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ORIGINAL RESEARCH

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Road traffic fatalities in rural and remote Australia from 2006 to 2017: The need for targeted action

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Abstract

Objective: To explore rural motor vehicle collision (MVC) fatalities by trends over time, mode of transport, age, state, sex, and Aboriginal and Torres Strait Islander status.

Design: A retrospective total population-based time series was conducted using the Australian Bureau of Statistics (ABS) death registration data.

Setting: All statistical local area (SLA) within Australia from 2006 to 2017.

Participants: Australian residents whose deaths were registered with the ABS between 01 January 2006 and 31 December 2017 where the underlying cause of death was related to unintentional transport accidents.

Main outcome measures: Fatality rates were determined using population data collected from the 2006, 2011 and 2016 census. Trends over time by rurality were analysed by financial year. Rates of transport deaths by vehicle type were determined by rurality. Risk ratios were calculated to compare demographic groups based on sex, Aboriginal and Torres Strait Islander status and age. A 3-year scorecard was organised by state and rurality using 99.7% confidence intervals.

Results: Motor vehicle collision fatalities increase with increasing remoteness. Females, children from 0 to 14 years, pedestrians, and Aboriginal and Torres Strait Islander peoples are at a significantly higher risk of fatal MVCs than their respective metropolitan counterparts. The 3-year scorecard indicates that road fatality rates in the NT, WA, and all rural and remote areas required immediate attention and targeted action.

Conclusions: There is a need for investment in MVC fatality prevention in rural Australia from inner regional to remote areas in order to meet the road safety targets established by the National Road Safety Strategy.

KEYWORDS

Australia, fatalities, motor vehicle collision, remoteness, road safety

1 | INTRODUCTION

Driving is a major component of life and work for those in rural areas and, unfortunately, comes with increased risk with increasing degrees of remoteness.[1] There is a public health need to address rural road safety as Australians living in rural and remote areas are overrepresented in fatal crash data.[2] Road safety was identified by the United Nations as an area of significant importance in the 2020 Agenda for Sustainable Development.[3] Many participating countries, such as Australia, have committed to an agreed set of national goals, objectives and action strategies to reduce motor vehicle collision (MVC) fatalities.[4] The 2020 deadline has passed, and its targets were not met, and thus, a reflection on road safety strategies is merited at this time.[3] In order for Australia to achieve the road safety goals in the next decade, high-risk groups, including rural populations, must be prioritised, and targeted action is required.

Motor vehicle collision fatalities in Australia decreased by 23.2% in the 10 years to 2018.[5] Progress has been made in legislation, road safety enforcement, education programs, vehicle safety and road infrastructure.[6] Despite these interventions, MVC fatalities remain a significant contributor to injury-related deaths in Australia, especially in rural settings.[7,8] The Australian Institute of Health and Wellness has determined that the rate of transport-related deaths is five times higher for those living in very remote areas in comparison with their urban counterparts.[7] This study intends to expand upon this report by examining the trends and risk factors contributing to the inequities in rural MVC fatalities.

Motor vehicle collision deaths are largely predictable and preventable and can be reduced with appropriate public health intervention.[9] Rural and remote areas are particularly challenged by health care access, higher rates of risky behaviour, complex social determinants of health, vast road networks and increased occupational hazards.[2,10] Urban solutions are often inadequate to improve rural road safety, and it is important to understand the unique characteristics and circumstances of MVC fatalities on rural roads.[2] Exploring trends in rural road fatalities is necessary to inform effective prevention strategies. This retrospective case series analyses MVC fatalities by rurality in Australia using deaths data from the Australian Bureau of Statistic (ABS) for the period of 2006–2017 by trends over time, mode of road use, age and sex, state, and territory.

What is already known on this subject:

- Motor vehicle collision (MVC) fatalities are a significant burden globally, and Sustainable Development Goals have not been met for 2020
- MVC fatalities increase rurally Australia-wide
- MVC fatalities are largely predictable and preventable with correct public health interference

What does this study add:

- Pedestrian deaths per 100 000 increased with increasing remoteness over the 12-year period
- Females (RR = 5.3), children aged 0–14 years (RR = 7.6–11.7), and Aboriginal and Torres Strait Islander peoples (RR = 4.4) in Very Remote areas were identified as high-risk demographic groups in comparison with their major city counterparts
- A road fatality scorecard identified that the Northern Territory, Western Australia and inner/outer regional areas in Australia require immediate attention and targeted action pertaining to safer roads, vehicles, speeds and drivers

2 | METHODS

This study used individual death data from the ABS for the years 2006–2017, including all deaths in Australia where year of death registration was 2006–2017 and year of death was 2006–2017. Data sets used include the final National ABS cause of death unit record file data for the years 2006–2014, revised data sets for 2015–2016 and preliminary data for 2017. Information regarding the deceased individual's age, sex, Aboriginal and Torres Strait Islander status, and usual residence was extracted from the data set.

The International Classification of Disease 10th Revision (ICD-10) was used by the ABS to code the deaths registration data.[11] The inclusion criteria were deaths registered with transport injuries as an underlying cause of death, as coded in Table 1.

The ABS reports usual residence as the place in which the deceased lived or intended to live for six or more months in the reference year. Death certificates are assigned a five-digit Statistical Location Area (SLA) code, categorised by the Australian Standard Geographical Classification (ASGS) as major cities (MC), inner regional (IR), outer regional (OR), and remote (R) or very remote (VR) areas.[12] Those who were registered as, 'usual residence overseas', or 'usual residence unknown', were excluded from the analysis. Intentional transport deaths (suicide) were also excluded from the analysis.

TABLE 1 ICD-10 codes related to transport accidents[11]

ICD-10 Code	Description
'V01-V09'	Pedestrian injured in transport accident
'V10-V19'	Pedal cyclist injured in transport accident
'V20-V29'	Motorcycle rider injured in transport accident
'V30-V39'	Occupant of three-wheeled motor vehicle injured in transport accident
'V40-V49'	Car occupant injured in transport accident
'V30-V39'	Occupant of pickup truck or van injured in transport accident
'V60-V69'	Occupant of heavy transport vehicle injured in transport accident
'V70-V79'	Bus occupant injured in transport accident
'V80-V89'	Other land transport accidents

Human ethics approval was granted for the study from James Cook University (H6136) and approval provided by the ABS.

The descriptive analysis of death data was completed using the SPSS™ software, version 24. Trends over time were presented using financial years from 1 July 2006 to 30 June 2017, so that drop-off rates from late registration of deaths did not affect interpretation. Where MVC fatality rates were determined, population data were averaged out based on 2006, 2011 and 2016 census data extracted from ABS Census QuickStats.[13] Due to small fatality numbers in particular road user classification groups, motorcyclists and occupants of three-wheeled motor vehicles were grouped together, and occupants of pickup trucks, vans, heavy transport vehicles and buses were also grouped together. Risk ratios were calculated for demographic groups using major cities as the comparator, along with 95% confidence intervals.

2.1 | Scorecard methods

To understand recent MVC fatality trends, a 3-year regional scorecard organised by state and transport mode was derived using fatality data from 1 July 2014 to 30 June 2017. Rates per 100 000 were calculated using population data from the 2016 census. All cells were compared with the overall rate for their given transport mode. 99.7% confidence intervals were calculated using the following formula:

$$99.7\%\ \text{CI} = \left(\frac{100\,000}{n}\right)(2.58 \pm \sqrt{d})$$

d = number of events per annum, n = population.

Cells with rates below three standard deviations of the overall rate were considered to be of low concern, and cells above three standard deviations were considered to be areas where immediate attention and targeted action are required.

2.2 | Definitions

2.2.1 | Road death or fatality

An individual who dies as a result of injuries sustained from an MVC within 30 days of the collision where the ICD code is V01-V89.[5]

2.2.2 | Rural and remote

Rural and remote areas include all areas outside of major cities. For the purposes of this research, rurality will be classified based on the Australian Statistical Geography Standard (ASGS) remoteness structure.[12] The four categories used to describe rural areas are based on relative access to services are as follows: inner regional, regional, remote or very remote.[12]

2.2.3 | Unintentional death

Unintentional deaths refer to deaths which result from an unanticipated event such as an injury or disease.[14] Unintentional deaths exclude deaths caused by suicide or homicide.

3 | RESULTS

There were 16 977 transport-related deaths registered from 2006 to 2017. Of these, 8465 were registered as residents of major cities, 4822 were residents of inner regional areas, 2698 were residents of outer regional areas, 532 were residents of remote areas, and 460 were residents of very remote areas.

Overall, MVC fatalities declined over the study period by 23.5%. Decline from 2006/07 to 2016/17 was present for all ASGS remoteness areas. The greatest decline was found in very remote areas followed by remote areas,

outer regional areas, major cities and inner regional areas. Fatality rates in remote and very remote areas were consistently higher than their regional and metropolitan counterparts (Figure 1).

Across the 12-year study periods (2006–2017), amongst transport-related deaths, the *car occupant* fatalities category was the most common (54%), and rates steadily increased with increasing rurality (2.0–12.3 per 100 000). *Pedestrian* fatalities (16%) (0.9–2.6 per 100 000) followed a similar trend and were over four times higher in very remote areas than in major cities. *Motorcycle or 3-wheeler* (17%) and *cyclist* (3%) fatalities (0.9–1.5 per 100 000) showed no trend with remoteness. However, the lowest rates of *Motorcycle or 3-wheeler* and *cyclist* fatalities occurred in major cities, at 0.87 per 100 000 and 0.14 per 100 000, respectively. *Pickup truck*, *van*, *heavy transport and bus* (5%) fatality rates (0.2–0.6 per 100 000) were highest in remote areas rather than very remote areas, and all remoteness categories were at least 2.8 times higher than major cities (Figure 2).

Over the 12-year period (2006–2017), the rates of MVC fatality rates per 100 000 for each state were consistently highest in the 'very remote' category where it existed, noting that Victoria and the Australian Capital Territory do not have very remote areas. The highest fatality rates in major cities, inner regional and outer regional areas occurred in Western Australia. Motor vehicle collision fatalities in remote and very remote areas were highest in the Northern Territory (Figure 3).

The 3-year scorecard revealed that of the five ASGS remoteness categories, the Northern Territory (61.1% red, 0% neutral and 38.9% green) and Western Australia (60.0% red, 16.7% neutral and 23.3% green) had the highest proportions of transport groups that require immediate attention and targeted action. Contrarily, the Australian Capital Territory (0.0% red, 37.5% neutral and 62.5% green) and Tasmania (33.3% red, 33.3% neutral and 54.2% green) had the highest proportions of transport groups with MVC fatality rates of low concern. Inner regional (56.3% red) and outer regional areas (64.6% red) exhibited a high number of transport groups with above average fatality rates that require attention and intervention (Table 2).

Relative risk calculations indicated an increasing level of risk with an increase level of remoteness for sex and Aboriginal and Torres Strait Islander status, with the exception of non-Aboriginal peoples in outer regional areas. Relative risk was higher for Aboriginal and Torres Strait Islander peoples than for non-Aboriginal peoples in outer regional, remote and very remote areas. The highest relative risk for males and females occurred in very remote areas. The demographic group with the highest risk of MVC fatality was children aged 0–4 in very remote areas. Overall, children under 15 in remote and very remote areas ranged from 4.8 to 11.7 times more likely to die in a fatal MVC than their metropolitan counterparts. For adults, those aged 30–39 showed the highest relative risk in remote and very remote areas (Table 3).

4 | DISCUSSION

Regional, rural and remote areas in Australia experience higher rates of MVC fatalities than their urban counterparts, with fatality rates increasing across the country as you move away from urban centres. This study explored MVC fatalities for the 12-year period from 2006 to 2017 and found a downward trend in deaths, though this trend has slowed in the last few years. Remote and very remote MVC fatality rates were consistently higher regardless of year, suggesting prevention activities appropriate for rural settings are needed for Australia to meet road safety targets. Evidence-based rural prevention strategies are lacking in current research and will be required to reduce the gap.

The success of road fatality reduction in high income countries has been attributed to decades of action including research in road systems, vehicle safety, exposure reduction for vulnerable road users and improved road design and enforcement.[15] Of 35 OECD countries, Australia's road fatality rate per 100 000 in 2017 ranked 17th of 35 nations, at 4.98 per 100 000.[16] The rural fatality rates tell a different story at 16.45 deaths per 100 000,[16] higher than the national rates of many low- and middle-income countries including Cambodia (11.9 deaths per 100 000), Jamaica (13.9 deaths per 100 000) and Columbia (14.1 deaths per 100 000) that same year.[17]

This study found that the likelihood of rural road fatalities varies by vehicle type, which was consistent with the findings of Wundersitz et al.[2] Vehicle types are often more diverse on rural roads where recreational vehicles and heavy transport vehicles for mining and agricultural purposes are more commonly seen, and travel greater distances.[1,18] This study also found high variation in fatality rates by transport type depending on remoteness category. The results may provide valuable information Australia wide for vehicle-specific road safety measures and crash prevention.

4.1 | Pedestrians

The data indicated a need for attention to pedestrian safety in rural and remote settings. There is a significant gap in research regarding pedestrian safety on low volume roads.[19] Pedestrian fatalities in remote settings may be attributed to a lack of footpaths and road crossings, poorer

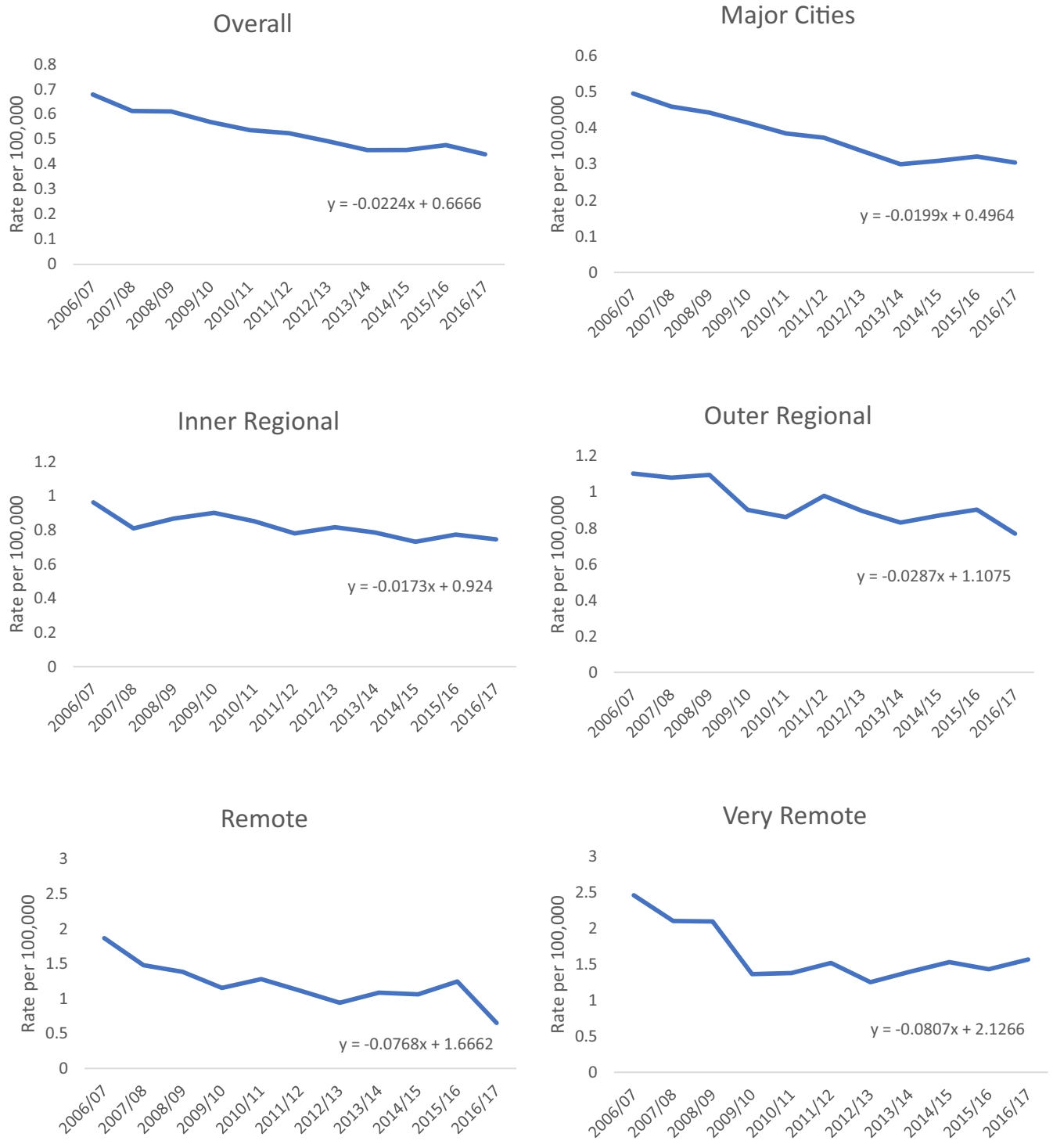

FIGURE 1 Motor vehicle collision fatality rates over time by rurality, Australia: 1 July 2006 to 30 June 2017. Rurality is defined by the Australian Statistical Geography Standard[12]

visibility and lighting in comparison with urban centres and/or higher speed roads.[20] The Australian Government is currently designing and funding healthy infrastructure to support safe road environments for active transport, including walking and cycling as a part of the National Road Safety Strategy,[4] and this needs to include specific strategies for rural locations.

4.2 | Other vehicles

Heavy agricultural vehicles are commonly seen on rural roads, and their large size and weight contribute to increased safety risks.[21] Our scorecard results indicated that fatality rates for pickup trucks, vans, heavy transport and buses were highest in inner regional and outer regional

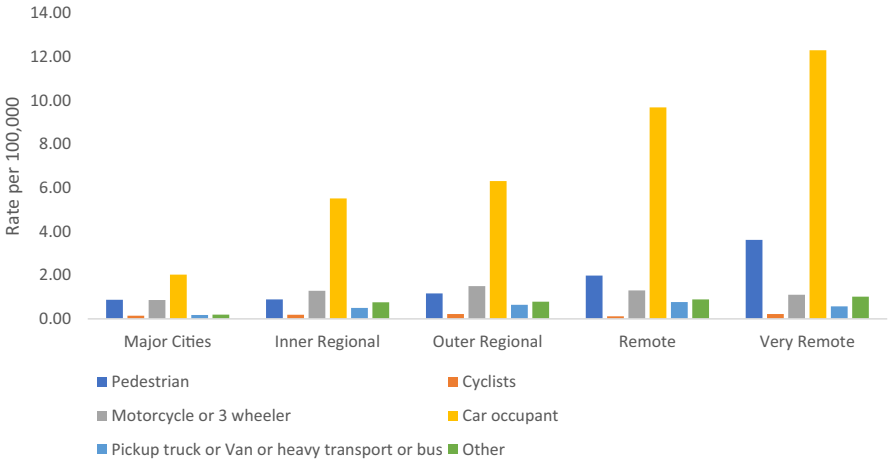

FIGURE 2 Motor vehicle collision fatalities per year by rurality by transport type: Australia, 2006 to 2017. Rurality is defined by the Australian Statistical Geography Standard[12]

areas. Prevention efforts surrounding heavy transport should include policy development, education for drivers and other road users, novel data collection (including GPS) and good quality roads, which can additionally enhance economic development.[21]

4.3 | State and territory

The Northern Territory and Western Australia showed consistently high rates of MVC fatalities, indicating that more work needs to be done in these regions. It is known that differences in built environment, including road quality, barriers and lighting, largely contribute to the risk of driving on rural roads.[2,22] It is recommended that these areas are prioritised during the development of road safety strategies with the consideration of their unique geographical challenges and built environments. This may require increased funding to improve infrastructure and promote research activity specifically in the Northern Territory and Western Australia.

4.4 | Demographics

Epidemiological studies have shown MVC fatality risk for Australian demographic groups is variable when it comes to age,[23,24] sex,[25] and Aboriginal and Torres Strait Islander status.[26] Contrary to standardised mortality ratios derived from 1997 to 1996 data, our results indicate that females in rural areas are at a significantly higher risk of fatal crashes in comparison with their metropolitan counterparts than males.[25] The influence of duration and frequency of road travel on the differences in relative risk between gender groups is unknown and cannot be determined by our data. However, the determinants of high female fatality rates in rural and remote Australia should be further examined.

Adverse injury outcomes for children in rural and remote settings have been attributed to increased exposure to environmental hazards, long travel distances to emergency services and inadequate supervision.[27] Previous research indicated high road traffic injury mortality rates for children aged 0–14 in Victoria demands further attention.[23] Our results were consistent with these findings and indicated children in rural and remote areas to be the highest risk of all demographic groupings. Further investigations are required to explore rural MVC child deaths in more detail.

4.5 | Aboriginal and Torres Strait Islander Peoples

Aboriginal and Torres Strait Islander peoples in Australia face higher rates of injury-related deaths in comparison with their non-Aboriginal counterparts.[7] Geography is a key contributor to road transport injury population inequalities as a greater proportion of Aboriginal and Torres Strait Islander peoples live in rural and remote areas.[28] These inequalities are compounded by socio-cultural and historical factors, which reduce access to medical care, employment, medical and training facilities, and other social services.[2,29] Aboriginal and Torres Strait Islander peoples are exposed to higher rates of drink driving, risky pedestrian behaviour, poor seatbelt compliance, overcrowding in vehicles, unlicensed driving and reliance on unroadworthy motorised transport.[30] Further, roads in Aboriginal communities are often of poor quality and are generally not included in governmental road maintenance works.[2] Our study showed a road fatality gradient by geographical remoteness, where Aboriginal and Torres Strait Islander peoples residing in Remote and Very Remote areas were over four times as likely to die in a fatal MVC than those residing in Major Cities. Despite high rates of road injury and fatality, Aboriginal and Torres Strait Islander peoples do not report less safe driving behaviours in comparison with the rest of the population.[15] The Closing the Gap framework aims to reduce the discrepancy of life expectancy between Aboriginal and Torres Strait Islander and non-Aboriginal Australians, which

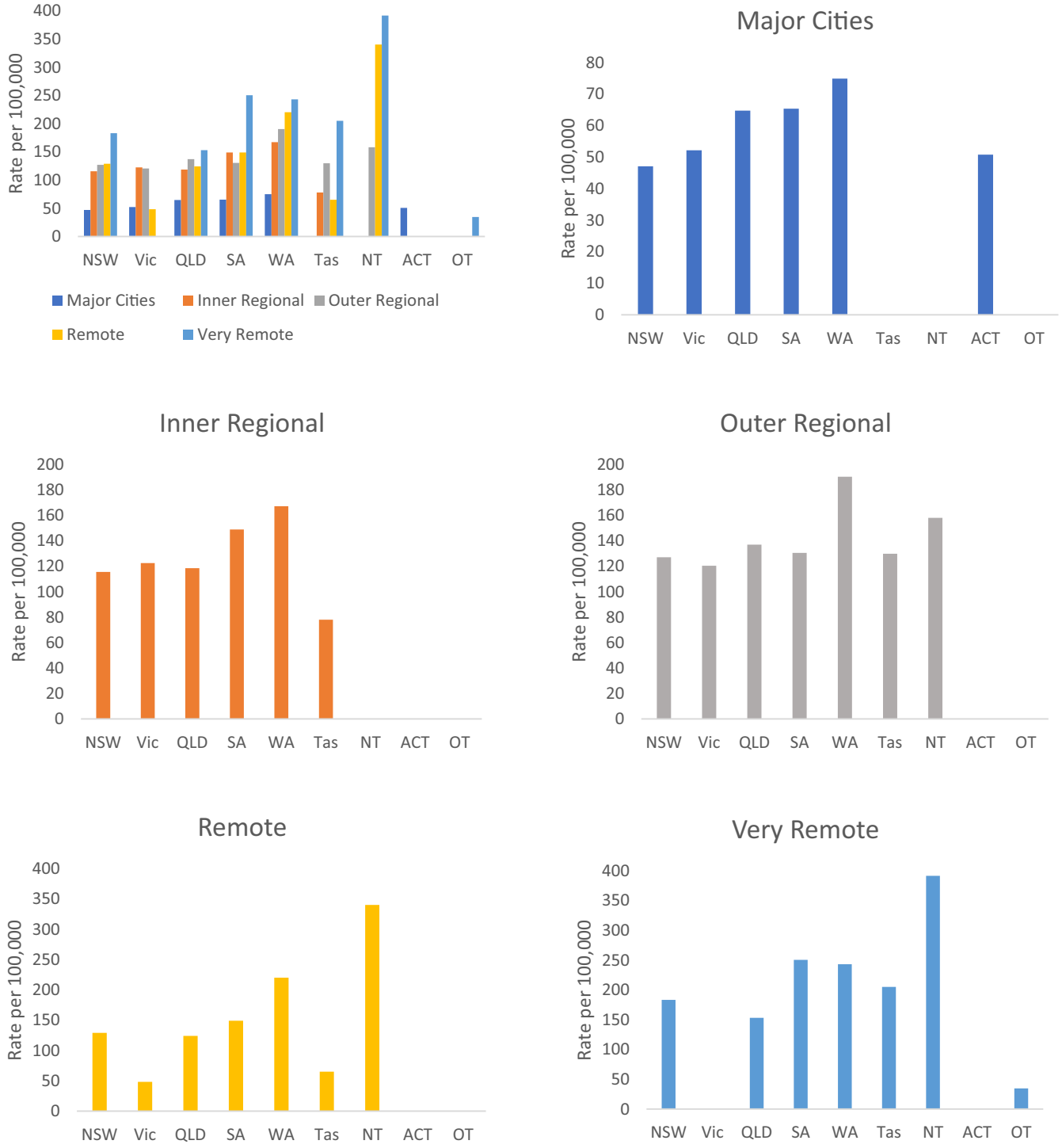

FIGURE 3 Motor vehicle collision fatalities by state by rurality: Australia, 2006 to 2017. Rurality is defined by the Australian Statistical Geography Standard[12]

must include improving injury outcomes.[29,31] In order to Close the Gap,[29,31] MVC fatality discrepancies must be addressed. Policy and prevention efforts in rural and remote Australia should include Aboriginal and Torres Strait Islander-led community-based action, developed with a thorough understanding of the determinants of road fatalities in these settings.

4.6 | Targeted action and prevention strategies

There is very little research determining the effectiveness of rural and remote MVC prevention strategies in Australia. A one-size-fits-all approach to prevention strategy development will not suffice, as rural environments

TABLE 2 Fatal MVC scorecard by state, rurality and vehicle type: 1 July 2014 to 30 June 2017

	NSW	Vic.	QLD	SA	WA	TAS	NT	ACT	Overall
Overall									
Pedestrian	0.863	0.785	0.785	0.976	0.751	0.899	3.807	0.336	0.845
Cyclists	0.104	0.192	0.110	0.215	0.191	0.064	0.136	0.084	0.144
Motorcycle or 3-wheeler	0.820	0.774	1.253	0.820	1.579	1.413	2.175	0.841	1.004
Car occupant	2.455	2.779	2.980	3.844	4.280	3.532	10.468	1.514	3.027
Pickup truck, van, heavy transport or bus	0.181	0.126	0.282	0.312	0.293	0.257	0.136	0.000	0.207
Other	0.487	0.264	0.296	0.195	0.217	0.450	0.136	0.336	0.337
Major cities									
Pedestrian	0.902	0.775	0.637	0.953	0.694			0.341	0.787
Cyclists	0.093	0.178	0.077	0.159	0.215			0.085	0.132
Motorcycle or 3-wheeler	0.572	0.704	1.098	0.635	1.306			0.852	0.798
Car occupant	1.353	1.770	1.811	2.303	2.380			1.534	1.743
Pickup truck, van, heavy transport or bus	0.116	0.064	0.220	0.238	0.182			0.000	0.134
Other	0.272	0.107	0.220	0.132	0.116			0.341	0.190
Inner regional									
Pedestrian	0.656	0.795	0.893	1.427	0.948	1.071		0.000	0.826
Cyclists	0.158	0.236	0.206	0.535	0.135	0.097		0.000	0.199
Motorcycle or 3-wheeler	1.719	0.884	1.305	1.070	3.520	1.460		0.000	1.461
Car occupant	5.745	6.185	4.806	8.026	6.904	3.212		0.000	5.607
Pickup truck, van, heavy transport, or bus	0.294	0.383	0.378	0.178	0.541	0.292		0.000	0.344
Other	1.018	0.707	0.446	0.535	0.541	0.195		0.000	0.696
Outer regional									
Pedestrian	1.114	0.956	1.289	0.662	0.177	0.601	1.392		1.005
Cyclists	0.074	0.273	0.143	0.331	0.000	0.000	0.232		0.144
Motorcycle or 3-wheeler	0.965	1.638	1.861	1.324	1.952	1.403	2.785		1.626
Car occupant	5.718	6.416	4.868	7.781	14.908	4.210	6.730		6.489
Pickup truck, van, heavy transport or bus	0.668	0.137	0.477	0.993	1.242	0.200	0.000		0.542
Other	1.337	1.229	0.382	0.166	0.355	0.802	0.000		0.670
Remote									
Pedestrian	0.000	0.000	0.850	0.727	0.644	0.000	6.822		1.566
Cyclists	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
Motorcycle or 3-wheeler	1.097	0.000	1.275	2.182	1.289	0.000	2.047		1.461
Car occupant	3.290	0.000	4.674	8.729	9.022	0.000	15.690		8.038

TABLE 2 (Continued)

	NSW	Vic.	QLD	SA	WA	TAS	NT	ACT	Overall
Pickup truck, van, heavy transport, or bus	0.000	0.000	0.000	0.000	0.322	0.000	0.682		0.209
Other	2.194	0.000	0.425	0.727	0.644	4.183	0.682		0.835
Very remote									
Pedestrian	0.000		0.567	2.252	3.723	0.000	7.590		3.458
Cyclists	0.000		0.000	0.000	0.532	0.000	0.000		0.165
Motorcycle or 3-wheeler	4.059		1.134	2.252	2.127	0.000	0.633		1.482
Car occupant	4.059		8.503	13.514	15.422	14.071	15.813		12.681
Pickup truck, van, heavy transport or bus	0.000		0.000	0.000	0.000	0.000	0.000		0.000
Other	4.059		0.567	0.000	1.064	0.000	0.000		0.659

Note: Red = Areas in need of improvement; Green = Areas of least concern. Rurality is defined by the Australian Statistical Geography Standard.[1]

Abbreviations: ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; QLD, Queensland; SA, South Australia; TAS, Tasmania; Vic., Victoria; WA, Western Australia.

have challenges unique to urban roads. Working partnerships across all three tiers of government are necessary to develop effective countermeasures.[2] Strategies designed for metropolitan areas are often not feasible nor affordable for rural communities.[2] Innovative, low-cost and cost-effective prevention strategies are urgently needed.[2] Such strategies should consider interventions that reduce crash severity rather than interventions that improve conditions for traffic flow and mobility.[2]

Motor vehicle collision prevention strategies can be grouped under the four pillars of safe roads, safe vehicles, safe speeds and safe people (drivers).[2] Commonly cited prevention strategies include improved road infrastructure (safe roads), improved vehicle design (safe vehicles), drink driving prevention (safe drivers), driving education (safe drivers), restraints (safe vehicles and safe drivers) and reduction of speed limits (safe speeds).[4,32]

In addition, rural emergency and trauma systems including aeromedical retrieval are a major determinant of road fatalities.[33] It is known that the likelihood of fatal outcomes increases as delays between the time of injury and definitive care increases.[34] Community-wide training in cardiopulmonary resuscitation (CPR) has been deemed an effective upstream strategy, especially in rural emergency situations.[35]

4.7 | Future directions

To achieve the proposed target of 50% reduction in road deaths and serious injuries by 2030, we must engage in a global health discourse that includes the consideration of the unique risk factors and conditions of rural and remote road fatalities. Efforts to reduce fatal MVCs need to be undertaken in partnership with rural and remote organisations and by people residing in these locations, who have an understanding of the wider social, economic and political challenges being faced by people living in rural and remote areas.

4.8 | Strengths and limitations

A strength of this paper is that we were able to conduct an Australian-wide population-based time series, minimising selection bias. This study has limitations. Australian Bureau of Statistics death data used are based on ICD codes, which do not go into detail. The denominator used for calculating fatality rates was an average of only the three available census years. Rates were calculated over the 12-year period, which takes out any improvements made over time. The examination of risk factors such as drugs and alcohol was beyond the scope of this paper; however, they should be explored in future research. Place of usual residence was used to assess rates by state, the 3-year scorecard, and relative risk. Deaths may have occurred outside of the individuals' usual place of residence, and this was not captured in the calculations. For example, residents of major cities may have died on rural roads; however, their death would have been analysed as a major city fatality, potentially distorting the true rates of rural and remote fatalities.

TABLE 3 Relative risk of fatal MVC for demographic groups by rurality: 1 July 2014 to 30 June 2017

		Relative risk [95% confidence interval]			
	Major cities	**Inner regional**	**Outer regional**	**Remote**	**Very remote**
Sex					
Male	1.00	1.98 [1.09, 2.07]	2.34 [2.23, 2.46]	2.86 [2.58, 3.17]	3.77 [3.37, 4.22]
Female	1.00	1.99 [1.86, 2.13]	2.17 [1.99, 2.36]	3.23 [2.74, 3.82]	5.25 [4.43, 6.23]
Aboriginal and Torres Strait Islander Status					
Yes	1.00	1.49 [1.21, 1.83]	2.03 [1.67, 2.47]	4.40 [3.58, 5.42]	4.38 [3.65, 5.26]
No	1.00	2.16 [2.08, 2.24]	1.60 [1.53, 1.68]	2.55 [2.29, 2.84]	2.80 [2.38, 3.29]
Age					
0–4 years	1.00	2.42 [1.82, 3.23]	4.65 [3.49, 6.20]	5.13 [2.95, 8.91]	11.67 [7.47, 18.19]
5–9 years	1.00	2.01 [1.44, 2.81]	3.49 [2.46, 4.95]	6.09 [3.41, 10.86]	7.56 [4.15, 13.78]
10–14 years	1.00	2.16 [1.60, 2.91]	2.77 [1.96, 3.92]	4.83 [2.60, 8.98]	10.10 [5.97, 17.05]
15–19 years	1.00	2.58 [2.31, 2.88]	2.86 [2.49, 3.27]	4.50 [3.43, 5.89]	3.84 [2.73, 5.37]
20–24 years	1.00	2.66 [2.39, 2.95]	3.17 [2.78, 3.60]	3.91 [3.00, 5.07]	4.02 [3.02, 5.30]
25–29 years	1.00	2.51 [2.22, 2.83]	3.06 [2.64, 3.52]	3.13 [2.33, 4.21]	4.63 [3.52, 6.07]
30–34 years	1.00	2.36 [2.06, 2.69]	2.99 [2.55, 3.49]	4.49 [3.40, 5.89]	6.05 [4.59, 7.91]
35–39 years	1.00	2.43 [2.11, 2.79]	3.33 [2.84, 3.90]	4.88 [3.66, 6.48]	7.33 [5.53, 9.65]
40–44 years	1.00	2.29 [2.00, 2.60]	2.43 [2.06, 2.86]	3.51 [2.56, 4.81]	3.21 [2.15, 4.77]
45–49 years	1.00	2.29 [1.99, 2.62]	2.51 [2.12, 2.96]	3.91 [2.85, 5.34]	5.74 [4.14, 7.93]
50–54 years	1.00	2.20 [1.90, 2.54]	2.54 [2.14, 3.02]	3.85 [2.76, 5.35]	3.81 [2.51, 5.78]
55–59 years	1.00	2.11 [1.81, 2.45]	2.24 [1.86, 2.70]	3.56 [2.47, 5.12]	3.30 [2.03, 5.34]
60–64 years	1.00	2.00 [1.71, 2.34]	1.96 [1.60, 2.39]	2.60 [1.66, 4.07]	4.92 [3.17, 7.62]
65–69 years	1.00	1.91 [1.62, 2.26]	2.04 [1.65, 2.51]	2.62 [1.59, 4.32]	4.22 [2.42, 7.34]
70–74 years	1.00	1.72 [1.44, 2.05]	1.93 [1.54, 2.42]	2.47 [1.42, 4.29]	3.25 [1.61, 6.55]
75–79 years	1.00	1.72 [1.44, 2.04]	1.96 [1.57, 2.44]	1.98 [1.06, 3.71]	2.89 [1.29, 6.45]
80+ years	1.00	2.80 [2.47, 3.14]	2.48 [2.07, 2.94]	3.06 [1.86, 5.00]	2.85 [1.28, 6.34]

Note: Rurality is defined by the Australian Statistical Geography Standard.[12]

5 | CONCLUSION

Traffic injury fatalities are a global concern, affecting countries and regions at differing rates. This study illustrated the patterns of Australian MVC deaths in the context of rurality. A total of 16 977 deaths occurred in Australia over the 12-year study period. The National Road Safety Strategy has been established to promote better injury and fatality outcomes for Australian road users. In order to meet 2030 road safety goals, immediate attention and targeted action must be paid to regions in Australia with high MVC fatality rates including the Northern Territory and Western Australia, all regional and remote areas, and high-risk demographic groups. Specifically, females, children under 15 years old, and Aboriginal and Torres Strait Islander peoples living in rural environments are at a high risk of road fatality in comparison to their metropolitan counterparts. Evidence-based prevention strategies should be developed within rural settings to suit the unique challenges of rural and remote road safety in Australia.

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CONFLICTS OF INTEREST

None.

AUTHOR CONTRIBUTION

HMM: conceptualization; formal analysis; investigation; methodology; writing – original draft; writing – review & editing. PAL: writing – review & editing. DV: writing – review & editing. RCF: conceptualization; data curation; formal analysis; investigation; methodology; project administration; supervision; visualization; writing – review & editing.

ETHICS APPROVAL

This study had ethical approval from the James Cook University Human Research Ethics Committee (H6136).

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