eligibility criteria for participation varied between programs, the majority expressly include Aboriginal and Torres Strait Island communities.
Somssich (2009) Australia	Overview of impacts of legislative change and interventions.	Indigenous Northern Territory (NT) residents.	An intervention that was previously delivered over a single three week period was required to be delivered over two periods six months apart to comply with legislative change of mandatory six months learner permit status.	None	Changes to driver licensing that may be effective for mainstream drivers are frequently inappropriate for indigenous NT populations.
Freethy (2012) Australia	Qualitative program review	Those who can demonstrate disadvantage in obtaining a driver licence.	A network of Government funded programs that provide a volunteer mentor, who is an experienced driver, to a learner driver to aid in supervision of the mandatory 120 logbook hours of supervised driving.	Licence test pass rates and total supervised hours.	Fifty-five Victorian Government funded mentor programs were examined. Approx. 12,000 hours of supervision and 84 licences were achieved in one quarter of 2012.

1st Author, year, country	Study design features	Population targeted	Key features of intervention	Outcomes measured	Key findings/results
Cullen, Clapham, Byrne, et al. (2016) Australia	Process evaluation	Aboriginal Australians living in three areas: Redfern, Griffith and Shellharbour.	Providing individualised support to Aboriginal Australians through the case management support of an Aboriginal youth worker.	Participant characteristics and whether services were being delivered.	The pilot program is working well and is being delivered as planned.
Cullen et al. (2017) Australia	Process evaluation	Aboriginal Australians facing licensing issues living in remote areas of the Northern Territory.	Facilitate and assist individuals to obtain a provisional licence through a structured program.	Increase in number of licences held in remote communities.	Program is achieving licensing outcomes in remote areas.

members (Freethy, 2012; McRae & Deans, 2014). The intervention typically paired learners with volunteers to provide legally required logbook hours of supervised practice. One study identified that a focus on licence test pass rates was an insufficient measure for success. The authors highlighted that a focus on teaching driving skills did not mean that young people were being taught to drive safely (McRae & Deans, 2014). The second study found an improvement in safe driving attitudes and behaviour within communities. The disparity may be found in the specific programs reviewed by Freethy (2012), which were tailored to suit each community. This was done by working to prepare young people for the inevitable challenges of learning to drive in one community and engaging a highly respected local elder to manage the mentor program in another (Freethy, 2012).

Two papers described programs developed with close consultation and sensitivity to specific indigenous communities (McIlwraith, 2001; Somssich, 2009). These papers both developed an intervention that could be applied to other indigenous communities by being flexible enough to respond to each community's individual needs. McIlwraith (2001) described developing an intervention that was then implemented with other indigenous communities by producing a resource pack for distribution. Community agencies were then given packs to implement programs independently. The paper cited communities using resources in unintended ways such as in family groups with more diverse ages. The most recent paper (Cullen, Clapham, Byrne, et al., 2016) was a process evaluation of a case management approach. In this intervention, an Aboriginal youth worker assists individuals to access local services and mentoring as well as helping manage any licensing fines or sanctions by liaising with organisations such as transport and debt recovery offices.

All papers, bar one, lack substantial empirical evaluation of each program beyond pass rate statistics and informal qualitative data. Instead, the process of intervention development and delivery was the main topic for all papers. McIlwraith (2001) stated an intention to perform an evaluation of licence pass rates of participants in the future. Long term follow up information on road safety improvements was also unreported. However, Somssich (2009) noted factors such as inaccurate records, low literacy skills and unreachable former participants common in indigenous communities that may make research difficult.

Two of the papers were process evaluations. Cullen, Clapham, Byrne, et al. (2016) undertook a comprehensive process evaluation that included 194 individuals. They were able to identify that the intervention was being delivered as planned. No studies contained experimental designs to test program effectiveness or best practice. There was no information regarding sample sizes or comparison groups. The Cullen, Chevalier, Hunter, Gadsden, and Ivers (2017) study was a mixed methods design incorporating 30 interviews with program staff, clients and stakeholders as well as a quantitative analysis of licensing data

Discussion

As noted by Mayhew (2007) and Mayhew and Simpson (2002), there are several requirements for driver education and training to be successful in achieving crash reductions. Firstly, it needs to address the factors that cause crashes, trainees need to have the motivation to use what they have learnt and the training and education needs to be appropriate for the group that is receiving it. Simulators are actually mainly used as an evaluation tool (e.g. Filtness, Reyner, & Horne, 2012; Watling, Smith, & Horswill, 2014), rather than a tool to develop an enriched and targeted education program for disadvantaged groups.

The use of a driving simulator within driver education for disadvantaged groups is in its infancy, as apparent from the limited number of publications found during this scoping review. The reported studies tended to conclude that there were benefits resulting from the use of their intervention. This is promising and suggests that there are advantages in continuing to explore the use of simulators to improve driver

education for these groups. One encouraging finding from Zider (1979) is that participants who undertook the simulator education were able to transfer what they had learnt to their driving in a vehicle while on a closed track. This is important because it demonstrates that participants were able to retain what they had learnt while in a simulator and then transfer it to a different context.

Additionally, research has shown hazard perception training to be effective in improving the hazard perception skills of drivers (e.g. Castro et al., 2016; Horswill, 2016; Horswill, Garth, Hill, & Watson, 2017; Vlakveld, 2014; Wetton, Hill, & Horswill, 2013). Therefore the fact that the Poulsen, Horswill, Wetton, Hill, and Lim (2010) study indicates that this training is also effective for minority groups such as those with ADHD is an important finding. This indicates the importance of taking training and education concepts that have been demonstrated as effective and evaluate them with different groups. These benefits were identified despite some non-significant findings, small sample sizes, lack of a control group and experiencing difficulty with participants completing the intervention in full across the studies included. Additionally, the types of disadvantaged groups considered are very limited in scope, with a focus on intellectual disabilities, attention deficit disorders and autism. Populations with social or economic disadvantages, such as remote or indigenous populations, and the use of simulators to help educate drivers in these groups and thus reduce the effect of these disadvantages, has been completely disregarded by the research community so far.

It is important to note that simulators are a tool that is used to deliver driver education programs rather than being a driver education program itself. Simulators are presented in the reviewed papers as being flexible, as they provide control over the cognitive load of novice drivers, and hence allow learners to acquire driving skills at their own pace. They were also used at different points in the learning process. In some cases they were used for individuals that had no driving experience and in other situations for individuals who had some on-road experience. While there is no research evidence from the studies above suggesting that there is an optimal time in the learning process to use a simulator for education, the work by Regan et al. (1998) suggests that it is more beneficial to provide this within the intermediate licensing phase.

Most of the reviewed studies used the simulator to teach vehicle control skills rather than higher level skills such as hazard perception. The studies did not provide any guidance toward which skills should be targeted with simulators, the necessary duration of education in the simulator, whether a simulator could be used as a standalone tool, or otherwise, how to effectively incorporate it within a program.

The studies also had limited scientific validity: they used low sample sizes, and more importantly they lacked the presence of a control group. Overall, they did not evaluate whether the skills learnt in the simulator transferred to the real road (except for one study on a test track), and whether the helped participants to become safe drivers. No study mentioned whether the education and training led to the participants obtaining a driver licence and then driving on-road. Given that incorporating simulators into driver education programs for young drivers shows promise (Hirsch & Bellavance, 2017), there is a need to consider their effect on disadvantaged populations.

No education program for indigenous populations using a driving simulator could be found in the literature. The limited literature found in our review is consistent with the review by Cullen, Clapham, Hunter, et al. (2016) which included 12 papers regarding barriers for indigenous people wishing to obtain a driver licence. In the current review, the included studies lacked scientific rigour and focussed on describing interventions targeting this group. Different interventions for indigenous populations were focussed on increasing the chance of obtaining a driver licence as opposed to improving road safety. Such an approach is the result of the difficulties inherent to the development of interventions for this disadvantaged group, with the need to overcome literacy issues, adapt programs to the local culture, and provide the intervention with the assistance of local partners. This is often challenging, but crucial to the long term success of interventions.

While a greater proportion of indigenous people live in rural and remote locations, research suggests that this geographic context is important for people regardless of ethnicity (Edmonston, Sheehan & Siskind, 2009). Thus there is a need to investigate how interventions that incorporate a driving simulator can be used in areas of sparse population. The use of PC based interventions is one option as this removes the requirement to take a more traditional simulator to each location. It also enables education to occur for larger groups of individuals. Research with a sample of high school students aged 16 and 17 years within the United States of America indicates that it is possible to use PCs to develop risk awareness skills (Fisher et al., 2002).

However, it is not possible to transfer an education program from one platform to another. When deciding what type of simulator is appropriate for a driver education and training program, two important considerations are fidelity, or similarity to real-life, and validity. There are two types of fidelity: physical fidelity and psychological fidelity. Validity refers to how effectively behaviours learnt in a driving simulator transfer to real life (Bates, Filtness & Watson, 2018). It is possible to have a low-fidelity simulator which has high validity. These are important considerations because research suggests that simulators with different levels of fidelity have different effects on novice driver crash rates (Allen et al., 2007).

Very few evaluations of driver education initiatives are undertaken despite them being needed to ensure the implementation of evidence based policy (Glendon, 2014). Our review indicates that there is a clear need for a significant amount of further research regarding the inclusion of simulators into driver education programs for disadvantaged populations. Additionally, there is a need for research that identifies how much education in a simulator is optimal and whether this should be self-paced. The outcome measures included in the reviewed studies make it difficult

to identify the safety and crash reduction benefits of these types of programs. Future research needs to collect evidence regarding this, either by a longitudinal examination of crash and offence records or by measuring a behaviour which is known to be associated with crash risk such as travelling above the posted speed limit.

A limitation of this study is that, while there were a number of search terms used to identify groups that may have been 'disadvantaged' as the result of their ethnic minority status, there were no search terms used to identify other forms of disadvantage such as intellectual disability, ADHD or geographical remoteness. Therefore, the results and conclusions are restricted and do not address these factors. Caution should be used when interpreting findings and conclusions. Future research could address this limitation by including more specific search terms to address these factors.

Conclusions

This review has investigated the research evidence for interventions that could be used to improve the safety of disadvantaged young people on the roads by reducing crashes and injuries. There are limited studies within this area highlighting the lack of research evidence for an initiative of this type making it difficult to develop evidence based policy and practice. However, based on the studies reviewed it does appear that (a) simulator education and training can be retained and transferred to practical contexts (b) Hazard Perception Training, which appears to have some benefits for mainstream drivers, may also have some benefits for those with ADHD and (c) indigenous programs are more focussed on obtaining a drivers licence rather than improving road safety. There is a need to conduct further research regarding the incorporation of a driving simulator into education and training for disadvantaged groups with a particular need for theoretically grounded research regarding those who are disadvantaged for social or geographic reasons such as young people living in remote areas or indigenous persons.

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Road Safety Policy & Practice

The effect of sanctions on Victorian speeding drivers

Kelly Imberger[1], Angela Watson[2] and Sherrie-Anne Kaye[2]

[1]Department of Transport (formerly VicRoads), Melbourne, Australia

[2]Queensland University of Technology - Centre for Accident Research & Road Safety – Queensland, Australia

Corresponding Author: Kelly Imberger, Level 10, 1 Spring Street, Melbourne, 3004, kelly.imberger@roads.vic.gov.au and +61 3 9854 2981.

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Key Findings

- Licence bans from speeding offences had a positive road safety effect both while drivers were banned from driving and once licensed after a ban.
- Increases to speeding ban periods for speeding offences introduced in 2002 were effective in reducing speeding offences and crashes.
- Increases in demerit points for speeding offences introduced in 2002 did not influence speeding offences but did reduce casualty crash rates.
- Offenders with a 12-month speeding ban and a subsequent demerit point ban had higher speeding offences and casualty crash rates than those who only received a 12-month speeding ban and no demerit point ban.
- Successfully completing a Good Behaviour Bond (Extended Demerit Point Period) after reaching the demerit point threshold for licence ban resulted in fewer speeding offences and casualty crashes compared with the period before the Good Behaviour Bond was served.

Abstract

Speeding is a major contributor to deaths and serious injuries in Australia. To assist in speed countermeasure development, VicRoads commissioned an examination of speeding offenders' characteristics, re-offence and casualty crashes during and after periods of licence sanctions. These analyses aimed to determine the effects of the following sanctions: licence bans; the increase in speeding ban periods and demerit points for higher level speeding offences; additional demerit point bans for high-range offenders in addition to a 12-month speeding ban; and the good behaviour bond available as an alternative to the licence ban after reaching the demerit point threshold. The study had several positive findings, for example licence bans from speeding offences reduced speeding re-offending and casualty crashes; and there were lower re-offence rates for those who elected to take the good behaviour bond when reaching the demerit point limit.

Keywords

Speed, sanctions, demerit points, good behaviour bond, licence ban, offence rates, crash rates

Introduction

Speeding is a major contributor to deaths and serious injuries on Australian roads. Department of Transport's (VicRoads) crash statistics, where Victoria Police assign a probable cause, show that approximately 30% of Victorian fatalities are due to speed (average for 2013/14 to 2017/18). Speeding behaviour not only increases the risk of crashing, but also increases the severity of the crash outcome (Kloeden et al., 2002). Despite many drivers recognising that speeding increases crash risk and the risk of serious injuries (Fleiter & Watson, 2006), speeding behaviour is often considered relatively socially acceptable and many drivers continue to speed (Fleiter et al., 2016).

Speeding countermeasures such as enforcement and public education campaigns are widely used to encourage drivers to comply with the posted speed limits. Evidence suggests that these countermeasures have resulted in significant reductions in crashes in Victoria and elsewhere (e.g., Delaney et al., 2003; Newstead & Cameron, 2003; Newstead et al., 1995; Tay, 2005). Other countermeasures exist to assist in managing speeding drivers. These countermeasures include the setting of speed limits and road design features to limit speeds (e.g., engineering treatments such as traffic calming devices (World Health Organization (WHO), 2008)). In addition, a range of penalties and sanctions exist

Table 1. Speeding penalties before and after 15 December 2002

Penalties (prior to 15 December 2002)			New Penalties (after 15 December 2002)		
Speed of vehicle	**Minimum ban period**	**Demerit points**	**Speed of vehicle**	**Minimum ban period**	**Demerit points**
Exceed speed limit by 15 km/h or less		1	Exceed speed limit by 10 km/h or less		1
Exceed speed limit by 15 km/h or more, but less than 30 km/h		3	Exceed speed limit by 10 km/h or more, but less than 25 km/h		3
Exceed speed limit by 30 km/h or more, but less than 40 km/h	1 month	4	Exceed speed limit by 25 km/h or more, but less than 35 km/h	1 month	4
Exceed speed limit by 40 km/h or more, but less than 45 km/h	4 months	4	Exceed speed limit by 35 km/h or more, but less than 45 km/h	6 months	6
Exceed speed limit by 45 km/h or more, but less than 50 km/h	4 months	6	Exceed speed limit by 45 km/h or more	12 months	8
Exceed speed limit by 50 km/h or more	6 months	6			

that aim to deter speeding behaviour and are applied after an offence has been detected. These countermeasures differ in their level of severity and can be considered as part of a suite of behavioural change measures and as part of a general and specific deterrence model to influence drivers to comply with speed limits. Commonly used speeding penalties and sanctions in Australia include demerit point penalties, monetary fines, licence bans (a sanction where a driver is not allowed to drive for a set period of time) and vehicle impoundment.

The application of demerit points for offences is one of the primary countermeasures used to deter drivers from driving behaviours that increase crash risk and to encourage safe driving behaviour. In Victoria, accumulation of 12 or more demerit points in three years results in a licence ban (suspension)[1] for a fully licensed driver. Alternatively, offenders may take a 12-month extended demerit point period or good behaviour bond (GBB), where if they accumulate further demerit points within the 12-month period, their driver licence or learner permit will be suspended for double the original suspension period. A licence ban (suspension) may also occur if a driver commits a more severe speeding offence (e.g. driving over 25 km/h, but less than 34 km/h results in an automatic licence suspension of three months in Victoria) (VicRoads, 2019).

Castillo-Manzano and Castro-Nuño (2012) conducted a meta-analysis of 26 studies on the effectiveness of demerit points on traffic crashes, injuries and fatalities. The review concluded that demerit points resulted in a 15% to 20% reduction in crashes, injuries and fatalities. However, the positive impacts of demerit points were reported to diminish in less than 18 months from the introduction of a point system. Further, Corbett and colleagues (2008) researched licence bans and found the threat of a licence ban was effective at reducing speeding behaviour. However, drivers who had been previously disqualified from driving were not reformed by receiving a licence ban.

Overall, relatively few investigations have assessed the effectiveness of post-apprehension speed-related countermeasures including licence bans, demerit points and GBBs for the speed offender population. There has been a range of changes to speeding sanctions over time in Victoria, particularly in December 2002 with increases to ban periods and demerit points for higher level speeding offences. This paper details an evaluation of the effectiveness of these countermeasures. Table 1 displays the changes in the ban periods and demerit points in 2002 and relates to one of the analyses undertaken (titled 'Increase in speeding ban periods and demerit points on 15 December 2002 for higher level speeding offences'.). The table also demonstrates how speeding offence bands were changed.

To assist in speed countermeasure development an examination of speeding offenders' licensing and offence history was undertaken to understand their characteristics,

[1] A licence ban in Victoria is a sanction where a driver is not allowed to drive. A ban can be a cancellation or a suspension of the licence. If a driver licence was cancelled, then when the ban ends, payment must be made by the driver to re-instate the licence. However, at the end of a suspension, the licence will automatically be re-instated.

Table 2. Four sanction evaluations – statistics and analyses undertaken

Sanctions evaluated	Statistics applied	Analysis details
Licence bans for speeding offences	Rate ratios	Comparison of licensing periods as per Figure 1
Increase in speeding ban periods and demerit points on 15 December 2002 for higher level speeding offences	Rate ratios Z-tests	Intervention and comparison groups before and after 15 December 2002
Additional demerit point ban(s) for high-range offenders in addition to a 12-month speeding ban	Rate ratios	For the total licensed driving period after the index offence (not including any ban from driving) for those with a high-range speeding offence (45 km/h over the limit or 145 km/h in a 110 km/h zone) compared with the same licensed period for three other groups
The GBB available as an alternative to a licence ban after reaching the demerit point threshold	Rate ratios	Before and after successful completion of the GBB. Offenders on a GBB versus offenders who opted for a three-month demerit point suspension

re-offence rates and casualty crash rates during and after periods of licence sanctions. The project evaluated four sanctions targeting speeding drivers:

1. licence bans for speeding offences
2. the increase in speeding ban periods and demerit points on 15 December 2002 for higher level speeding offences
3. additional demerit point ban(s) for high-range offenders in addition to a 12-month speeding ban
4. the GBB available as an alternative to a licence ban after reaching the demerit point threshold.

Methods

Data preparation

Drivers convicted of a speeding offence committed between 1 January 1996 and 31 December 2014 were considered eligible persons for all four sanctions analyses. Data files relating to speed and dangerous driving offences (from 1 January 1994 to 31 December 2014), licence status changes, bans from driving, licence conditions and driver demographics were provided from the VicRoads Driver Licensing System (DLS). The crash involvement file was provided from the VicRoads Road Crash Information System (RCIS). The first speeding offence for each offender in the time periods analysed in each sanction analysis was deemed to be the index offence. Offenders holding only a motorcycle licence were excluded from the data. Also, where possible, offences committed whilst driving a motorcycle or a truck were also excluded.

Statistics applied to each of the four speed sanction analyses

The analyses involved calculating rates of speed offending and crashing per 1,000 licence person-years. Rates (based an adaptation of the method used by Siskind (1996)) were calculated for the analyses on each of the four sanctions in Table 2 (further explanation is provided in the text below).

To test the differences in speed offence or crash rates across the different time or licensing periods (Figure 1), rate ratios were calculated, separately for all casualty crash rates and speeding offence rates (e.g., rate per 1,000 licence person years of speeding offending during ban or time period / rate per 1,000 person licence years of speeding offending between index offence and ban start or for the time period) at a statistical significance level of $p < .01$ to account for large sample sizes.

Confidence intervals for each of the rate ratios were calculated as follows:

95% Lower confidence level = $\mathrm{EXP}[\ln(Rate\ Ratio) - 1.96 \times SE]$
95% Upper confidence level = $\mathrm{EXP}[\ln(Rate\ Ratio) + 1.96 \times SE]$

Where: $$SE = \sqrt{\left(\frac{1}{X_1} + \frac{1}{X_2}\right)}$$

Where: X_1 = No. of offences/crashes in period 1 and X_2 = No. of offences/crashes in period 2

Interpretations of any statistically significant difference in rates were based on the confidence interval not including the value 1. If the rate ratio was above 1 then one period (in the numerator) had a higher rate than the period it is being compared with (in the denominator). However, if the rate ratio was below 1 it would have a lower rate (e.g., a rate ratio of 0.5 for comparing a ban period to the licence period would suggest that there was a lower rate (50% lower) of

offending per 1,000 person-years during the ban period than during the licence period).

For comparisons between the rate ratios (pre to post) for intervention groups and comparison groups, a Z-test for the difference in log odds was used:

X_1 = No. of speed offences/all casualty crashes in period 1 for the treatment group

X_2 = No. of speed offences/all casualty crashes in period 2 for the treatment group

X_3 = No. of speed offences/all casualty crashes in period 1 for the control group

X_4 = No. of speed offences/all casualty crashes in period 2 for the control group.

If the Z-test was statistically significant this indicated that there was a difference between the change from pre to post for the treatment and the change from pre to post for the control. Confounding variables were identified and accounted for using a Generalised Linear Model (GLM).

Speed sanction analyses

Licence bans for speeding offences

This analysis examined speeding offence and casualty crash rates to determine the effectiveness of licence bans due to a speeding offence. The evaluation considered whether speeding drivers' crash and offences rates differed across the following periods within the licensing cycle (Figure 1):

a. between the speeding offence and the start of the ban ('pre-licence ban' – there is a 28 day grace period before the ban begins)
b. 'licence ban' (ranging from one to twelve months or longer if multiple bans applied)
c. licensed after ban ('licensed ban finished')
d. post-ban unlicensed (re-licensing not sought after a second ban disqualifying the driver following the initial speeding ban) ('unlicensed').

Increase in speeding ban periods and demerit points on 15 December 2002 for higher level speeding offences

In order to assess the effects of changes to speeding offences (demerit points and bans) in December 2002 (changes are outlined in the introduction - Table 1), intervention groups and comparison groups were identified within the relevant study time periods (Table 3 and Table 4). The tables also indicate the number of offenders (N) in each group.

Increase in suspension periods
Table 3 outlines the intervention and comparison groups for this analysis:

- Intervention group A - second highest tier speeding offence, where the ban period increased from four to six months
- Intervention group B - highest tier speeding offence, where the ban period increased from four to twelve months.

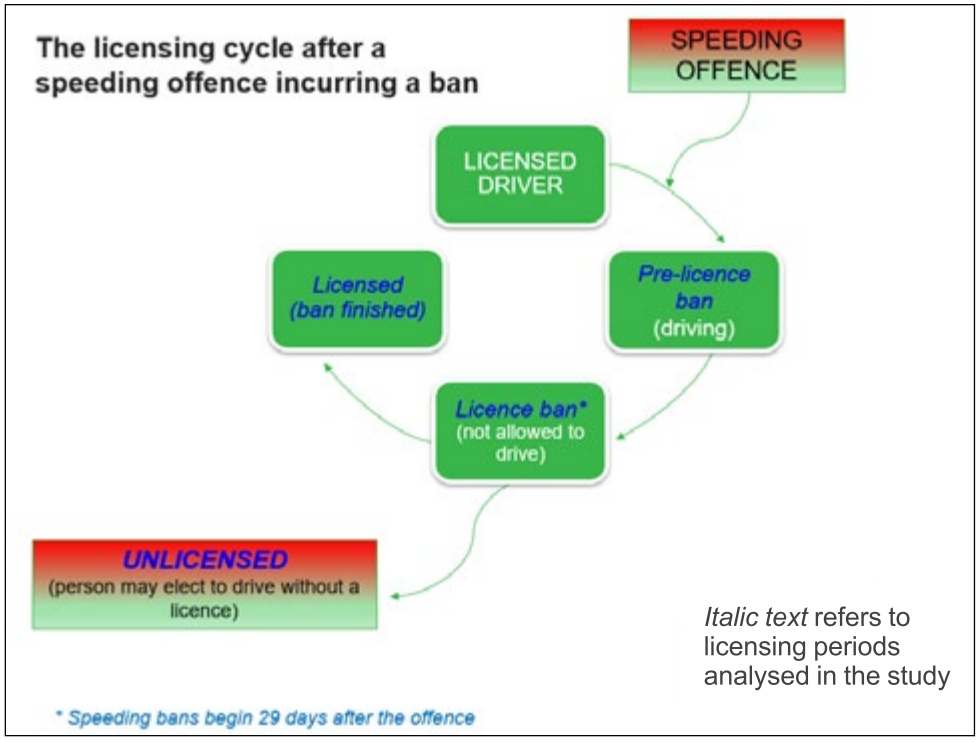

Figure 1. The licensing cycle indicating the licence periods for drivers who have their licences banned (suspended) for a speeding offence

Table 3. Offender groups for effect of increases to suspension periods

Group	Pre (1 January 1996 – 14 December 2002)	Post (15 December 2002 – 31 December 2014)
Intervention group A (higher mid-range offenders)	Speeding offenders with a first offence between 30 and 44 km/h over the speed limit N = 32,931	Speeding offenders with a first offence between 25 and 44 km/h over the speed limit N = 85,259
Intervention group B (high-range offenders)	Speeding offenders with a first offence of 45 km/h or more over the speed limit N = 11,963	Speeding offenders with a first offence 45 km/h or more over the speed limit N = 7,862
Comparison group (low-level offenders)	Speeding offenders with a first offence less than 15 km/h over the speed limit N = 1,263,437	Speeding offenders with a first offence less than 10 km/h over the speed limit N= 2,104,547

Table 4. Offender groups for effect of increases in demerit points

Group	Pre (1 January 1996 – 14 December 2002)	Post (15 December 2002 – 31 December 2014)
Intervention group	Speeding offenders with a first offence between 15 to 29 km/h over the speed limit N = 444,362	Speeding offenders with a first offence between 10 to 24 km/h over the speed limit N = 861,264
Comparison group (offences)	Speeding offenders with a first offence less than 15 km/h over the speed limit N = 1,263,437	Speeding offenders with a first offence less than 10 km/h over the speed limit N = 2,104,547
Comparison group (crashes)	Drivers with a Victorian licence and no demerit points between 1 January 1996 and 31 December 2014 PLUS a demerit point balance of four or less as at 1 January 1996 N = 1,943,578	

Increase in demerit points

The intervention group for the demerit point analyses (Table 4) were lower-mid range offenders. This group had changes to demerit points (more people being subject to higher demerit points) but did not have a ban. Therefore, for the changes to demerit points on 15 December 2002, the analysis was not impacted by the changes in bans for speeding offences. Different comparison groups were used for the offence and crash effect analyses (Table 4).

Additional demerit point ban(s) for high-range offenders in addition to a 12-month speeding ban

A high-range speeding offence (45 km/h over the limit or 145 km/h in a 110 km/h zone) incurred eight demerit points as well as a 12-month speeding ban prior to 1 November 2018. Often the addition of eight demerit points resulted in the offender incurring an additional demerit point ban after the 12-month speeding ban, resulting in a longer ban period. This is because the offender already has a high level of demerit points and the extra points puts the offender over the 12-point demerit point limit. This is what results in the additional demerit point ban (unless the offender nominates to take a GBB). This analysis examined the speeding and crash rates of high-range (45 km/h over the limit or 145 km/h in a 110 km/h zone) speeding offenders to determine the effect of the additional demerit point ban/suspension (a licence is suspended for three months for the first 12 demerit points incurred plus one month for every additional four demerit points incurred; a GBB is offered as an alternative to the ban).

Speeding offence and casualty crash rates for high-range speeding offenders who had an initial 12-month speeding ban and a subsequent demerit point suspension were compared with three other speeding offender groups:

- 1 to 6-month initial ban from a speeding offence, with no subsequent demerit point suspension
- 1 to 6-month initial ban from a speeding offence, with a subsequent demerit point suspension
- 12-month initial ban from a speeding offence, with no subsequent demerit point suspension.

The GBB available as an alternative to a licence ban after reaching the demerit point threshold

Analyses were conducted to examine the effects of the GBB on speeding offences and crashes for speeding drivers who reached the demerit point threshold through all demerit point offences (not just speeding offences). Firstly, speed offence and crash rates after successful completion of the GBB were compared with speeding offending and casualty crashing before the GBB. The rate of offences/casualty

crashes per 1,000 person years for period before GBB and the period after GBB were calculated and compared using a rate ratio and calculation of confidence intervals. Secondly, a comparison was made between the rate per 1,000 licence person-years for those on GBB and those who opt for a three month demerit point ban. Rate ratios were calculated and compared for this three-month ban (compared with post GBB).

Results

Licence bans for speeding offences

There were 3,450,338 speeding offenders in the study period (1 January 1996 to 31 December 2014), of which 109,102 (3%) were banned from driving because of their speeding offence. As shown in Table 5, speeding offenders had statistically significantly lower rates of speeding offences and casualty crashes during the ban compared with the:

- pre-licence ban (71% lower for offences and 71% lower for crashes)
- licensed (ban finished) (48% lower for offences and 16% lower for crashes).

Offenders also had statistically significantly lower rates of speeding offences and casualty crashes in the licensed (ban finished) period compared with the pre-licence ban (45% lower for offences and 66% lower for crashes).

Offenders had higher statistically significantly rates of speeding offences and casualty crasehs during the post-ban unlicensed period compared with the:

- licence ban (240% higher for offences and 260% higher for crashes).
- licensed (ban finished) (76% higher for offences and 202% higher for crashes).

Increase in speeding ban periods and demerit points on 15 December 2002 for higher level speeding offences

Increase in ban periods
Increases in ban periods were associated with a statistically significant reduction in speeding offences by:

- 33% for the higher mid-range intervention group A (RR = 0.67, 99% CI [0.66 - 0.68])
- 40% for the high-range intervention group B (RR = 0.60, 99% CI [0.59 - 0.62])
- 16% for the low-range comparison group (RR = 0.84, 99% CI [0.83 - 0.85]).

However, there was a greater reduction pre to post for the treatment groups compared with the comparison group ($Z = 46.89$, $p < .001$ for the higher mid-range intervention group A; $Z = 30.44$, $p < .001$ for the high-range intervention group B). This indicates that the changes to ban periods had an effect on speeding offences.

Increases in ban periods were also associated with a statistically significant reduction in casualty crashes by:

- 71% for the higher mid-range intervention group A (RR = 0.29, 99% CI [0.28 - 0.30])
- 76% for the high-range intervention group B (RR = 0.24, 99% CI [0.23 - 0.26])
- 64% for the low-range comparison group (RR = 0.36, 99% CI [0.35 - 0.37]).

Again, there was a greater reduction pre to post for the treatment groups compared with the comparison group ($Z = 13.08$, $p < .001$ for the higher mid-range intervention group A; $Z = 30.99$, $p < .001$ for the high-range intervention group B). This indicates that the changes to ban periods had an effect on casualty crashes.

Increase in demerit points
The analysis of the effect of increases in demerit points on 15 December 2002 found there was a statistically significant reduction in speeding offences from pre to post for both intervention and comparison (offence) groups who were low range speeders (17% reduction for speeding offences in the intervention group, RR = 0.83, 99% CI [0.82 – 0.84]; 16% reduction in speeding offences in the comparison (offence) group, RR = 0.84, 99% CI [0.83 – 0.85]). However, there was no statistically significant differences in the rate ratios for the comparison and intervention (offence) groups [$Z = 2.11$, $p = .035$]. This suggests that there was no effect of the increase in demerit points for these offenders in terms of speeding offence reduction.

Table 5. Speeding offence and casualty crash rate ratios for each period

Comparison	Rate ratio (99% CI)	
	Speeding offences	Casualty crashes
Licence ban versus Pre-licence ban	0.29* (0.27 – 0.30)	0.29* (0.24 – 0.35)
Licence ban versus Licensed (ban finished)	0.52* (0.50 – 0.54)	0.84* (0.72 – 0.98)
Unlicensed versus Licence ban	3.40* (3.27 – 3.53)	3.60* (3.07 – 4.23)
Unlicensed versus Licensed (ban finished)	1.76* (1.56 – 1.98)	3.02* (1.68 – 5.43)
Licensed (ban finished) versus Pre-licence ban	0.55* (0.54 – 0.57)	0.34* (0.31 – 0.38)

For crashes, there was a statistically significant reduction in casualty crashes from pre to post for the intervention group (53% reduction, RR = 0.47, 99% CI [0.46 – 0.48]). There was however, an increase pre to post for the comparison (crashes) group (117% increase, RR = 2.17, 99% CI [1.92 – 2.46]). The difference in rate ratios was statistically significant ($Z = 23.84$, $p < .001$). This result shows that the change in demerit point penalties was associated with a reduction in casualty crashes for speeding offenders.

Additional demerit point ban(s) for high-range offenders in addition to a 12-month speeding ban

This analysis found that offenders with a 12-month speeding ban and a subsequent demerit point ban had statistically significantly ($p < .01$):
higher speeding and casualty crash rates compared with those with a 12-month speeding ban and no subsequent demerit point ban (59% higher for speeding offences, RR = 1.59, 99% CI [1.53 – 1.67] and 52% higher for casualty crashes, RR = 1.52, 99% CI [1.09 – 2.12])

higher speeding and casualty crash rates compared with those with a 6-month speeding ban and no subsequent demerit point ban (36% higher for speeding offences, RR = 1.36, 99% CI [1.33 – 1.39] and 31% higher for casualty crashes, RR = 1.31, 99% CI [1.11 – 1.54])

lower speeding offences (17% lower, RR = 0.83, 99% CI [0.81 – 0.85]) compared with offenders with a 6-month speeding ban and a subsequent demerit point ban. There was no difference between these groups for casualty crashes (RR = 0.86, 99% CI [0.73 – 1.02].

The GBB available as an alternative to a licence ban after reaching the demerit point threshold

During the study timeframe for the GBB analysis:

- There was a pool of 3,450,338 speeding offenders and 444,400 (12.9%) reached the demerit point threshold.
    - Nearly 75% of speeding offenders who reached the demerit point threshold opted to serve a GBB.
    - Twenty-five percent of offenders who reached the demerit point threshold opted for the minimum three-month demerit point ban (as an alternative to a GBB).
    - Of offenders who opted to serve a GBB, the majority (80.3%) successfully completed the bond.

There were statistically significantly lower speeding offence rates (6%, RR = 0.94, 99% CI [0.93 – 0.95]) and casualty crash rates (31%, RR = 0.69, 99% CI [0.68 – 0.70]) following the successful completion of the GBB than in the period before it was served. This finding suggests that the application of a bond had an influence in terms of reduced speeding offending and casualty crash involvement.

There were statistically significantly higher speeding offence rates (13%, RR = 1.13, 99%
CI [1.12 – 1.14]) and casualty crash rates (23%, RR = 1.23, 99% CI [1.21 – 1.26]) for the 'after period' for offenders who opted to serve a demerit point ban compared with the 'after period' for those who opted to serve a GBB. This indicates that the GBB was more effective in reducing subsequent offending and crash involvement than the demerit point ban. However, it is also possible that offenders who opt to serve a suspension differ in risk profile.

Discussion

This is one of the first studies to clearly indicate that licence bans resulting from speeding offences reduce subsequent speeding re-offending and casualty crashes. This is an important outcome for improving road safety, as research has generally found a relationship between speeding and crash involvement as well as speeding offences and other traffic offences (Brown, 2002; Fleiter et al., 2015; Parker et al., 1995; Watson et al., 2015).

Offenders had significantly lower rates of speeding offending during bans compared with the pre-licence ban and licensed (ban finished) periods. This is also a positive finding as one of the purposes of such bans is to incapacitate individuals from re-offending for a period of time (Watson et al., 2015). Further, the finding that offenders had lower rates of offending during the licence (after ban) period compared with before the ban started is encouraging as it provides support for the central aim of applying bans, which is to specifically deter speed offenders from re-offending (Beccaria, 1963).

The increase in ban periods for speeding on 15 December 2002 had a positive impact on speeding offences and casualty crashes, whereby stronger penalties increase deterrence of the behaviour. Another affirmative finding was that the increase in demerit points on 15 December 2002 was effective in reducing casualty crashes for lower-mid range offenders.

The analysis of the additional demerit point ban for high-range offenders with a 12-month speeding ban suggest that a demerit point ban imposed after the 12-month speeding ban was not effective in reducing subsequent speeding offending or crashing when compared with offenders who received a speeding ban (6 or 12 months) only. It appears that very long ban times may result in unlicensed driving. Unlicensed driving carries an increased crash risk ranging from three to nine times that of licensed driving (Knox et al., 2003).

As a result of the research reviewing the effect of an additional demerit point ban for high-range offenders with a 12-month speeding ban, on 1 November 2018 the Victorian Government changed the law so that demerit points no longer apply for all four excessive speed offences. The changes to the speed offences appear in the Appendix. As the demerit points were removed from the highest-level speeding offence, they were also removed from the other three high range speeding offences for consistency. To ensure penalties reflect the relative crash risk, drivers caught

exceeding the speed limit by 25 km/h or more, but less than 35 km/h lose their licence for three months instead of one month. The same penalty will apply for offenders who exceed the speed limit by 20 km/h or more but less than 25 km/h in a 110 km/h zone. Approximately 10,000 motorists a year are charged with these two excessive speed offences. The Department of Transport hopes these changes will reduce unlicensed driving, as unlicensed drivers are over-represented in crashes (Watson et al., 2011).

The application of the GBB alone was an effective behaviour change measure for speeding offenders in terms of reduced speeding offending and reduced crash involvement. The GBB was also more effective in reducing subsequent offending and crash involvement than the alternative demerit point ban. However, it is possible that drivers who have lower propensity for risk taking opt for the GBB.

There were several limitations in the current study. Firstly, for the effects of changes to demerit points and ban periods in 2002, the unique contribution of demerit point changes versus ban period changes cannot be identified. As a result, the reductions found for these offenders could be due to either the ban increase, the demerit point increase or a combination of both. Another limitation, as with any study of this nature, is that the speeding offender sample only includes those who are detected, rather than all those who actually offend (Watson et al., 2015). A further limitation for these analyses was that the control (comparison) groups were not matched controls. Due to the nature of the changes to the legislation, the control groups were those offenders who did not experience the treatment, and hence had characteristic differences in terms of offence profile that may have affected the results. It is not possible to determine if changes not related to the increase in demerit points and bans (e.g., enforcement, media) affected the control groups differently to the treatment (intervention) groups because of their characteristics and offence profiles. It is not possible to determine in which direction this bias may impact, so it may have enlarged or diminished the effects of the sanction changes.

Conclusions

The study findings indicate that licence bans from speeding offences reduce speeding re-offending and casualty crashes. The increase in speeding ban periods in December 2002 had a positive impact on speeding offences and casualty crashes and the increase in demerit points at this time was associated with a decrease in crashes. A demerit point ban imposed after a 12-month speeding ban was not effective in reducing subsequent speeding offending or casualty crashes compared with those who received only a speeding ban (6 or 12 months). This finding led to the Victorian Government to change the penalties for higher level speeding offences. There were positive outcomes for the GBB, with lower re-offence rates for those who elected to undertake this option when reaching the demerit point limit.

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Appendix

Four excessive speed offences committed on or after 1 November 2018 no longer incur demerit points. Two of these offences had their suspension periods increased from one to three months (Table 6).

Table 6. Changes in excessive speed offences 1 November 2018

Offence	**Minimum suspension period**	**Demerit points**		
	Before 1 Nov 2018	**On or after 1 Nov 2018**	**Before 1 Nov 2018**	**On or after 1 Nov 2018**
Exceed speed limit by 25km/h or more, but less than 35km/h	1 month	3 months	4	0
Exceed speed limit by 35km/h or more, but less than 45km/h	6 months	6 months	6	0
Exceed speed limit by 45km/h or more	12 months	12 months	8	0
Exceed the speed limit by 20 km/h or more but less than 25km/h in a 110 km/h speed zone	1 month	3 months	3	0

Novice drivers' experiences of parental encouragement with road rules in Queensland: Scope for a third party policing approach?

David Belsham[1], Alexia Lennon[1], Lyndel Bates[2], Sarah Matthews[1]

[1] Queensland University of Technology, Centre for Accident Research and Road Safety-Queensland, Institute for Health and Biomedical Innovation, Brisbane, Australia
[2] School of Criminology and Criminal Justice and Griffith Criminology Institute, Griffith University, Brisbane, Australia

Key Findings

- Young drivers recognise that parents are concerned about their safety and are supportive;
- Young drivers believe that police enforcement is important for ensuring formal rules are obeyed;
- Theoretical frameworks such as third party policing may be useful in this area;
- Third party policing involves partnering with organisations or people and the availability of a legal lever to increase compliance.

Abstract

This study explored whether a third party policing approach is appropriate for increasing young driver compliance with graduated driver licensing restrictions. Focus groups (n = 3) and semi-structured interviews (n = 24) were conducted with young drivers from Brisbane, Queensland, Australia. Participants (n = 39 in total) were aged 17 to 19 years and held a Provisional 1 or 2 licence. Many young drivers appreciated the involvement of their parents in their novice driving period and reported that parents provided practical support and planning strategies. There is potential for the use of a third party policing intervention to improve compliance amongst young drivers.

Keywords

Third Party Policing, Graduated Driver Licensing, intermediate licence, teen drivers, young drivers, provisional licence

Introduction

The commencement of solo driving is characterised by an increase in crashes, possibly related to risky driving behaviours, particularly within the first six months of licensure (Elvik, 2010; Mayhew, Simpson, & Pak, 2003; Scully, Newstead, & Keall, 2014). Norwegian data indicates that the youngest car drivers crash at 5 to 10 times the rate of the safest age group (Elvik, 2010). The known risk factors for this group include age and inexperience (Curry, Pfeiffer, Durbin, & Elliott, 2015) along with high-risk driving conditions such as night time driving, peer passengers, alcohol impairment, and speeding (Bates, Davey, Watson, King, & Armstrong, 2014; Beck, Hartos, & Simons-Morton, 2002; Greydanus, 2018; Shope, 2006).

One of the most effective countermeasures developed to reduce crash rates for this high risk group is Graduated Driver Licensing (GDL) (Bates, et. al 2014b; Shope, 2007). Shope (2007) reviewed 27 studies of GDL and identified that there were crash reductions of 20 – 40 per cent depending on the exact elements within GDL and the evaluation methodology. An evaluation of the Queensland GDL system, introduced in mid-2007, identified a 31% reduction in fatal crashes involving novice drivers (Scully et al., 2014). GDL systems require novice drivers to progress through learner and provisional (also known as intermediate) licences before obtaining an open licence (Bates, Filtness, & Watson, 2018). However, it appears that as novice drivers progress through the GDL system, provisional or intermediate licence holders' compliance with road rules decreases as demonstrated in a number of studies that use Queensland samples (Allen, Murphy, & Bates, 2017; Bates, Darvell, & Watson, 2017; Scott-Parker, Watson, King, & Hyde, 2012). This decrease in compliance is consistent with patterns identified in California. Researchers found that, within the first three years of unsupervised driving, 55 per cent of new teen drivers had received a traffic infringement (Chapman, Masten, & Browning, 2014). Canadian research identified that intentions to violate road rules by drivers on a restricted (the Canadian version of a provisional licence) was not associated with the driver's experience or driving frequency (Poirier, Blais, & Faubert, 2018). It appears that young driver perceptions of police enforcement affects their self-reported compliance with the road rules. Those provisional drivers who perceived that police officers frequently enforce traffic rules were less likely to report violating fixed rules such as drink driving. However, perceptions of police enforcement did not affect young driver violations of transient offences such as speeding (Bates, Scott-Parker, Darvell, & Watson, 2017). Perceptions of legitmacy may also be important. For instance, younger people perceive that

it is not legitimate for the police to charge someone if they crash as a result of sleepiness (Watling, 2018).

Enforcement

While traffic enforcement based on deterrence theory by police is one of the most common methods used to alter driver behavior (Bates, 2014; Bates, Soole, & Watson, 2012; Tudor-Owen, in press), research studies which utilised a cross-sectional design indicate that this type of formal enforcement does not appear to be as effective with young new drivers (Allen, et al, 2017; Bates, et al., 2017). One Australian study used a deterrence theory framework to consider the effect of deterrence variables on self-reported compliance with road rules. This study, which used a convenience sample of university students, found an 'emboldening' effect where drivers exposed to higher levels of police enforcement were more likely to report lower levels of compliance (Bates, et al., 2017). The emboldening effect, first defined by Piquero and Pogarsky (2002), suggests that individuals who are the most committed to offending are also the most likely to be punished and thus punishment is an effective method for identifying these offenders. An alternative explanation, at least for some individuals, is that traffic offending is representative of a pattern of wider offending behaviour (Nunn, online first, 2018).

Given that formal deterrence does not appear as effective for young novice drivers in encouraging compliance with road rules, there is a need to consider alternative theoretical perspectives (Allen, et al, 2017; Bates, et al., 2017). One method that has been used to prevent or control crime is third party policing (Mazerolle & Ransley, 2005). Third party policing involves police agencies developing either voluntary or involuntarily partnerships with non-offending individuals or organisations in order to reduce crime (Buerger & Mazerolle, 1998; Ransley & Mazerolle, 2009). Although they are not used in many partnerships (Mazerolle, 2014), a key element of third party policing is the presence of a legal lever that can be used to coerce the partner if necessary. One example of a third party policing partnership is a partnership between police and pharmacies in order to limit the production of methamphetamines. In this example, the law requires pharmacists to keep records of their sales of pseudoephedrine and report these to the police (Webster, Mazerolle, Ransley, & Mazerolle, 2017). Third party policing partnerships have been used in range of contexts including controlling drug, alcohol and disorder crimes in entertainment areas (Manning, Mazerolle, Mazerolle, & Collingwood, 2016), reducing thefts at construction sites (Clarke & Goldstein, 2002), truancy (Bennett, Mazerolle, Antrobus, Eggins, & Piquero, 2017; Mazerolle, Bennett, Antrobus, & Eggins, 2017) and gang violence (Grogger, 2002). However, this approach has not been considered in a road policing context.

Parental involvement

Parental involvement during the provisional phase has the potential to encourage compliance with GDL restrictions and the road rules more broadly. This parental involvement is frequently implied within GDL frameworks (Simons-Morton, 2007; Williams, Leaf, Simons-Morton, & Hartos, 2006), though not necessarily always formally supported in the form of practical assistance. Parents generally appear to be aware of the risks faced by novice drivers and want to be involved in the licensing process so that they can reduce their teen's risk (Williams et al., 2006). In an investigation of parental influence on adolescent compliance with GDL restrictions, Brookland, Begg, Langley, and Ameratunga (2014) found that many parents were knowledgeable and supportive of GDL conditions. However, their results also suggest that limited parental knowledge is associated with greater likelihood of adolescent breaches of the restrictions.

Parent management during the early stages of independent driving does have the potential to improve the safety of novice drivers (Simons-Morton & Ouimet, 2006) and the apparent low level of enforcement by police officers may be one reason why programs such as Checkpoints are needed. The Checkpoints program encourages parents and their children to establish a parent-teen driving agreement in order to reduce exposure to high risk driving situations. When choosing to participate, parents receive educational materials such as a video, newsletter and a parent-teen driving agreement. Research indicates that the program encourages parents to set stricter limitations and there also appears to be a reduction in teen driving offences, but no differences in their subsequent crash rates (Simons-Morton, Hartos, Leaf, & Preusser, 2006). This program has also been delivered by driver educators, though this mode of delivery presents barriers to parental participation. Despite this, some safety benefits still appear to result including a greater number of teenage drivers having restrictions placed on them by their parents and a reduction in high-risk driving (Zakrajsek et al., 2013). Additionally, research involving 579 parent and 16 year old adolescent dyads identified that those parents who had been given a video and driving agreement to take home from a licensing authority when their child obtained a provisional licence, were more likely to have parental limits on passengers, driving on high-speed roads and night driving than those who did not receive any materials (Simons-Morton, Hartos, & Beck, 2004). These types of programs encourage parental involvement with provisional drivers including increasing compliance. However, a third party policing framework is stronger as it involves a partnership between police and parents with the support of a legal lever that can be, but is not necessarily, used by police to force parental involvement.

Some aspects of the GDL system, within the learner licence phase particularly, are effectively third party policing measures. For instance, in Queensland, learners must record 100 hours of supervised driving practice within a log book before they are able to obtain a provisional licence (Scott-Parker, Bates, Watson, King, & Hyde, 2011). Given that parents are the main supervisors of learner drivers (Bates, Watson, & King, 2014; O'Brien, Foss, Goodwin, & Masten, 2013), this is effectively a legal lever that enables parents to enforce this requirement. However, the legal levers within the provisional phase of the GDL process are less clear.

Previous research has suggested that provisional drivers are more concerned about parental enforcement of their driving than with police enforcement (Allen, et al, 2017; Bates, et al., 2017). This suggests that there is scope for police to partner with parents in order to enhance enforcement efforts. Parental limits becoming stricter when a GDL system is in use is indicative that the GDL laws act as a legal lever, a key component of third party policing.

While previous research has considered parental involvement in the provisional licensing phase, this has traditionally occurred in jurisdictions that licence earlier than in Queensland, and therefore where parents may have greater contact with their children (e.g. Brookland & Begg, 2011; Peek-Asa et al., 2014). It is thus important to consider this issue in a later licensing jurisdiction where parents may have less leverage over their children because they are more likely to be over the age of 18 (and legally adults).

Queensland context

In Queensland, Australia, the GDL system allows individuals aged 16 years and over to obtain a learner licence (L) which they must hold for a minimum of one year. During this time they must obtain 100 hours of supervised driving before passing a practical driving test to obtain a 'Provisional 1' (P1) licence. After one year of driving and successful completion of an online hazard perception test, P1 drivers can progress to a Provisional 2 (P2) licence which is held for a minimum of 2 years (depending on the age of the driver), before obtaining an open licence (Senserrick, 2009). Restrictions are placed on new drivers, and these are progressively relaxed at the different stages of licensing, allowing a graded exposure to riskier driving circumstances as novices gain driving experience (Bates, et al., 2014b). In the Queensland GDL system, restrictions on P1 drivers include having a zero blood alcohol limit, displaying a red P plate on the vehicle to indicate licence status and being unable to use a mobile phone (including on blue tooth or hands free mode), drive a high-powered vehicle or drive with more than 1 passenger who is younger than 21 years old. The restrictions for P2 drivers include adhering to a zero blood alcohol limit, displaying a green P plate to indicate licence status and being unable to drive a high-powered vehicle. Table 1 outlines the restrictions in Queensland.

The degree to which police enforce the GDL laws appears low across a range of jurisdictions (Bates, Rodwell, & Matthews, 2019). This means that it becomes even more important for parents to monitor their children's behaviour and enforce GDL requirements and other road laws. For this reason, any support that provides parents with a stronger ability to perform this role need investigation. The current study explores the feasibility of a third party policing approach to increase young driver compliance with road laws. It does this by examining the young driver experience in order to understand the mechanisms of parental influence.

Table 1. Queensland Provisional Licensing Restrictions (Adapted from: Queensland Government https://www.qld.gov.au/transport/licensing/driver-licensing/applying/provisional/index.html)

	Provisional Licence One (P1)	**Provisional Licence Two (P2)**
Drivers must	Display red P plates	Display green P plates
	Only drive vehicles allowed on your licence class	Only drive vehicles allowed on your licence class
	Have your licence with you and show it to a police officer when asked	Have your licence with you and show it to a police officer when asked
	Comply with any conditions on your licence (i.e. wear corrective lenses)	Comply with any conditions on your licence (i.e. wear corrective lenses)
	Obey the Zero Alcohol limit	Obey the Zero Alcohol limit
Drivers must not	Use a mobile phone (even using hands-free or Bluetooth accessories) unless you are legally and safely parked. Passengers cannot use the loudspeaker function on their mobile phones	
	Drive a high-powered (performance) vehicle	Drive a high-powered (performance) vehicle
	Drive with more than 1 passenger under 21 who is not an immediate family member (unrelated by blood, marriage, or a guardian relationship) between 11pm and 5am	
	Drive under the influence of illegal or prescription drugs	Drive under the influence of illegal or prescription drugs
	Accumulate 4 or more demerit points in any 1 year period	Accumulate 4 or more demerit points in any 1 year period
	Supervise a learner driver	Supervise a learner driver

Method

This study utilised both focus groups and in-depth interviews. Prior research has indicated the importance of peer influences on novice drivers (e.g. Buckley & Foss, 2012; Curry, Mirman, Kallan, Winston, & Durbin, 2012; Horvath, Lewis, & Watson, 2012). Therefore, focus groups were used in order to benefit from the interactions between novice drivers who were of a similar age and assess group feelings and reactions. However, brief individual telephone interviews were also used in order to minimise the impact of peer conformity on socially desirable responding (Roller & Lavrakas, 2015).

Sample

As the target group was young novice drivers, the undergraduate psychology participant pool at a large metropolitan university in Brisbane, Queensland, Australia was used to recruit participants. Participants were offered course credit in exchange for participation. Within this pool, provisional licence holders were invited to participate either in focus groups (n = 15 participants in 3 groups; 9 females, 6 males) or individual telephone interviews (n = 24; 19 female, 5 male) to both explore their experiences in complying with the restrictions required as part of the driver licensing system in Queensland and their perceptions of how their parents approached the issue of encouraging compliance. This sample size is comparable or larger than those used in other qualitative Australian road safety studies (e.g. Gauld, Lewis, & White, 2014; Glendon, 2013). Participation was confidential and any identifying details were destroyed immediately following attendance at the group or completion of the interview. Two-thirds of the focus group participants were driving on a P2 licence (n = 10) while the remainder were on a P1 licence (n = 5). Participants ages ranged between 17 and 19 years old and groups contained a mix of individuals who were residing at the parental home and those who were living elsewhere. The provisionally licensed drivers who completed semi-structured interviews were aged aged 17 to 22. Of these, half were driving on a P1 licence and half were driving on a P2 licence.

Data collection

Focus groups (one hour duration) and telephone interviews (10-15 minutes) were semi-structured and facilitated by experienced qualitative researchers. Conversations in two of the focus groups were recorded and transcribed by a professional stenographer (present in the room at the time). Detailed notes were taken by a research assistant who was present during the third focus group. Responses to the focus group questions then guided the development of the interview schedules for the individual semi-structured telephone interviews. Interviews were audio recorded and later transcribed by a professional stenographer to allow a thematic analysis of the transcript.

Questions in the interview schedule covered the same content areas for both the focus groups and the interviews. These focused on novice drivers' knowledge of the restrictions appropriate to both provisional licence phases, their beliefs about their parents' level of knowledge of the restrictions, ways in which their parents had encouraged or supported them in complying with these (or not), and their views of the ease of compliance with restrictions, and whether they thought their parents were aware of any breaches or infringements of the GDL restrictions or the road rules generally (e.g. speeding tickets). Young people were also asked what they thought their parents' views were about breaches or infringements, and how they thought parents would (or already had) responded to these. There were no major differences in the responses between the focus groups and the interviews. For this reason, the data was combined.

Results

Awareness of restrictions

When asked to identify the restrictions on their provisional licences, participants in both the focus groups and the interviews demonstrated good understanding of some GDL restrictions and the details of the rules, and appeared to understand that the purpose of these is to promote safety. Only one provisional driver admitted to not knowing the rules well.

The first restriction mentioned by most interview participants, and in all three focus groups, was the zero blood alcohol concentration (BAC) requirement. The next most common recalled was the peer passenger restriction, identified in all three focus groups and most interviews. Fewer participants identified that they must not use a mobile phone, and although this restriction tended to be mentioned in the focus groups, it was clear that not all focus group members were aware of this licence restriction beforehand. Restrictions related to demerit points, displaying plates, engine size and the requirement to carry their licence appeared to be the least well known. For some young drivers, this appeared to be due to some of those restrictions (e.g. displaying plates) being seen as routine behavior, and therefore not something they thought to identify as a requirement:

"Displaying plates and carrying your licence… comes naturally." (22, Female, Provisional 2 (P2)).

Provisional drivers gave many reasons as to what they thought the purpose of GDL restrictions were. Most acknowledged that they included rationales such as: because they were new to driving, because they were inexperienced, and that the restrictions enabled them to become more competent and experienced drivers while protecting them from various factors such as 'stupidity', peer influences, and developmental factors.

"[the restrictions are] *to keep us safe and the people around us.*" (17, Male, Provisional 1 (P1))

"*Young people do stupid things so restrictions help with that and protect you when you're learning*." (19, Female, P2)

"*…when you get your P plates, you can drive alone and you feel like you can do everything but in reality you don't have*

that much more experience than when you were on your Ls; you just think you do because you have graduated a level. They put the restrictions on to make sure we realise we can't do everything straightaway and we need to ease into it and that's why you have got your two P's." (17, Female, P1)

Compliance

Participants reported that they found the zero blood alcohol restriction the easiest restriction to comply with, though it represented a challenge to manage at times. All of the focus groups and some of the interviews contained references to parents giving strong admonitions about avoiding driving after drinking:

"*If I go to a party, [my parents say] 'Just wait, even if you are going to be late or something, just call me. Please don't drive if you have had any alcoholic drink.' They were really restrictive on drink driving. Once I turned 18, it was like, 'If you are going to drink at a party, please, we will pick you up or catch a cab*'." (18, Female, P2)

For some, compliance was accomplished by setting an absolute rule and simply sticking to it:

"*Just don't drink and drive so that's easy.*" (18, Female, P1)

Others appeared to have less absolute rules in relation to alcohol consumption, but gave accounts of how they dealt with instances where they thought there was a risk of being over the zero blood alcohol limit, as here:

"*I was not sure how long it took for the standard drink to get out of your system. I was, like, looking it up online. I called my mum on the day we were coming home: 'Am I okay to drive?' [she said] 'I wouldn't risk it'. [So] I had someone else drive. It had been 8 hours or so; I was a bit unsure. I didn't want to take that risk.*" (19, Female, P2)

Young drivers identified that the passenger restrictions imposed during the first phase of their provisional licence was the most difficult condition for them to comply with. This was largely due to the demands of social situations. For example, drivers talked about their obligations to be the person who did not drink at parties and social gatherings so that they could drive everyone else home. However, this was often at odds with the realities of not being permitted to have more than one peer aged non-family passenger after 11pm:

"*…That is the biggest one I struggle with because I am normally DD [designated non-drinking driver] and no party finishes before eleven. You never come home that early...*" (17, Female, P1)

"*I don't have a car…so usually the only time I am driving is from a party when I am 'desying' [being the designated sober driver for] a lot of people and I usually break that rule quite a bit. I believe if people are going to drive drunk or break the rule, [breaking the passenger rule is] the lesser of two evils*." (17, male, P1)

Parental role in encouraging compliance

All the young drivers interviewed reported that their parents had spoken to them about not speeding with some parents sharing their experiences of losing their licences as a result of their own infringements. Provisional drivers reported that their parents had also discussed drink driving with them, and had established clear rules around this, as well as offering practical support in the form of lifts and advice (such as being aware of the length of time alcohol remains in the system, and not driving the morning after drinking large amounts of alcohol, as illustrated above). Young people recognised that such actions were motivated by parental concern for their safety, and many reported that at times they had accepted offers of support.

"*They would always pick me up if I needed it, no matter what the time.*" (18, Female, P2)

"*If I go out and drink, my dad says he will pick me up. [He says] "Leave the car" he will pick me up*." (18, Male, P1)

In some cases parents provided the young driver with access to a vehicle for driving. Nearly all focus group participants reported parental rules regarding the use of the car, including rules relating to driving in certain conditions.

"*Then they'd just give me a curfew of around 10pm during the week and home in time for the passenger restrictions on the weekends.*" (18, Female, P1)

Parental rules included consequences for non-compliance by the young driver that were directed at encouraging compliance and accepting individual responsibility for doing so. Provisional drivers in Queensland lose their driver's licence once they accumulate four demerit points for committing driving offences such as speeding. Parents were able to remind their children of this.

"*The other thing they also made me realise is that I only have four points. They decided, if I was going to get caught speeding, I would first have to pay for the ticket and then they would take away my car.*" (17, Female, P1)

Participants also identified a combination of helpful measures undertaken by their parents in attempting to encourage compliance. Most suggested that their parents had done helpful things, such as being available and showing parental concern through checking up on their activities. Placing responsibility on the young driver by parents was reported as helpful by some participants, as were generic reminders, such as 'stay safe'.

The role of police

Participants acknowledged that police had a role in encouraging novice driver compliance with GDL restrictions. Focus group participants suggested that police enforcement of rules was necessary if parents had not provided adequate guidance and support.

"*I think it is good to have it [enforcement] from the police…A lot of people who don't have a really supportive*

relationship with their parents, they haven't been taught these kinds of rules. They haven't had the enforcement from family; they are going to need some enforcement options." (Female, 18, P2)

Inherent in this comment is the recognition that some parental approaches could lack the control ("these kinds of rules") required to effectively manage a young novice driver. Police, and the formal GDL restrictions that they enforce, were recognised as not only necessary in order to compensate for ineffective parenting, but also to deal with purposeful law breaking.

In a focus group, a participant gave an example where he thought the police should have approached his infringement differently, issuing a warning to him for not carrying his licence rather than the formal sanction that had been imposed:

"*They* [police] *should approach it differently. I can understand if the person was hectic, speeding or being crazy or reckless or something* [that police enforcement is necessary]. *For someone like me, I really try my best to abide by every law possible*." (Male, P1)

This participant's comment acknowledges the role of police as enforcers of formal rules and prevention of deliberate law breaking. However, at the same time, the suggestion that a caution could have been issued instead of a sanction suggests a desire for police to operate with a more parental/developmental approach, taking into account his normal intentions to comply, and rewarding the spirit of his approach to the restrictions rather than adopting a punitive and rule-bound stance. He does not appear to consider that avoiding the punishment on this occasion means that he will likely continue to engage in the behaviour in the future.

Parents as policing partners

Participants acknowledged a necessity for both parental and police approaches to reflect the different roles/functions of each group: parents as encouraging safe driving practices and the development of self-regulation of compliance behaviour; police as enforcing formal rules. There was also recognition that, while for many young drivers, the expectations from their parents was enough to encourage compliance, there were others who might need more than this:

Police are important because for people like us who make genuine mistakes, it might be okay [enough] *coming from our parents. People who don't abide by the laws, you need the higher up officials to enforce them. Teenagers aren't always going to listen to their parents. If they have the specific rules and guidelines in place, there is a better chance they might listen to them* (18, Female, P2)

A lot of people who don't have a really supportive relationship with their parents, they haven't been taught these kind of rules. They haven't had the enforcement from family; they are going to need some enforcement options. (18, Female, P2)

Where parents were perceived as supportive, there was also still an expectation that there would be some level of enforcement from them. For instance, when asked about how their parents would respond if they were to tell them they had breached GDL restrictions, young drivers made the following comments:

"*we have a strong relationship and they'd appreciate me telling them. They would punish me*." (17, Male, P1)

"[I'd be] *ashamed. Hate lying to my parents; hate the thought of disappointing my parents*" (18, Female, P1).

One participant discussed what her parents had actually done in response to her revealing a GDL breach:

"*I drove one night after drinking a little bit. Mum was quite cross and put restrictions on my driving for a little while – no driving for a month unless it was essential.*" (Female, P1)

These responses suggest that, at least some, parents step into a policing role when necessary, as evidenced by the imposition of consequences (a driving ban). The importance to young drivers of maintaining the parent's good opinion when there appears to be a positive and supportive parent-child relationship also can be regarded as evidence for the positive outcomes of parenting on compliance. One young driver described what happened when his speeding ticket was sent to his home:

"*My parents took the [demerit] points [for his speeding infringement] but I had no idea they did it. When I found out I wasn't proud. I wouldn't have let them do it. [It] was a big lesson for me*." (Male, P2)

This novice driver appears to be experiencing an intense shame response to his parents' assumption of the responsibility for his action and openly states his preference for the official sanction in preference to the negative emotional state produced by the apparent realisation of having let his parents down as well as having violated his own internal expectations of self. This young man's psychological self-sanction (self-shaming) was apparently a more significant influence on his response and future intentions than an external sanction (fine, demerit points).

Other novice drivers provided descriptions of their experiences that are consistent with wanting to avoid negative emotional states as the result of disobeying GDL laws. For example, one young woman stated:

"*My mum, because she has drilled it into me to be more careful, I wouldn't think about doing it* [driving after drinking]. *I know she would be disappointed…*" (Female, P1)

Discussion and conclusion

The results of this study suggest that parental involvement while their child is provisionally licensed is important, particularly in terms of encouraging compliance with GDL laws. Young people perceived that their parents used a variety of strategies and styles to support them in remaining

safe and complying with the restrictions on their licences. Formal GDL restrictions could be adhered to by utilising absolute rules (i.e. 'just don't drink and drive'), or drawing on parental support and advice. Some parents appeared to provide restrictions that complemented the legal ones but which were tailored to their child (e.g. "Then they'd just give me a curfew of around 10pm during the week and home in time for the passenger restrictions on the weekends.").

Traffic violations are influenced by a number of factors apart from the law including other needs that are more urgent, they are unaware of the law or they accidentally break the law (Wells & Savigar, 2019). However, P-platers in this study generally seemed accepting of formal police enforcement of restrictions, and particularly were able to see the necessity of this in order to compensate when (other) young drivers had not developed self-regulatory compliance, or when deliberate violation occurred. Several participants highlighted that they felt, or would feel, uncomfortable if their parents found out that they had disobeyed the GDL restrictions. This is consistent with work by Allen et al., (2017) indicating that the emotion shame plays a mediating role in young driver compliance within a deterrence theory framework. Other authors have also noted that emotional factors influence offending behaviour. For instance, Freeman et al. (2006) noted that participants felt guilty after engaging in drinking and driving behaviours. Furthermore, qualitative research conducted with Australian drivers identified that social punishments such as embarrassment and breaching the trust of others influences speeding behaviour (Fleiter, Lennon, & Watson, 2010). Therefore, there appears to be potential to explore how these social feedback forms can be used to influence novice driver behaviour. Additionally, novice drivers recognised parental attempts to support them to comply with the restrictions of GDL.

This study has highlighted, consistent with previous work (Allen, et al, 2017; Bates, et al., 2017), that young drivers are concerned about their parents becoming informed of any traffic infringements if they occur. This indicates that there is significant potential for an intervention based on a third party policing framework (Ransley & Mazerolle, 2009). In this particular context, policing agencies would develop partnerships with parents meaning that the parents would become the third party. While the presence of a legal lever is important within this framework (Mazerolle, 2014), this research suggests that the existence of the GDL provisional phase is not sufficient as a legal lever. While some parents take on a policing function, it does not appear to be necessarily widespread. Thus, the introduction of explicit legal levers at this stage of the licensing process would enable police to access parental resources and force them to encourage compliance by their children is needed. In many contexts, police do not activate the use of the legal lever (Mazerolle, 2014) but for third party policing to work effectively within this context, there would need to be more active involvement from police agencies in encouraging parental participation and monitoring of their child.

It is possible that some parental reluctance to become more involved in managing their child's compliance with road laws is associated with their children becoming legal adults during the provisional phase and the parents feeling that their authority is less legitimate once this occurs. If police were to be more definite in their appeal to parents, this could provide at least some parents with a greater sense of legitimacy in relation to maintaining their current rule-setting or monitoring role. There is some evidence to support this assertion in the child restraint area with legislation having a positive effect on compliance levels and raising parental awareness of the need to ensure children remain in specific restraints for longer (Lennon, 2012).

Encouraging parents to engage more comprehensively in enforcement activities may also reduce the number of novice drivers who avoid being punished for committing offences. Previous research has indicated that punishment avoidance, either directly or vicariously, encourages individuals to continue to engage in the illegal behaviour (e.g. Armstrong, Watling, & Davey, 2018; Freeman, Kaye, Truelove, & Davey, 2017; Szogi et al., 2017; Watling, Palk, Freeman, & Davey, 2010).

While this study is encouraging for the development of interventions using a third party policing approach, there are some limitations associated with this study. Firstly, this is a preliminary study, involving a cohort that tends to come from families with well engaged parents and thus the young drivers might be more compliant generally and underrepresent young drivers who are less likely to conform. This is partly a result of the voluntary nature of the recruitment processes and is also possibly influenced by the level of education of our sample (first year university students). Secondly, the sample was disproportionally female, which therefore may not adequately account for the young male provisional licensing experience. This is particularly important to consider given the greater crash involvement of young male drivers and their more likely engagement in risky breaches of road rules (Shope & Bingham, 2008). Finally, the sample was obtained from within a capital city and may therefore not reflect the challenges facing rural and remote residents, such as the increased crash risk of rural drivers (Chen, Berrocal, Bingham, & Song, 2014). The challenges of reduced access to alternative modes of transport and greater driving distances may also fall disproportionately on young rural and regional drivers during their provisional licence periods, and make compliance with GDL more difficult for them compared to their urban counterparts. We note, for example, that young people in our sample reported that they had the most difficulty complying with the passenger restriction. We would expect this would be even more pronounced for young people in regional and rural locations.

Future research could consider which other partnerships may be useful for novice drivers. For instance, peers have been found to be a strong influence on novice drivers (e.g. Curry et al., 2012; Simons-Morton et al., 2012) and thus there appears to be scope to use peer relationships to influence driving behaviour (Buckley, Chapman, & Sheehan, 2014).

This study suggests that the interaction between novice drivers and their parents in relation to effective navigation and compliance with restrictions on provisional licences

occurs in a manner that provides scope for the development of an intervention using Third Party Policing principles. This may ultimately improve compliance with GDL restrictions and road rules and thus safety.

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Community participation in road safety policy development and strategy planning

Teresa Williams

Road Safety Commission, Perth, Australia

Corresponding Author: Teresa Williams, Post Office Box 6348, East Perth WA 6892, teresa.williams@rsc.wa.gov.au, 08 6552 0808

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Key Findings

- The scope of a WA whole-of-government approach to citizen engagement requires clarification;
- Community participation in activities that has significant influence on decisions is different to the public being involved in decision-making;
- Of the initiatives reviewed, the International Association for Public Participation (IAP2) spectrum levels of inform and consult were prevalent.

Abstract

Public participation in Western Australian (WA) government policy development and strategy setting is not governed by a particular best practice model. The WA Service Priority Review Working Together One Public Sector Delivering for WA, released 2017, identified the need to build a public sector focussed on community needs and to develop a whole of government citizen engagement strategy for WA, including co-designing. The Road Safety Commission (Commission) employs a diverse range of public participation and engagement initiatives. An initial step in preparing for development and introduction of a whole of government strategy review of the nature of public participation initiatives of the Commission. The review method was an analysis of five initiatives that provide reasonable representation of the Commission's public participation and engagement activities. For the purposes of this review, the International Association for Public Participation spectrum of public participation has been used to classify the activities. This paper presents a summation of the review to date, communicating the current status and potential future direction of the Commission. Further work is required by the Commission.

Keywords

Community engagement; informing; consulting; involving; co-designing

Introduction

Public participation in Western Australian (WA) government policy development and strategy direction setting is not governed by a particular best practice model. The WA Auditor General's 2007 Report Having your Say: Public Participation in Government Decision-Making, noted that community consultation and public participation practices varied within and across agencies. The report recommended that agencies should build upon good practice examples. Whilst reference was made to the International Association for Public Participation (IAP2) model, no recommendation for adoption was made.

More recently the final report of the WA Service Priority Review Working Together One Public Sector Delivering for WA, released 2017, identified the need to build a public sector focussed on community needs. The report states that, since 2006 when the State's Citizenship Policy Unit was disbanded, commitment and prioritisation of engagement with the community by government agencies has diminished. It is also noted that whilst some jurisdictions, such as South Australia, Victoria, Tasmania, the Australian Capital Territory and New Zealand, have adopted whole-of-government approaches, no sector-wide approach for community engagement exists in WA. In the blueprint for reform associated with the Review, it is recommended that the quality of engagement with the community must improve to facilitate a more overt focus on community needs. The report discusses a process for co-designing services and identifies the development of a whole-of-government strategy for WA as an action item for the Department of the Premier and Cabinet.

Through the Organisation for Economic Co-operation and Development – International Transport Forum principles,

shared responsibility is embedded in the road safety Safe System. As such, the consistency that should be gained from a whole-of-government approach to public participation and engagement in road safety policy development and strategy planning would be beneficial. In addition to the WA Road Safety Commission (Commission) there are ten other State government agencies directly involved in WA's road safety policy, legislative framework and community education. Several other agencies are less directly engaged through funding agreements and service delivery. In anticipation of the introduction of a whole-of-government approach, the current modes of community engagement and public participation used by the Commission should be reviewed.

The Commission has commenced this review to prepare for the introduction of a whole-of-government approach. A search of corporate records has not revealed any similar review by the Commission. This paper presents a summation of the review to date, communicating the current status and potential future direction of the Commission. The objective of this paper is to share what has been learnt from examining the community engagement and public participation approach of the Commission, which includes identifying potential work required to prepare for introduction of a whole-of-government approach. This work will be particularly important if the extent to which citizens participate in decision-making is to increase. This review does not provide an evaluation of the Commission's ability to adopt a whole of government approach.

Methods

For the purpose of reviewing the public participation and engagement activities of the Commission, the IAP2 public participation model has been used as the reference framework. IAP2 and the term "public participation" are used in authoritative reviews, such as the WA Auditor General's 2007 Report Having your Say: Public Participation in Government Decision-Making and the Victorian Auditor General 2017 report Public Participation in Government Decision-Making. In contrast, the WA Service Priority Review focussed on co-designing for services and favoured the term "citizen engagement". In the Service Priority Review report co-designing is differentiated from engagement methods such as consultation, but neither the characteristics of co-designing nor a spectrum of methodologies are presented for reference or consideration. Most of the publications referred to for this review used the terms community engagement and public participation interchangeably.

The IAP2 framework was considered a valid reference framework for the review as it has frequently been used for guides and frameworks developed by other States. Examples include the New South Wales Information and Privacy Commission 2018 Charter for Public Participation – a guide to assist agencies and promote citizen engagement, Victoria's Department of Health and Human Services 2018 Public participation framework and Stakeholder engagement toolkit, and the South Australian (SA) Government's Premier and Cabinet Circular 2019 Best practice stakeholder engagement and SA Department of Environment, Water and Natural Resources 2016 Guidelines for developing a community engagement strategy.

The stated intention of IAP2 is to improve the practice of public participation and enable development in understanding, use and effectiveness of approaches to public engagement and participation. The IAP2 spectrum, as shown in Table 1, identifies levels of public participation in decision-making. It is important to understand the spectrum presents levels, not stages for participation.

Table 1. The International Association for Public Participation Spectrum

	Increasing impact on the decision ⇨				
	Inform	**Consult**	**Involve**	**Collaborate**	**Empower**
Public participation goal	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To provide the public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise to the public	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

A sample of the Commission's public participation and engagement initiatives conducted during 2018 and 2019 were selected for review. The sample included initiatives that had well-defined objectives, different methodologies, and were conducted by different teams; for some external resources were procured. The sample represents the breadth of regular activities of the Commission.

Each of the initiatives reviewed was compared to the IAP2 spectrum levels of: inform; consult; involve; collaborate and empower. This resulted in classification of the initiatives according to the IAP2 spectrum. For the purposes of this review, co-designing of services is considered comparable to collaboration on the IAP2 spectrum.

The extent to which each initiative delivered the goals and promises on the IAP2 spectrum was assessed based on available documentation. One initiative has a multi-year duration and one remains incomplete, so outcomes of these are yet to be determined. These initiatives were classified based on the objectives, planned actions and intended use of the outcomes.

This is not an evaluation of the initiatives per se. The quality or effectiveness of the initiatives, or extent to which each has fulfilled the Commission's objectives or citizen expectations, are not included in the scope of this review. This review is limited to identifying the nature of activities with reference to the IAP2 spectrum.

Results

The review of initiatives revealed the following in relation to the level of citizen engagement, such as co-designing of services, signaled by the WA Service Priority Review *Working Together One Public Sector Delivering for WA*.

- The intended scope of a WA whole-of-government approach to citizen engagement needs to be defined so activities intended to be in-scope can be identified.
- Initiatives that have a high level of community engagement and influence, but do not involve the public in decision-making, are difficult to classify using the IAP2 spectrum.
- There is a difference between community participation in activities that may have significant influence on decisions and the involvement of the public in decision-making, which will need to be taken into account in any whole-of-government approach.
- A common language is required to consistently differentiate between community participation that influences decisions and community participation in decision-making.

Of the initiatives reviewed and classified with respect to the IAP2 public participation spectrum:

- two were classified as *consult*, with community input being obtained about alternatives and feedback being provided to the community about how the input influenced decisions;
- two were classified as *inform*, as the community were provided with information and to some extent kept informed; and
- one did not fit sufficiently within the requirements of the spectrum to be classified.

Discussion

This discussion is confined to the sample of five Commission initiatives included in the review. The sample represents different activities carried out in implementing the initiatives. As such, each initiative represents a group of like activities. There may be diversity within the groups of activities that could attract different classifications on the IAP2 spectrum. This diversity is noted when apparent.

The following discussion should be considered in the context of applying to a small sample, including:

- driver attitude and behaviour research;
- community perception of Commission engagement;
- motorcycle rider rules;
- fire and emergency volunteer exemption; and
- road safety leadership.

Within the broader desired outcome of improving road safety and reducing road trauma, each of the initiatives had specific objectives to be achieved. As a result, some of the initiatives included in the sample were found to have distinct stakeholder groups as the focus for the participation or engagement effort whilst others were very broad.

In the absence of any broadly agreed framework for public participation and engagement activities, the teams responsible for the initiatives used different approaches and practice principles. The public policy efforts of the Commission are guided by a documented framework intended to facilitate selection of public participation and engagement methods.

Routinely, the outcome of an initiative is used to determine the extent to which it was successful. Most often, if a policy position was determined or a legislative amendment was developed, these outcomes were used as evidence of success or failure. This approach emphasises the production of outcomes, rather than evaluating the public participation or community engagement process.

This review provides insight into the extent to which the Commission is ready to adopt a whole-of-government approach. Where the Commission may need to explore and adopt new methods as a result of the development and introduction of a whole of government approach will be better understood. Some work has commenced in this area.

Community attitude and behaviour research use for policy development

Activities to inform and raise awareness within the community account for the biggest single budget allocation within the Commission. The Commission's objective

for these activities is to improve road safety outcomes and reduce road trauma through raising awareness and improving understanding of road safety issues amongst road users. Similar to other road safety agencies, this effort is guided by evidence.

Through the Commission's community education and awareness raising function, public participation is achieved through a range of attitude and behaviour surveys, workshops and community monitoring mechanisms. The primary objective for these activities is to develop evidence-based communication strategies. These activities provide several benefits, including furnishing the Commission with statistically relevant and reliable data that is used both to evaluate the effectiveness of community education and awareness raising efforts and to provide evidence to inform planning and development of future effort. Initiatives based on these activities have been included in the review because the information gathered enables consideration of community attitudes when developing policy, or when amending or devising legislation.

Driver segmentation

The WA Driver Segmentation research undertaken by Kantar Public market and social researchers on behalf of the Commission is included in the review because the results have been used for policy and legislation development and the setting of priorities. This research focusses on community attitudes and self-reported behaviour in relation to distractions (mobile phone use) while driving, speeding, drink driving and use of seatbelts. The research was carried out during 2015 and 2018.

The community engagement in this initiative was a survey of respondents. The 2015 research included a survey of 1,620 respondents and deep dive workshops to further explore attitudes and beliefs. The 2018 research was a 26-minute survey, eliciting 2,116 total responses. Based on WA's population for the respective years, both surveys had high confidence levels and low margins of error. The data was post-weighted to the known population parameters of WA drivers at the analysis stage using data sourced through licencing statistics from the WA Department of Transport. Whilst such details are important, it is the public participation aspect of this work which is relevant to the review.

The IAP2 spectrum is formed on the basis of the "... increasing impact on the decision..."; the decisions being those of the entity conducting the public participation, such as the Commission. Comparable to other research carried out on behalf of the Commission, the WA Driver Segmentation research does influence decision-making. The significance of the decisions made can vary. For example, the 2018 research revealed that compared to 2015 there had been no significant improvement in the attitudes and behaviours of hard-core speeders, but the research did find that the proportion of the population reporting that they never exceed speed limits had increased. The research outcomes informed decisions regarding potential amendments to legislation to address high-level speeding and recidivist drivers.

The WA Driver Segmentation research influences decision-making, informs the Commission regarding trends in the community, and assists in development of alternatives and solutions. The research has potential for significant influence on decision-making based on information gathered from the public. In comparison to the IAP2 spectrum, active public participation in the decision-making process does not occur. Subject to the extent to which the Commission provides information to the public, such as the problems discovered through the research, the WA Driver Segmentation research most closely aligns with inform. However, considering its design and purpose, it may be inappropriate to classify this initiative using the IAP2 spectrum.

The inform level has the goal of providing information to the public to increase understanding of decision-making and the promise is to keep the public informed. The Commission uses the Driver Segmentation research to influence decisions; however, generally the community are not informed about how the results of the WA Driver Segmentation survey are used for policy, legislation or the setting of priorities.

With respect to the WA Driver Segmentation research, the use of the IAP2 spectrum as the classification framework for the review has highlighted the need for further investigation regarding public participation and any potential whole-of-government approaches. There may be dimensions that distinguish public participation from community engagement, and differentiate deliberative influence on decision-making from participation in decision-making.

Community perception of the Commission's community engagement

With the Government and Public Sector Practice organisation's 2019 Leaders' Report – Increasing trust through citizen engagement as background, Kantar Public was engaged by the Commission to collect, analyse and present the public's perception of the Commission and road safety. This work is ongoing; it is discussed as a public participation activity due to the potential for the public to influence decisions about the future direction of the Commission. Public input will directly influence the Commission's development of community engagement for strategic communications, policy and strategy development.

The objective of the initiative is to identify opportunities to establish an action plan for better engagement. Whilst the initiative is ongoing, the work to date is relevant for this review. Essentially, the Commission is obtaining community input that will assist it in moving towards the intended whole-of-government approach for citizen participation and engagement. Kantar Public is using its proprietary 10C Citizen Engagement Framework. This example also raises the issue of the public's influence on decisions in contrast to being involved in decision-making processes. Subject to the Commission providing information to the public about decisions made, the characteristics of inform level of the IAP2 spectrum may be present. The community can express concerns, although they are not presented with alternatives as required for a classification of consult.

Targeted stakeholder groups for legislation development

Community participation regularly occurs for policy and legislation development carried out by the Commission. Often, the range of options suitable for consideration by government is limited or largely known to the Commission. The nature and extent of public participation is considered in the context of the issue, the objectives of the government and the available evidence. Each public participation or engagement methodology is specifically developed for the target group and the issues involved. The public policy effort of the Commission is guided by a documented framework.

Road safety issues may be contentious when evidence regarding effective road safety measures does not reconcile with community expectations or beliefs. A divergence between what the community may want and what evidence indicates should be done requires careful management of public expectations in the policy or legislation development process. Some processes, for example road traffic penalty reviews, may not be appropriate for community participation.

Motorcycle rider policy development and potential legislation amendments

The Commission is presently implementing the Western Australian Strategic Direction for Improving the Safety of Motorcyclists and Moped Riders 2016 – 2020. Several actions are included in this document, including adoption of National initiatives like the motorcycle protective clothing rating tool. Most WA-specific actions were identified as issues that would benefit from public participation in the development of options or making of decisions about existing options. This policy development project is typical of such work by the Commission.

The public consultation process for the project which was focussed on rules regarding motorcycle rider use of bus lanes, lane filtering and lane splitting (motorcycling rules). A consultation paper was produced to elicit feedback from the community during June and July 2018. Initially 858 responses were received from the public. This sample of respondents was largely made up of motorcycle riders, with 803 out of the 858 respondents holding valid motorcycle rider licences. During September 2018 a supplementary process was conducted to obtain a more balanced sample of respondents. Consequently, an additional 373 respondents who did not hold motorcycle licences contributed to the overall public input of 1,231 responses. Given WA's population, a high confidence level with a low margin of error should have been achieved. However, the bias within the original set of public submissions highlighted the need for the Commission to strengthen consultation methodologies to mitigate the likelihood of such scenarios.

Inviting community participation for this policy development, and any potential legislation development or amendment process, required the Commission to make a commitment to reflect community concerns or aspirations in the decisions made. Motorcycle rider associations and advocates were keenly interested in the outcomes of the public consultation process, with expectations being amplified as a consequence. The general community is supportive of some of the changes, which will assist in meeting the expectations of the motorcycle riders, and not supportive of others. The latter requires the Commission to ensure motorcycle riders are provided with adequate feedback to understand how broad public input has influenced the outcomes.

The characteristics of the consult level of the IAP2 spectrum are clearly evident in the consultation process about motorcyle rules. Clear alternatives were provided for consideration, as required by the consult public participation goal. The consult promise to listen, acknowledge and provide feedback about the influence of public input upon the decision are all identifiable characteristics of this process.

This initiative does not reflect the characteristics of the higher levels on the IAP2 spectrum. The promise of the involve level requires public input to be reflected in alternatives developed, whereas in this initiative the alternatives were developed without such public input. Similarly, the public participation goal and promise for collaborate includes public participation in the development of alternatives and solutions. These characteristics were not evident. This reinforces the classification of the public consultation process about motorcycle as consult.

The classification of consult undoubtedly comes as no suprise to those involved in public policy development. Public policy development has customarily involved processes identified as consultation, often with consultation or options papers being produced to elicit public comment. The various public participation reports, frameworks and guides developed and implemented by other jurisdictions and agencies indicate an intention to employ greater innovation in public participation for policy development. The WA Service Priority Review Working Together One Public Sector Delivering for WA signals the direction that is likely to be taken with the WA whole-of-government public participation or community engagement approach. It discusses the opportunity for government to "...embed ways to include community viewpoints in decision-making, policy development and service design."

This review is intended to provide insight into the current status of the Commission in relation to implementing such reforms. Based on the status of the Commission, greater public involvement in decision-making will be required to achieve a higher level on the IAP2 spectrum. The public policy consultation process for motorcycle rules demonstrates the need to investigate innovations in public participation and engagement in public policy development in order to be better positioned for implementation of any whole-of-government approach.

Fire and emergency volunteers potential legislation amendment

The need to reconsider an exemption for fire and emergency volunteers from a zero-blood alcohol limit when driving vehicles of 22.5 tonnes or more was identified. This work was very narrowly focussed, did not require the development of additional alternatives or solutions as the exemption was either required or not, and involved a very distinct group

within the community. The initiative is representative of similar specific legislative changes that may arise as consequential amendments, discovered as part of another legislative review process or may result from an event that raises concern regarding the adequacy of existing legislation.

The Commission had the ability to identify every fire and emergency volunteer organisation that would be affected by the exemption. Therefore, a very targeted process was developed and conducted early 2019. The process included writing to all affected organisations describing the exemption, its application and how it originated, and inviting written submissions regarding potential repeal of the exemption. To increase certainty of participation, all relevant local governments were also provided with the material and invitation to comment. This approach was taken because, based on anecdotal information, in regional areas most local governments employ some fire and emergency volunteers or there is an ongoing relationship between the local government and the volunteer organisations.

Gaining input from the fire and emergency volunteer organisations and the local governments was intended to inform the Commission's analysis as to whether the zero-blood alcohol limit exemption was required. A follow-up workshop was conducted with respondents to communicate the results of the survey, discuss the Commission's proposal and clarify any matters of concern. The approach demonstrated many of the characteristics of the IAP2 spectrum level consult.

Similar to the process for motorcycle rules, participation of the public was clearly defined to provide feedback about specific, limited alternatives. The characteristics required for this initiative to be classified as an IAP2 spectrum level of involve or collaborate, are not met. Primarily, both these levels require a promise of public input being reflected in the alternatives developed, or in the development of alternatives and solutions. This supports a classification of this public consultation process as consult.

Investigation of the most contemporary approaches to public participation and engagement in legislative development and amendment is required. A greater understanding of the opportunities and limitations will inform how existing processes might be modified or redesigned.

Notably, this review has not identified any policy or legislative review initiatives that demonstrate the characteristics of empower on the IAP2 spectrum. The nature and extent of decisions that could be delegated to the public as envisaged by the IAP2 level of empower would need careful consideration. A decision about the zero-blood alcohol limit exemption for fire and emergency volunteers might be a candidate as it is a matter with a low level of complexity, the breadth of impact within the community is narrow and the potential risks are readily mitigated. However, providing such a narrow scope for public participation may not be in the spirit of what is intended for the empower level on the IAP2 spectrum.

Road safety leadership for local government and industry

The Commission hosted the Monash University Accident Research Center (MUARC) to conduct an Executive Road Safety Leadership Programme in WA once during June 2018 and again during June 2019. The objective was to improve the level of road safety knowledge and understanding of leaders within multiple sectors of the community and establish networks for collaboration across sectors. The Commission invited people from various sectors in WA with the intention of engaging individuals and organisations who can influence within the community and their respective sectors to participate. Participants came from various geographical regions of WA and both cohorts had diverse representation including: industry, State and local government, not-for-profit organisations, and tertiary education institutions.

The programme included a road safety leadership challenge that requires organised groups to work together during the programme and for several months afterwards. The challenge concludes with each of the groups presenting their findings and recommendations at a follow-up session, which for the 2018 event was attended by the WA Minister for Road Safety.

The Executive Road Safety Leadership Programme actively engages participants, encouraging high level participation in a road safety activity. However, the participants' engagement is not in a decision-making process. The programme is intended to foster a shift in thinking by the participants and motivate them to be road safety leaders within the community. This includes cultivating their ability to influence and improve road safety strategies and policies within their respective sectors and organisations.

The Executive Road Safety Leadership Programme is recognised by the Commission, participants and stakeholders as highly engaging. The programme enables participants to hone their ability to contribute to improving road safety outcomes within their communities and sectors, and to foster cultural change for WA. Whilst a significant and highly valued activity contributing to the Commission's engagement efforts, the decision-making element in the public participation goals and promises of the IAP2 spectrum indicates that it may not be classifiable as a public participation activity. This activity aims to influence the decisions and actions made in other sectors, for the good of the community.

As noted above, the terms community engagement and public participation are used interchangably in many of the referenced publications. The WA Service Priority Review Working Together One Public Sector Delivering for WA used the term engagement and did not articulate any interpretation of this as being different from participation or limited to engagement for decision-making. The Government of SA's Department of Environment, Water and Natural Resources Guidelines for developing a community engagement strategy define community engagement as "...any process or interaction used to occupy the attention

and efforts of a community, including ... community participation in activities." The Guidelines also provide a definition for community participation in decisions and explains that community participation may be a part of community engagement.

The Executive Road Safety Leadership Programme does not have the characteristic of participation in decision-making. However, as an activity in which the community participates, the broader definition provided in the SA's Department of Environment, Water and Natural Resources Guidelines for developing a community engagement strategy could be applicable. In the context of this review, the Executive Road Safety Leadership Programme reinforces the need for the Commission to gain an understanding of any whole-of-government approach for community engagement, in particular the nature of activities that will be included.

Conclusions

The review of initiatives has provided insight into the public participation and engagement activities of the Commission. It has mainly assessed the initiatives as being in the IAP2 public participation levels with lower degrees of impact on decisions resulting from public involvement in the decision-making process.

The review process, including the classification of activities using the IAP2 spectrum, prompts reconsideration of the Commission's public participation activities. Some activities, such as the community perception and monitoring research, may have significant influence on decisions. Such activities elicit information from the community which subsequently influences policy and legislative development and amendment; however, they do not directly involve the community in the decision-making process. On the other hand, the Executive Road Safety Leadership Programme has a high level of community engagement, but does not involve the public in the Commission's decision-making. Ideally, it influences decision making in other sectors. The programme serves an important purpose of educating and joining forces with the community.

Further work will be required by the Commission if it is to proactively adopt any whole-of-government approach for citizen engagement. Compared to the level and nature of citizen engagement discussed in the WA Service Priority Review, the Commission will need to maximise the information and opportunity which should be derived from the research being carried out by Kantar Public using their 10C Citizen Engagement Framework. In addition, work is required to establish common language and definitions for public participation and community engagement if any whole-of-government approach is to be adopted. Other activities need to be explored by the Commission to achieve the higher levels of public participation in decision making.

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Due recognition is given to Kantar Public as the source and owners of the proprietary tool 10Cs framework.

The Monash University Accident Research Centre is acknowledged as the owners of the intellectual property of the Executive Road Safety Leadership Programme.

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Contributed articles

Road Safety Case Studies

Bicycle-Friendly Roundabouts: A Case-Study

Tana Tan[1], Shafiul Haque[1], Lachlan Lee-Archer[2], Thomas Mason[3], Jey Parthiban[1], Tom Beer[1]

[1] *Safe System Solutions Pty Ltd., Brunswick, Vic. 3056, Australia,*
[2] *Rail Projects Victoria, Melbourne, Vic. 3001, Australia*
[3] *City of Port Phillip, St Kilda, Vic. 3182, Australia*

Corresponding Author: Tana Tan, Safe System Solutions Pty Ltd., G2/10-14 Hope St., Brunswick 3056, Australia. info@safesystemsolutions.com.au (03) 9381 2222

Key Findings

- The upgrade to Moray Street, South Melbourne, and the innovative new design for the roundabouts at the intersections of Moray Street/Coventry Street and Moray Street/Dorcas Street have improved the safety of pedestrians and bicyclists.
- Surveys indicate that pedestrians and bicyclists perceive themselves to be safer. The percentage of bicyclists who felt safe when using the roundabout increased from 34% to 57%. The percentage of pedestrians who felt safe when using the roundabout increased from 44% to 72%.
- The eventual analysis of crash statistics will confirm (or deny) this perception, though it is to be hoped that the roundabout safety is of such a high order that there will be no crashes upon which to perform statistics.

Abstract

Roundabouts constrain speeds and impact angles for vehicles as they approach. Therefore, they are considered to be a 'Safe System' solution for intersections. Though roundabouts are a positive road safety treatment for cars they do not show as dramatic a reduction in road trauma for bicyclists. New Zealand crash data for 2001-2011, found almost 28% of injury crashes at roundabouts involve cyclists, while at priority-controlled intersections and signalised intersections the proportions are 8% and 5.5% respectively. VicRoads specifies technical guidance in relation to road safety treatments at roundabouts specifically targeted for the protection of cyclists and pedestrians. In 2018 this guidance was used to design and build two cycle-friendly protected roundabouts in Moray St, South Melbourne, as part of the Metro Tunnel Project. The project upgraded the Moray Street bicycle path to provide cyclists with a safe path in the north-south route and raised pedestrian crossings at all branches of the roundabout during Metro Tunnel works on St Kilda Road. Safe System Solutions Pty Ltd evaluated the performance and found a moderate utilisation rate of cyclists on the dedicated bicycle lanes and a high utilisation rate of pedestrians using raised crossings. The evaluation also found no significant issues with near-crashes for bicycle-and-pedestrian and bicycle-and-vehicle interaction. There were no significant problems with vehicle drivers using the protected roundabout. However, it was noted that when pedestrians are crossing at the raised crossings then vehicles would sometimes stop in the middle of the roundabout thus blocking traffic.

Keywords

Cyclists, roundabouts, vulnerable users, protected, Safe System treatments

Background

The Metro Tunnel Project is building a new underground train line from the northwest of central Melbourne through to the southeast of the city. The associated construction activity has led to closure of multiple lanes on roads and in some cases road closures leading to a localised redistribution of traffic to other roads. St Kilda Road is the main bicycle access route to central Melbourne from the south of the city and is heavily affected by construction. Rail Projects Victoria identified a need to provide an alternative route to St Kilda Road for cyclists from the south of the city to provide

Figure 1. Moray Street & Coventry Street roundabout pre-construction (left) and post construction (right) (Source: Google)

choice for cyclists who may feel uncomfortable riding through the major work site.

As a result, a 1.4 km bicycle route along Moray Street, South Melbourne was upgraded. It carries 6,000-10,000 vehicles per day with a pre-construction works speed limit of 60km/h. It consists of one traffic, parking and bicycle lane in each direction with a central median.

Roundabouts constrain speeds and impact angles for vehicles as they approach and therefore they are considered to be a 'Safe System solution' for intersections (Austroads, 2013). Though roundabouts are a positive road safety treatment for cars they do not show as dramatic a reduction in road trauma for bicyclists. New Zealand crash data for 2001-2011, found almost 28% of injury crashes at roundabouts involve cyclists, while at priority-controlled intersections and signalised intersections the proportions are 8% and 5.5% respectively (Austroads, 2017).

Moray Street has roundabouts at Coventry Street and Dorcas Street. The Coventry Street roundabout was judged to be most hazardous to cyclists (Figure 1). Using guidance in the VicRoads (2016) Technical Engineering Manual, Volume-3, Part-2.15 as a starting point, the roundabout was upgraded with an innovative design specifically chosen to reduce the hazard to bicyclists.

Because of the issues noted above (Austroads, 2017), bicycle lanes inside a roundabout are nowadays considered an unsafe treatment. Bicycle lanes inside a roundabout provide a false sense of priority for cyclists. They also can lead to side-swipe and/or rear-end bicycle/car collisions (i) when a bicycle is turning right next to a car travelling straight ahead or (ii) due to visibility issues of a bicycle hidden behind a car.

Thus, the chosen design included raised pedestrian crossing on all four legs as well as a tighter radius for cars so as to lower vehicle speeds. It was initially intended to include "sharrows" with shared lanes in the roundabout but it was subsequently realised that the "sharrow" treatment would force cyclists to merge with heavy traffic flows. This issue was raised as a concern during consultation by Bicycle Network and Melbourne Bug (Bicycle Users Group) who also proposed potential alternative treatments.

Prior to choosing the design, a total of 127 cyclists were consulted. Of these, 13% noted that a general problem with Moray Street was that of cars backing into cyclists during parking manoeuvres. Almost twice as many (27%) noted that the roundabouts on Moray St. had poorly marked bicycle lanes.

The final chosen design (Figure 2), while innovative in total, consisted of elements each of which is well tested, namely:

- Raised priority bicyclist and pedestrian crossings
- Dedicated bicycle lane leading into and around the roundabout
- Raised bicycle lane around the roundabout
- Kerbside bicycle lanes

A visual "ride-through" the roundabout is available at https://qre.host/MoraySt. This paper reports on the results of an evaluation of vehicle, cyclists, and pedestrian traffic flow resulting from the construction of the Moray Street & Coventry Street Roundabout.

Methods

Two types of surveys were conducted. Social surveys of user attitudes were based on intercept surveys of users. Quantitative surveys of vehicle counts were based on manual traffic counts and video analysis. A pre-construction survey was commissioned in early 2018 by the City of Port Phillip and the data from that survey was provided to Safe System Solutions Pty Ltd for analysis. A post-construction

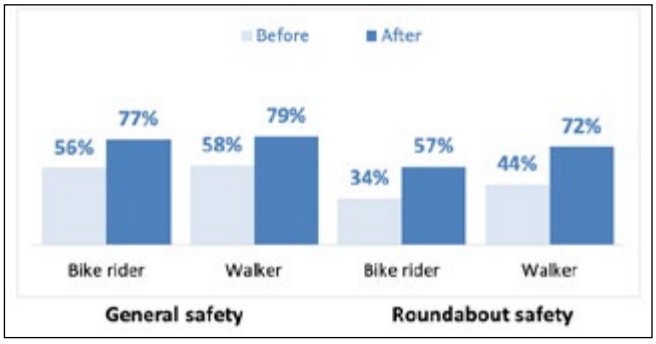

Figure 2. Final design of Moray Street & Coventry Street roundabout (Source: RPV)

survey was performed in December 2018 with the City of Port Phillip undertaking the intercept survey and Safe System Solutions Pty Ltd undertaking vehicle counts. Both quantitative and qualitative analyses were undertaken.

User Perceptions

To understand how the changes impacted on perceptions of safety, 351 surveys were conducted in April 2018, before the upgrade, and 389 surveys were conducted in March 2019, after the upgrade. The surveys asked users what type of user they were – bicycle rider, pedestrian, or both – their perception of general safety, and their perception of roundabout safety. Cyclists were also asked whether they would recommend Moray Street to inexperienced riders.

User Behaviour

Because it is too early to use crash statistics to measure safety improvements, the analysis examined video footage of all users of the Moray Street roundabout between 0700 and 1900 on six separate occasions in 2018. The three pre-construction occasions were on Saturday 17 March, Tuesday 20 March and Wednesday 21 March. The three post-construction occasions were on Tuesday 4 December, Wednesday 5 December and Saturday 8 December. This analysis had both a quantitative and a qualitative element to it. The quantitative element related to the direction of travel. The qualitative element documented the number of pedestrians and non-compliance (i.e., not using the raised crossing if they were within 20 m of the crossing).

Results

User Perceptions

Figure 3 displays the results of the surveys of user perceptions before and after construction of the roundabout. There was a substantial increase in perceptions of safety both in terms of general safety – which increased from 56% to 77% of those that replied to the survey – and in terms of safety at the roundabout – which increased from 34% to 57%.

With respect to the query about whether cyclists would recommend Moray St. to inexperienced riders, before the upgrade only 57% of cyclists who responded to the survey

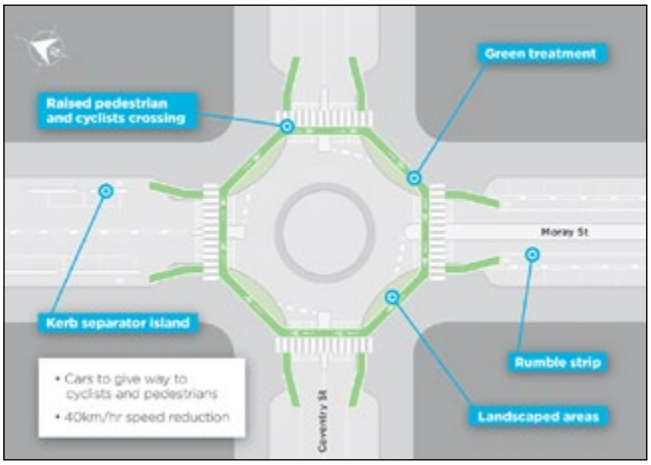

Figure 3. Since the upgrade more cyclists and pedestrians feel safe, both overall and when using the Moray St. roundabout (Source: City of Port Phillip)

indicated that they would do so, whereas after the upgrade this figure rose to 80%.

The survey responses after the upgrade identified potential new safety challenges that may require further monitoring to ensure acceptable outcomes as familiarity of all road users with the roundabout treatment increases. Many respondents (30%) noted that because cyclists are directed to designated areas of the footpath next to the roundabout, a) driver visibility of riders is reduced; b) cyclists are slowed down; c) there is occasional confusion as to who has priority; and d) there is increased potential for cyclists to crash into pedestrians – and presumably for pedestrians to crash into cyclists.

User Behaviour

There has been an overall decrease in the vehicle volume at the Moray Street & Coventry Street roundabout. This decrease ranges from 14%, for the north approach of the roundabout, to 18%, for the west approach of the roundabout. However, there was a 15% increase in vehicle volume at the south approach of the roundabout. Traffic congestion was occasionally observed, generally during peak hour (e.g. weekdays at 17:30 - 18:30) and appears to be due to traffic congestion from adjacent intersections.

The percentage of bicyclists using the bicycle lane in the east-west is moderate and north-south travel direction is high. The bicycle lane usage in the east west direction, which corresponds to the direction of local traffic, varies from 58.7% to 79.2% with an average usage of 69.9%. The bicycle lane usage in the north-south direction, which corresponds to traffic to (northward) or from (southward) the city, varies from 81.2% to 91.4% with an average usage of 88.0%. The percentage of bicyclists using the bicycle lane to perform right hand turns is moderate. Bicycle lane usage for this manoeuvre varies from 50.0% to 77.2% with an average usage of 70.1%. It is expected that the reduced usage of the lanes in an east-west direction is because the east-west streets do not have formal bicycle lanes aside from those on the immediate approach to the roundabouts.

Pedestrian usage of the pedestrian crossing is high. The average usage percentages for the north, east, south and west approaches are 89.4%, 92.3%, 94.5%, and 95.7%, respectively.

The video analysis indicates that there were very few cases where vehicles would not yield to pedestrians and bicyclists. Near crashes between vehicles, pedestrians, and bicyclists did occasionally occur but are a rare occurrence.

Most vehicles approaching the roundabout would yield to vehicles already in the roundabout, as per VicRoads road rules. Where two vehicles are simultaneously approaching the roundabout from two adjacent arms it was observed that the vehicle to the right would be given the right of way. Most vehicles also gave way to pedestrians at the pedestrian crossings at the roundabouts. This also applies to vehicles giving way to cyclists.

The photos obtained from a site visit of the roundabouts indicate that there are no significant obstructions to drivers', bicyclists', or pedestrians' sightlines at all four arms of both roundabouts. The reader may confirm this using the visual "ride-through" the roundabout, which is available at https://qre.host/MorаySt .

There has not been a significant change in vehicle traffic volume on Moray Street south of the roundabout. This was measured between Cobden Street and Raglan Street both pre- and post-construction. However, there has been an increase in vehicle average speed, 85th percentile speed, minimum speed, and maximum speed of 10%, 12%, 0.1% and 9%, respectively.

Discussion

The evaluation found no significant issues with near-crashes for bicycle-and-pedestrian and bicycle-and-vehicle interaction. There were no significant problems with vehicle drivers using the protected roundabout. However, it was noted that when pedestrians are crossing the raised pedestrian crossings then vehicles departing the roundabout would sometimes stop in the middle of the roundabout thus blocking traffic.

It would appear that upgrading Moray Street did not lead to an increase in vehicle volume, as measured south of the roundabout. However, the drop in east-west vehicles at the roundabout itself, and the rise in vehicle volume at the south approach implies that an increase in vehicle numbers during morning peak periods - when the northward flow of traffic into the city resulted in increased numbers of vehicles – may have been offset by reduced numbers at other times of day.

It is too early to use crash statistics to measure safety improvements, but it is heartening that survey results indicate that both pedestrians and bicyclists felt much safer after the upgrade of the roundabout than they had felt before the roundabout upgrade, and that video analysis confirms that most (but not quite all) bicyclists use the bicycle lane.

However, there still remain safety challenges that will need to be monitored as usage of the roundabouts increases and familiarity with the design is gained by all road users. In particular, the sections of the roundabout where the bicycle lane is immediately adjacent to the pedestrian crossing (see Fig. 1) is of concern to 30% of respondents.

Conclusions

It would appear that the upgrade to Moray Street, and the innovative new design for the roundabout at the intersection of Moray Street and Coventry Street has improved the safety of pedestrians and bicyclists. Surveys indicate that pedestrians and bicyclists perceive themselves to be safer. The eventual analysis of crash statistics will confirm (or deny) this perception, though it is to be hoped that the roundabout safety is of such a high order that there will be no crashes upon which to perform statistics.

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