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Challenges for rural and remote road safety

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Abstract

The growing national and international awareness of the increased representation of serious injuries and fatalities in rural and remote areas is the focus of this paper. Australia was one of the earliest countries to try to address this issue with a targeted national action plan in 1996. This was an important document but the most recent national plan fails to dedicate attention to developing countermeasures for the particular problems of improving road safety in these regions.

The findings of a major program of research in Northern Queensland are discussed to stimulate interest and research into potential countermeasures. Specifically, the need to monitor clusters of crashes as a focus for intervention and local ownership is advocated. Taking action towards a national reduction of speed limits on rural roads and investment in proactive research based trials of drink driving countermeasures such as courtesy buses are strongly advocated.

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Introduction

The present paper discusses a presentation made to the ACRS conference in Sydney in 2012 which was stimulated by the recent National Road Safety Strategy 2011-2020 [1]. This important document that sets the scene for actions across the jurisdictions made the point that there is ‘some evidence that road trauma trends over the last decade have varied between metropolitan, regional and remote areas of Australia though more work is required to better understand and respond to the road safety issues affecting people in different parts of our country’ [1, p19]. This comment is deeply conservative, which is arguably appropriate in an area in which there needs to be justification for both the heavy costs incurred by countermeasures and reasonable evidential support for their potential effectiveness.

However, ‘some evidence’ and ‘more work is required to understand’ suggests more caution than is justifiable from the evidence in the strategy document itself or by reference to the earlier national examination of this area in Australia’s Rural Road Safety Action Plan, “Focus for the Future” 1996 [2]. This plan had required that ‘progress will be formally reviewed and reported to Governments early in 1998, by which date considerable progress would be expected in reduction of the differential in public health road fatality rates between urban and rural sections of Australia’ [2, p6]. The expectation of considerable progress was optimistic and has obviously not been achieved.

There are constraints on direct comparison of the rural crash and fatality rate statistics due to ongoing failures to standardise definitions of rurality across jurisdictions, nationally, internationally and across time. A major review funded by Austroads in 2005 [3] found that state classifications are unique to each state with resultant problems establishing base line statistics or comparing effectiveness of relevant state countermeasures. For example, at the time of the review Queensland Transport varied the definition used for rural and remote roads depending on the particular issue being examined. The most frequent usage was for roads with 100km or higher speed zones [3, p1].

Nevertheless, a comparison of Figures 1 and 2 extracted from the 1996 Rural Road Safety Action Plan [2] and the latest National Road Safety Strategy 2011-2020 [1] make it clear that the issue of road fatalities linked positively to level of rurality has been a consistently and clearly demonstrated finding for more than a decade.

It is always commendable to collect more data and to replicate findings, but it is difficult to determine how an accumulation of similar statistics is going to appreciably affect the conclusion that fatalities are meaningfully and positively associated with the degree of rurality of a crash location. Nor is such a finding unique to Australia. Even

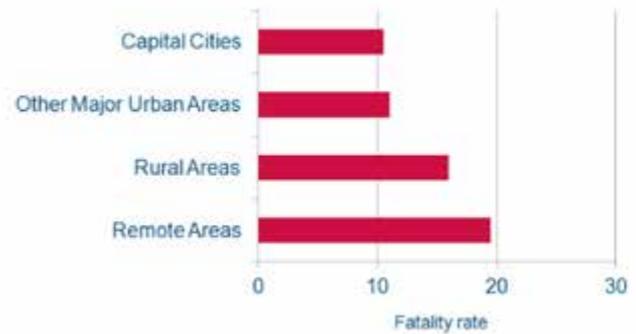


Figure 1. Australian annual road fatality rates per 100,000 population: Australia 1990-1992

Source: Extracted from Australia’s Rural Road Safety Action Plan “Focus for the Future” 1996. [2, p2]

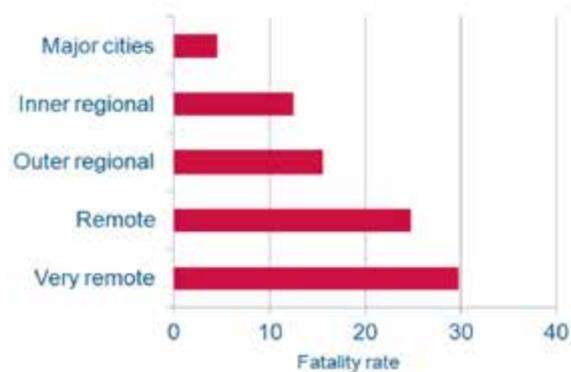


Figure 2. Road deaths per 100,000 population by remoteness area, Australia, 2006

Source: Extracted from Figure 11. National Road Safety Strategy 2011-2020 [1, p25]

given definitional variations, and these are extensive, comparisons with the recent National Centre for Statistics and Analysis (NCSA) figures on American fatality rates by rurality are even more startling [4]. In Australia in 2006-2010 an estimated 700 persons were killed annually in rural and remote crashes [5]. These areas account for 31% of the population and 46% of fatal crashes and 48% of fatalities [6]. The related NCSA figures for 2010 report that in the USA 18,026 persons were killed in rural and remote crashes and whilst only 19% of the US population lives in rural areas 54% of the fatal crashes occur there and 55% of the fatalities [4]. I draw on these findings to suggest that the issue for research consideration is not does an urban-rural differential exist but what are the priorities for countermeasure research?

In addressing this question I will draw on findings from the CARRS-Q Rural and Remote Road Safety Research Program undertaken in association with colleagues from James Cook University in Townsville and Cairns looking at factors influencing crashes in rural and remote north Queensland. The areas selected for the program of research are those areas of North Queensland classified as rural and

remote according to the Accessibility/Remoteness Index of Australia (ARIA +) system of classification [7] that is used for Australian national health statistics. The area covered by the studies included all the geographical region with a southern boundary from the coast at Bowen and West to the SA and Northern Territory border and north to the top of Cape York including those islands classified as within Australian territorial boundaries. It excluded crashes occurring in the urban areas of Townsville and Cairns.

The program was funded and supported by the Motor Accident Insurance Commission of Qld (MAIC) and all relevant central and regional government departments and hospitals. The program included the national review [3] of the actions undertaken in response to the 1996 Plan; a five year review of road crash statistics and socio-demography of the north Queensland rural and remote regions covering the period January 1st 1998 to December 31st 2002 [8]; and a prospective study of all fatal and serious crashes in the area reported in health, police and coroners' records beginning March 2004 and finishing in June 2007 [9]. There were 732 eligible crashes including 119 fatal crashes and 613 hospitalised crashes in which at least one person was hospitalised for at least 24 hours. Police, hospital and where necessary coroners' reports were reviewed for each crash. As part of the study 404 adult hospitalised patients were interviewed about the crash and road safety and 682 persons were recruited at crash sites matched to cases and they completed roadside interviews on the same issues.

CARRS-Q Rural and Remote Road Safety Research - Crashes

As an example of coverage and the types of crashes considered in the research program the identified crashes in the region around the North Queensland town of Ravenshoe are presented in Figure 3.

Ravenshoe has been selected as an example for two reasons. The College of Road Safety has made a recent 3M-ACRS Diamond Road Safety Award to the community collaborative Project RAPTAR [10] coordinated by Sergeant Musumeci from Ravenshoe. The project was a collaborative road safety response to what was considered to be a very large number of crashes experienced in that area. Figure 3 extracts the types of crashes and their locations in Ravenshoe from the rural and remote data sources. This type of cluster of crashes is not unique but represents one of a number of similar clusters of crashes that were identified across the very large geographical area of 661,335.4 km² or 38.1% of the total Queensland land area covered in the major data gathering [8].

There is no typical rural and remote crash though some aspects stand out in the Queensland studies that are replications of the data collected across jurisdictions for the national report [3] undertaken as background preparation for the Queensland Program. A very brief summary of the

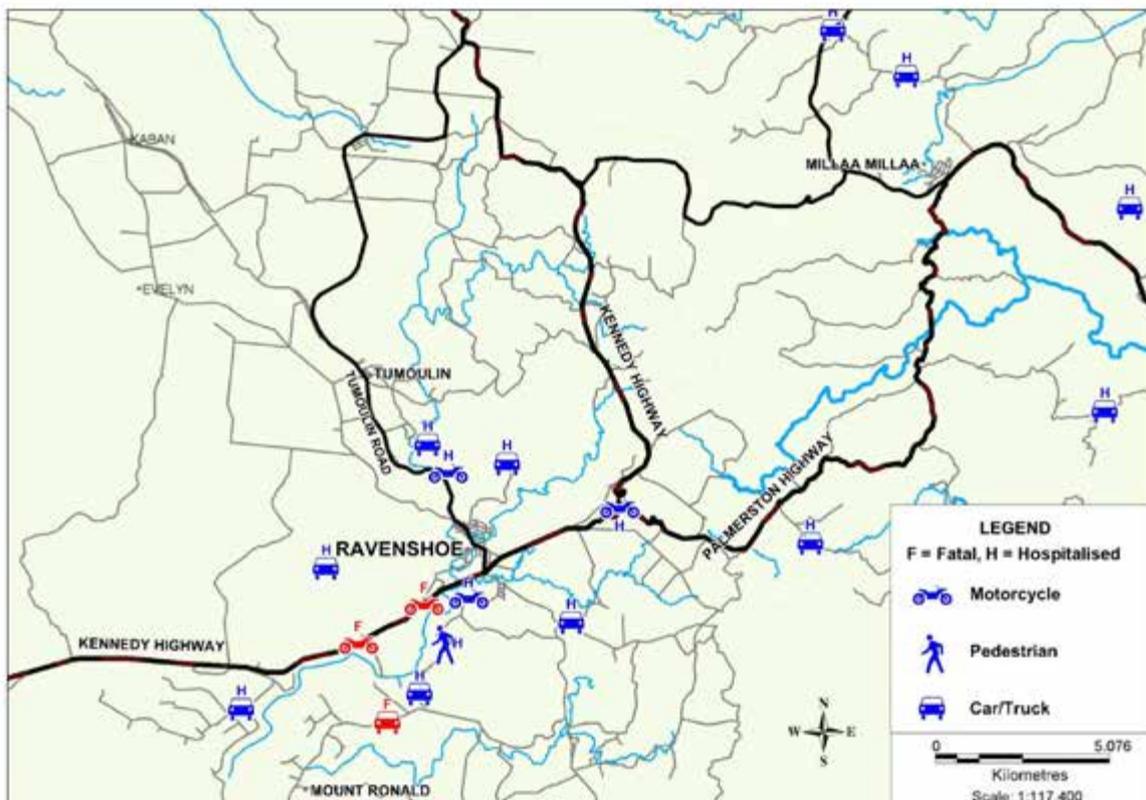


Figure 3. Crash cluster – Ravenshoe: 30.03.2004 – 30.6.2007 [9]

common findings are given here before a closer analysis drawing on differences between fatal and casualty crashes in the North Queensland region [11].

Just on three-quarters (76%) of the people involved in the crashes were male and just over half were aged between 16 and 34 yrs (52.9%). Car and truck drivers and motorcyclists made up the majority of crashes (66%). Crashes occurring across the two days of the weekend accounted for 40% of all crashes and the time period of 12 noon to 6.00pm was consistently the most likely time for a crash across all days. A more detailed analysis by time and day is available in the main study report [9]. The proportion of all study period crashes by time of day is given in Figure 4 [9] with related estimates of exposure.

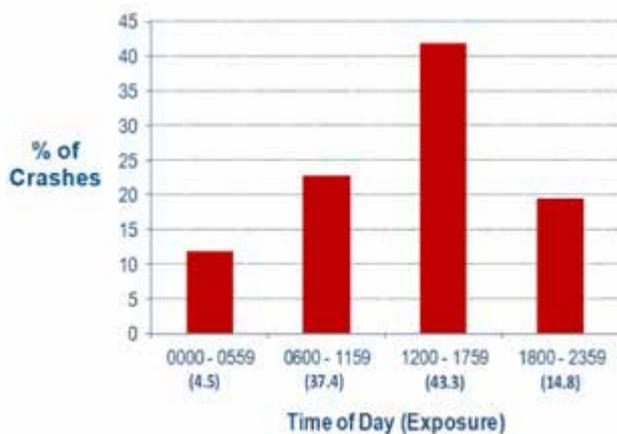


Figure 4. Time of day of fatal and hospitalisation crashes (% exposure) [9, 12]

Estimates of exposure were calculated from annualised hourly Queensland Department of Main Roads vehicle counts in 2005 along a comprehensive network of road segments across the region. On-road measurement was by means of automatic traffic counters [11].

There are numerous limitations to the comparisons drawn in these data. However, they do reinforce the previously identified apparent over representation (12%) of night crashes in the 6pm to 6am period compared with the 4.5% level of travel exposure. They also indicate a lower representation in the morning period. The highest crash involvement of just over two-fifths occurs in the period 12 noon to 5.59pm which corresponds to the exposure measures. The research team argue that there are major challenges for effective intensity of enforcement programs such as RBT and speed camera monitors in the very great distances involved in rural and remote regions. While such programs may target periods of over representation in relation to exposure in metropolitan areas they could have a stronger prevention effect in rural and remote communities by concentrating on the time when most crashes occur.

A more general finding from the study relates to attributed causes for the crashes. It was possible to link over 200 interviewed hospitalised cases who had given their perceptions of the cause of their crash with police records of the same crashes. A similar coding frame was used to match the attributions and the findings are summarised in Figure 5 below.

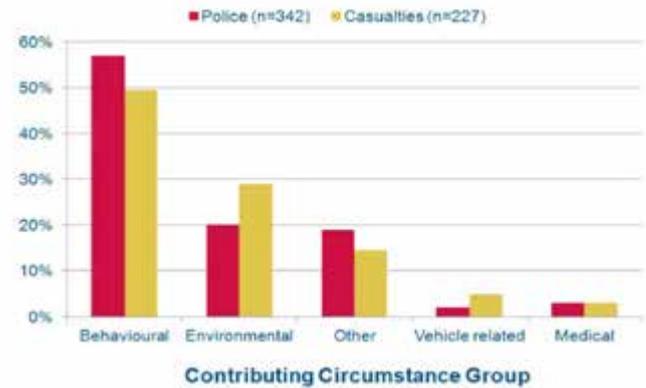


Figure 5. Contributing circumstances to crashes – police and interview reports [9]

There was a surprisingly high level of concordance between contributing circumstances with most cases attributed by both to behavioural factors. The behaviours included in this category were insufficient care and attention, alcohol and drug impairment, traffic violations, speeding, failure to give way, fatigue, disobeying signals and markers and failure to avoid another road user. Detailed analyses of these data are provided in the main study report [9]. There were some differences in attribution and perhaps not surprisingly police were more likely to give behavioural circumstances while the crash-involved respondents gave relatively more attention to environmental factors such as animals on the road, road conditions, etc. Vehicle and medical related factors were only infrequently noted by either reporter.

Finally, one of the issues that frequently arises in discussions of rural and remote crashes is the time taken for emergency retrieval. In this study the mean notification time in minutes to the hospital was 100m, the median time was 78.5m and the Interquartile range was 49-130m. A separate analysis of the fatalities by the surgical team came to the conclusion that in this study the overwhelming majority of fatal road crash casualties appeared to have injuries that were un-survivable at the outset [9, p145].

There is enormous variation in crash circumstances and the crash reported in this female interviewee’s comment cannot be considered typical for a number of reasons. The injured person is female (23.9% of total sample), a passenger (19.7% of total sample) and the crash took place in darkness in a lighted street in a small town (5.5% of total sample). It is quoted here because it reflects contributing

factors frequently mentioned in the interviews and the key behavioural elements most commonly reported by both police and respondents.

“The driver was drunk. It’s his car. He was giving us girls a lift home. Another car wanted to have a race with us and we told the driver “no”. The driver just started to laugh and wanted to race and started speeding up. We all started yelling at him that we wanted to stay alive...We told him that he should put our lives before his but he wouldn’t listen and just drove really fast. Then we hit a drain and the car clunked a few times before smashing into a building. None of us had seatbelts on except the driver.” [13]

From a prevention perspective this quote indicates that the passengers involved were aware of the risks they were taking in travelling with a drink driver, speeding and failing to wear seat belts.

A comparison of fatal and non-fatal crashes

The research program included police reported data on both the fatal crashes and those that involved a person

experiencing more than 24 hrs of hospitalisation. It was possible to compare these records to determine the factors that contributed to the more severe crashes. The major distinguishing difference between crashes leading to fatalities and those with hospitalisation outcomes does not explain the cause of the crash but the severity of the outcome once the crash had occurred. This is the use of a seatbelt and to a lesser extent protective gear in a motor cycle crash. In the sample of crashes where the police indicated that they could determine whether or not protective gear and belts had been used 41% of those in a motor vehicle fatality were not wearing a seat belt compared with 14.5% of those hospitalised. The comparable rates for failing to wear helmets by motorcyclists were lower with 10.5% fatalities and 7% for those who were hospitalised [9, p39].

In terms of road user types, car and truck drivers were more highly represented among fatalities (51.5%) than non-fatal crashes (30%). On the other hand, motorcyclists were less likely to be in the fatal crashes (17.7%) than in the non-fatal crashes (35.6%). Fatal crashes were more likely to occur on the weekend (53.8%). Vertical alignment, roadway features such as T-junctions or crossroads, or presence or absence of traffic control signs did not increase the likelihood of

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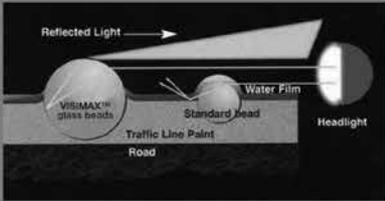


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the crash involving a fatality. Road surface condition was not associated with likelihood of fatality but a curving, horizontal alignment with the view obscured was ($p = .003$). As noted earlier, night time conditions were significantly ($p = .036$) associated with a fatal outcome from a crash. Licence status, including unlicensed and not licensed in Australia, was not more likely to be associated with a fatality. The major factors significantly and positively associated with a fatal crash were the behavioural ones of alcohol use, speeding, fatigue and road rule violations [11]. See Table 2.

When the relative risk ratios for a fatal outcome in serious crashes were derived by modified multiple logistic analysis (see Table 3) the significant factors were alcohol involvement, speeding, high speed conditions (100,110km/h) and road rule violations. What is unexpected from this analysis was that alcohol involvement made an additional contribution to the fatal outcome over and above its probable involvement in speeding. In the context of a crash with the same amount of physical forces,

illegal alcohol levels mean that the person is physically compromised in regard to injury outcomes.

Alcohol involvement

The need to develop countermeasures for reducing alcohol and driving in rural and remote crashes has been long established and recognised [2]. Self reported alcohol use and alcohol involvement in hospitalised injuries and fatal crashes was collected for the study and as noted is significantly related to fatality over and above speeding and other risk behaviours.

Other studies in the program examined whether the self reported drinking and associated behaviours of the interviewed hospitalised sample of drivers (who may or may not have had an alcohol involved crash) were similar to other people in the community in which they lived or whether they were a meaningfully different group. The information provided by the sample ($n=682$) recruited from road side surveys at locations matched to the crash sites

Table 2. Operator factors in fatal and non-fatal crashes

Road condition		Fatal %	Non-fatal %	p value*
Alcohol	Attributed	30.7	13.7	< 0.001
	Not attributed	69.3	86.3	
BAC > 0.05	Attributed	24.0	9.3	< 0.001
	Not attributed	76.0	90.7	
Speeding related	Attributed	18.7	6.6	< 0.001
	Not attributed	81.3	93.4	
Travelling over speed limit	Attributed	6.7	0.9	< 0.001
	Not attributed	93.3	99.1	
Fatigue	Attributed	16.0	11.6	< 0.001
	Not attributed	84.0	88.4	
Distraction/inattention	Attributed	20.0	25.5	< 0.001
	Not attributed	80.0	74.5	
Road rule violation	Attributed	14.7	13.4	< 0.001
	Not attributed	85.3	86.6	

* p values correspond to chi-squared tests between named groups

of the hospitalised sample were analysed for comparisons. Among a wide range of measures the AUDIT C score was used as a measure of self reported drinking levels that would be harmful to the person's health [14]. While the hospitalised sample were significantly more likely to be classified as harmful drinkers (56.8%) than the road side sample (41.2%) both figures indicate very high levels of drinking by drivers in the rural and remote community. Both groups reported similar levels of drinking alcohol in the previous 24 hours (hospital:43.2%; roadside: 37.5%). Self reported levels of drink driving in the past month were similar and reported by 16.3% of the hospitalised patients and 11.6% of the roadside participants. There was a difference between the two groups in their reports of being a passenger of a drink driver which was significantly higher for the hospitalised group [9, p122].

The role of alcohol as a risk factor in driving was recognised by both these groups. In Table 4, the first ranked 3 of a selection of 20 possible road safety interventions which could reduce crashes are compared between the hospital and road side respondents. The mean scores on the items for each group are reported and then ranked by their mean importance score.

'Courtesy buses from pubs and clubs' is given the most important rating by both groups as the best possible strategy for safety. There is not a great difference in mean scores but it is the consistency between the groups that is noted here. A further comparison of the ten highest options selected by those persons reporting harmful drinking levels and those who were either non- or relatively safe level drinkers is given in the following Table 5.

Table 3. Risk ratios, with 95% confidence intervals (95% C.I.), for a fatal outcome in serious crashes in North Queensland, derived by modified multiple logistic analysis

Factor	Risk ratio	95% CI	p value
Alcohol involvement definite	1.71	1.15 – 2.54	0.01
Speeding	2.39	1.61 – 3.55	0.001
Speed limit 70 – 90 km/h	2.00	0.90 – 4.44	0.09
Speed limit 100, 110 km/h	3.53	1.73 – 7.22	0.001
Road rule violation	1.74	1.10 – 2.74	0.02
Curve – view open	1.31	0.91 – 1.87	0.14
Curve – view obscured	1.30	0.87 – 1.96	0.20
Fatigue attributed	1.57	0.93 – 2.65	0.09

Table 4. Top 3 safety interventions ranked in importance by hospital patients and road side sample

Intervention	Hospital patients	Roadside sample
Courtesy buses from pubs and clubs	1.5 (1)	1.6 (1)
Better roads	1.6 (2)	-
Clearer identification of road hazards	1.7 (3)	-
Overtaking lanes	-	1.7 (2)
Roadside test facilities	-	1.8 (3)

Note: Importance rates from 1 = very important to 5 = not important at all

Table 5. Top 10 safety interventions ranked in importance by hospital patients (harmful level drinkers compared with other hospital respondents)

Intervention	Harmful drinkers	Others
Courtesy buses from pubs and clubs	1.5	1.6
Better roads	1.7	1.6
Clearer identification of road hazards	1.7	1.7
Overtaking lanes	1.7	1.7
Road-based fatigue initiatives	2.1	1.9
Loss of licence for serious offenders	1.9	1.9
Improved mobile phone range	1.7	2.0
Roadside test facilities	1.9	2.0
Policing people riding in back of utes	2.2	2.2
RBT	2.3	2.2

Note: Importance rates from 1 = very important to 5 = not important at all

Table 6. Key areas of intervention by cornerstone and geographical (rural and remote) location
Source: *National Road Safety Strategy 2011-2020* [1, p44]

Safe Roads	Safer roads programs targeting run-off-road and head-on crash risk, and safety intersection treatments.
Safe Speeds	Review of speed limits on higher crash risk routes.
Safe Vehicles	Focus on countering run-off-road crashes.
Safe Road Use	Improved access to graduated licensing for disadvantaged groups.

Once again ‘Courtesy buses from pubs and clubs’ is rated as the most helpful safety intervention by both groups. The lower level of importance given to RBT is also of interest.

There was consistent recognition throughout the study that drink driving is an unacceptable risk. People still engage in it or participated as passengers but it was viewed with condemnation and regret. A clear illustration of these attitudes is given in another interview excerpt from the remote community crash quoted earlier. The first part of this excerpt illustrated that the passengers were well aware that they were taking a serious risk driving with someone who had been drinking. This second excerpt describes very strong family and social condemnation of the drink driver and of their folly in being a passenger of a drink driver.

“When we crashed other people had seen it and came over and growled at us for getting in the car with the driver. They also hit the driver for being so stupid and putting us all in danger. All five of us have ended up in hospital.” [13].

It is often recommended that rural and remote people need more media campaigns and education to raise awareness about the risk of drink driving. The present studies suggest that this is too simple a solution. The communities are aware of risks but for lifestyle reasons find it very difficult to avoid the situation. They would welcome organised alternative transport and it is time for this issue to be recognised as a complex one that will need different solutions to those used in the major cities and urban areas.

Recommendations

A comprehensive range of recommendations was developed from the overall research programme findings [15]. Those that are summarised here are confined to the information discussed in this paper. They are placed in the context of the recommendations presented in the current National Road Safety Strategy 2011-2020 [1] and in the earlier 1996 Rural Road Safety Action Plan [2].

A major recommendation of the program was that there should be a similar or if possible, the same classification

used by transport jurisdictions for regional and remote crashes. Use of a nationally developed and comprehensive code would provide consistency in reporting across jurisdictions and linkage for comparison with health status figures. A move to consistency would enable compatibility of outcome indicators and facilitate meaningful evaluation of countermeasures.

The National Road Safety Strategy 2011-2020 identified key areas for intervention in geographical (rural and remote) locations extracted in Table 6.

These are commendable but are not directly responsive to the needs identified in this and other similar studies. Clearly a reduction in speeding levels would reduce fatalities [11] though the catastrophic role of failure to wear seat belts is a leading priority. The 1996 recommendations for speed are extracted below [2, p8].

- Rationalise speed limits on rural roads to provide greater consistency for similar conditions, develop guidelines and tools for nationally consistent speed zoning.
- Use the same guidelines for speed zoning roads through rural villages and towns and in the approaches to provincial cities.
- Introduce traffic calming to increase more moderate speed in rural towns.

These are primarily tailored to the particular needs and issues of rural towns and villages and the 2005 Austroads Review of the implementation of these recommendations found that there had been progress towards implementing them across jurisdictions [3]. In the rural and remote program the speed recommendations were based on the medical findings that speed is the ‘final common pathway’ to serious crash outcomes. The team recommended that lower speeds should be specified for a broader range of roads that include but are not limited to those identified as “high crash risk routes”. Rural speed limits should be reduced to 90km/hr for sealed off-highway roads and 80km/hr for unsealed roads [15]. This recommendation has two goals. The first is a decreased injury severity by reducing crash speeds. The second recognises that there can be a high level of community resistance to lowered road speeds in rural and remote areas. This has been attested by the ongoing political debate in the Northern Territory. The issue here is that change and change acceptance grows through the process of community debate and discussion. Recommendations to change speed limits to more closely accord with road conditions should stimulate increased recognition of the need to drive at a speed limited by road conditions rather than to defined limits. That there is already a degree of recognition of this need was suggested by the counterintuitive crash protective factors of adverse weather conditions found in the study of fatal crashes [11].

The earlier 1996 Action Plan identified a need for localised content of public education in the area of alcohol and an associated need to increase enforcement and utilise new technologies to counter the problems of distance and local attitudes to enforcement. The later National Road Safety Strategy 2011-2020 [1] includes a reference to recognising drink driving as a crash problem area that should be addressed as part of the general ‘safe people’ initiatives. There is no particular consideration of rural and remote drivers in the seven road user groups identified in ‘crash problem areas’ or associated recognition that their needs and potential countermeasures should be specially targeted.

The following recommendations from the present research program related to alcohol are placed in the context that rural and remote communities are characterised by alcohol associated life styles in places where there are few if any public transport options.

- Courtesy buses should be advocated and supported and schemes such as the Skipper project promoted as local drink driving countermeasures in line with the very high levels of community support for these measures.
- Distances impact on the visibility and general deterrence effectiveness of alcohol and speed enforcement programs. These programs should target the period between 2pm and 6pm because of the high numbers of crashes and high levels of potential exposure in the afternoon period throughout the rural region.

These recommendations were made in the context that all groups of respondents almost without exception reported knowledge and attitudes similar to those quoted above in the crash comments. That is, people knew that drink driving was unsafe and considered it involved a quite serious infringement of community and personal norms. In their consistent allocation of courtesy buses as the most likely intervention to reduce road fatalities and crashes they indicated also an awareness and acceptance of a need to find travel alternatives to drink driving. The lower levels of importance given to RBT by these groups probably also reflect personal experience of its reduced impact in a rural context.

There are further recommendations from the research program that should be considered. These policy recommendations are linked to the absolute numbers of fatalities and seriously injured as a direct way of impacting on those most directly affected. Thus it was recommended that in the context of limited funding for interventions the very high representation of males among rural and remote road crash fatalities should be the focus for change. In particular, those males aged between 30 and 50 years who comprise the largest number of casualties must be targeted

if there is to be a meaningful reduction in rural and remote fatalities and serious hospitalisations.

It was considered that timing and local focus was vital for maximum effectiveness given the very great geographical distances involved. The requirement for black spot identification of clusters of accidents in rural areas is relatively tight as for example ‘all areas with more than 6 accidents per square km per year’ [16,p21]. In many cases in the present research program such as the one at Ravenshoe noted earlier this criterion would not have been reached. However, clusters of crashes do occur and can be readily identified by police, local government and the relevant communities who become aware of and concerned by heightened numbers of local deaths and crashes. Any such identification of clustering represents an optimum opportunity to introduce increased enforcement and community change countermeasures. The intervention by Musumeci in Ravenshoe [10] is an example of excellent and timely use of such a cluster as a way to mobilise community response across a range of road safety concerns.

Finally, it is recommended that an interim second Australian Rural Road Safety Action Plan be developed with particular attention to potential countermeasures and commitment to research to address the clearly known need for effective interventions.

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