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Disparities in road safety outcomes between Indigenous and Non-Indigenous Australians

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Abstract

Despite ongoing road safety efforts, transport-related injuries remain a considerable public health concern in Australia, particularly in high-risk regional and remote areas. Indigenous Australians are disproportionately affected, experiencing 25-30% higher rates of fatal and severe injuries compared to their non-Indigenous counterparts. This study investigates road crash vulnerability and fatality rates among Indigenous and non-Indigenous Australians (2012-2021) using data from the Australian Institute of Health and Welfare (AIHW, 2023). We conduct a comprehensive comparative analysis across demographics and geography, including yearly trends, location, gender disparities, age groups, road user types, collision patterns, and hospitalisation rates. The analysis reveals persistent disparities, with Indigenous Australians consistently exhibiting higher vulnerability and fatality rates throughout the study period. Fatality rates per 100,000 population remain much higher for Indigenous Australians, highlighting the ongoing challenge. Geographic variations exist, with Western Australia and the Northern Territory displaying the highest rates for Indigenous Australians. Fatalities differ by gender and age, with males in the 26-39 age group most at risk, and females primarily experiencing road fatalities as car occupants/passengers. Remoteness emerges as a potential factor, with road deaths disproportionately higher in remote areas. Indigenous people aged 17-39 have a higher rate of crash involvement than non-Indigenous people aged 17-39. Finally, hospitalisation rates due to severe road injuries are higher for Indigenous Australians residing in regional and remote areas. By revealing these persistent disparities and underlining the potential impact of remoteness, this study aims to inform the development of targeted interventions and evidence-based policy initiatives to improve road safety for all Australians.

Keywords: Traffic crashes; Indigenous communities; Road trauma; Road safety disparities; Social equity.

1 Introduction

Road safety remains a critical public health issue in Australia, particularly for high-risk groups such as Indigenous Australians. Despite sustained efforts to improve road safety outcomes, Indigenous Australians continue to experience disproportionately high rates of road crash fatalities and severe injuries compared to their non-Indigenous counterparts. This disparity is most pronounced in remote and regional areas, where Indigenous Australians face unique challenges that exacerbate their vulnerability to road traffic incidents.

This study aims to provide a comprehensive comparative analysis of road crash vulnerability and fatality rates between Indigenous and non-Indigenous Australians from 2012 to 2021. Using data from the Australian Institute of Health and Welfare (AIHW), the paper explores trends in road safety outcomes across different demographics, geographic locations, and collision types. The analysis identifies persistent disparities in road crash fatalities, highlighting significant differences by gender, age, road user types, and geographic location.

The structure of the paper is as follows: the methodology section details the data sources and comparative descriptive analysis employed. The findings section presents the results of the analysis, focusing on key trends and disparities. The discussion offers insights into potential contributing factors and implications for targeted interventions and policy development. Finally, the conclusion summarises the key findings and outlines recommendations for future research and policy actions to address these disparities.

2 Background

Road safety has been a longstanding policy priority in Australia, yet the rate of road transport injuries remains a pressing concern. Despite efforts to address this issue, hospitalisation rates have increased over the past nine years, with no decline in 'high threat to life' hospitalisations (Economic Connections, 2017; BITRE, 2021). The total cost of road trauma is estimated to be $29.7 billion annually, with each hospitalisation from a road traffic injury costing $239,000 (Economic Connections, 2017).

Indigenous Australians represent a higher percentage of the population in remote areas (Henley & Harrison, 2013). Indigenous Australians face a notably higher risk of road crash involvments compared to non-Indigenous populations, with a 25-30% greater likelihood of suffering transport-related fatal and severe injuries (Henley & Harrison, 2013; Cullen et al., 2017). They are also three times more likely to be overrepresented in road deaths than non-Indigenous Australians (AIHW, 2019; Transport for NSW, 2017). Transport injuries are the second leading cause of death and fourth leading cause of injury for Indigenous communities (Pammer et al., 2021).

Several factors contribute to the disparity in road safety outcomes between Indigenous and non-Indigenous Australians. Alcohol, seatbelt non-use, and passenger overcrowding are identified as main factors contributing to increasing the severity of road crashes involving Indigenous Australians (Pammer et al., 2021). Cultural alienation, dispossession, poor socioeconomic levels, and geographical remoteness also increase Indigenous Australian's traffic injury risk (Ivers et al., 2009). Unlicensed driving is common in Indigenous communities, resulting in fines and road trauma (Cullen et al., 2017).

The literature highlights the need for a comprehensive understanding of the incidence, socioeconomic factors, and overall burden of transport injuries in Indigenous communities. Currently, this information is inadequately characterised, with national reporting lacking material on Indigenous status (BITRE, 2021). Collaborative research is essential to contextualise data for Indigenous communities, government entities, and other stakeholders. Effective interventions, such as community-based programs incorporating cultural elements, training, educational activities, and collaboration with law enforcement, have shown promise in reducing motor vehicle crashes among Indigenous communities (Macaulay et al., 2003). Initiatives like the Stop Territory Aboriginal Road Sadness project in Australia aim to raise awareness and address the disproportionately high fatality rates among Indigenous Australian road users (Fuller, 2011).

The international context also highlights the need for targeted interventions. Indigenous Peoples in Canada face much higher risks of road crash involvments compared to non-Indigenous populations, with similar factors contributing to this disparity (Williams et al., 2022). A combination of human, vehicle, roadway, and environmental factors (Soltani & Qadikolaei, 2024) interact to increase the risk of road crash involvments within Indigenous and First

Nations populations (Rothe, 2005). Therefore, a comprehensive approach addressing these factors is crucial to reduce the burden of road trauma among Indigenous Australians.

3 Research objective/questions

The research objective is to investigate and compare the vulnerability and fatality rates of road crashes comparing Indigenous and non-Indigenous Australians, with a focus on identifying disparities and underlying factors contributing to these differences. The research questions can be described as below:

1. What are the trends in vulnerability and fatality rates of road crashes among Indigenous Australians compared to non-Indigenous Australians over the period from 2012 to 2021?

2. How do the vulnerability and fatality rates of road crashes vary across different Australian states for Indigenous and non-Indigenous populations, and what factors contribute to these disparities?

3. What are the primary modes of road use associated with fatalities among Indigenous Australians, and how do they compare to those among non-Indigenous Australians?

4 Methodology

The data utilised in this study were sourced from secondary data collected and published as open source by the Australian Institute of Health and Welfare (AIHW) in 2023. The dataset encompasses a comprehensive collection of road crash statistics spanning the period from 2012 to 2021, providing valuable insights into the vulnerability and fatality rates among Indigenous and non-Indigenous Australians. The method of analysis employed in this study is comparative description, wherein various attributes are compared across different demographic and geographic categories to identify disparities and trends in road safety outcomes.

Comparisons were made across multiple dimensions, including yearly fluctuations, geographic location (State-wide and remoteness), gender, age groups, road user type, and collision type. By systematically examining these attributes, the study aims to identify patterns, disparities, and potential risk factors associated with road crashes among Indigenous Australians compared to their non-Indigenous counterparts. This comprehensive approach allows for a nuanced understanding of the complex interplay of factors contributing to road safety outcomes and provides valuable insights for targeted intervention strategies and policy development.

5 Analysis and findings

In Australia, the issue of road safety is one that extends beyond mere statistics; it reflects broader societal inequities and historical disparities. Within this context, the vulnerability and fatality rates of road crashes among Indigenous Australians stand out starkly in comparison to their non-Indigenous counterparts.

Table 1 shows that across the years 2012 to 2021, Indigenous Australians consistently exhibit higher vulnerability and fatality rates in road crashes compared to non-Indigenous Australians. For example: In 2012, the road crash rate per 100,000 population for Indigenous Australians was 14 fatalities/100,000 people, whilst for non-Indigenous Australians, it was notably lower at 5.3 fatalities/100,000 people. This disparity continued throughout the following decade, with Indigenous Australians consistently experiencing rates almost three times higher than their non-Indigenous counterparts.

However, the size of these fluctuations (on a year-by-year basis) are because of the smaller size of the population and the number of crashes for the Indigenous group compared to the

non-Indigenous group. The statistical test confirms that there is no statistically significant difference between the rates of Indigenous Australians and Non-Indigenous Australians over the years (Chi-Square Statistic: 0.254; p-value > 0.9). The test also suggests no significant difference in the rates for each group across different years, as the p-value remains very high (Chi-Square Statistic: 0.538; p-value > 0.9).

Table 1: Road crash fatality rates compared for Indigenous and non-Indigenous Australians (2012-2021).

Calendar Year	Indigenous Australians		Non-Indigenous Australians	
	(Total)	Rate per 100,000 Population	(Total)	Rate per 100,000 Population
2012	77	14	841	5.3
2013	70	12.8	779	4.8
2014	82	14.7	771	4.7
2015	71	11.7	785	4.7
2016	85	14.3	840	5
2017	71	11.2	811	4.7
2018	81	12	755	4.4
2019	88	13.1	751	4.3
2020	90	12.6	732	4.1
2021	76	10.8	650	3.7

Examining the yearly data reveals a nuanced picture. While there are fluctuations in the vulnerability and fatality rates for Indigenous Australians, there is no discernible consistent decrease over the decade. For instance, in 2013, the fatality rate per 100,000 population for Indigenous Australians decreased slightly to 12.8 fatalities, only to rise again in 2014 to 14.7 fatalities. Despite occasional fluctuations, the rates remain consistently higher, indicating a persistent and growing vulnerability to road crashes.

Conversely, the trend for non-Indigenous Australians exhibits a more stable pattern, with relatively lower vulnerability and fatality rates compared to Indigenous counterparts. Although there are slight variations across the years, the rates generally remain lower and do not exhibit the same level of persistent disparity seen amongst Indigenous Australians. Figure 1 demonstrates this using of regression equations to predict the future of road crash fatalities for both groups.

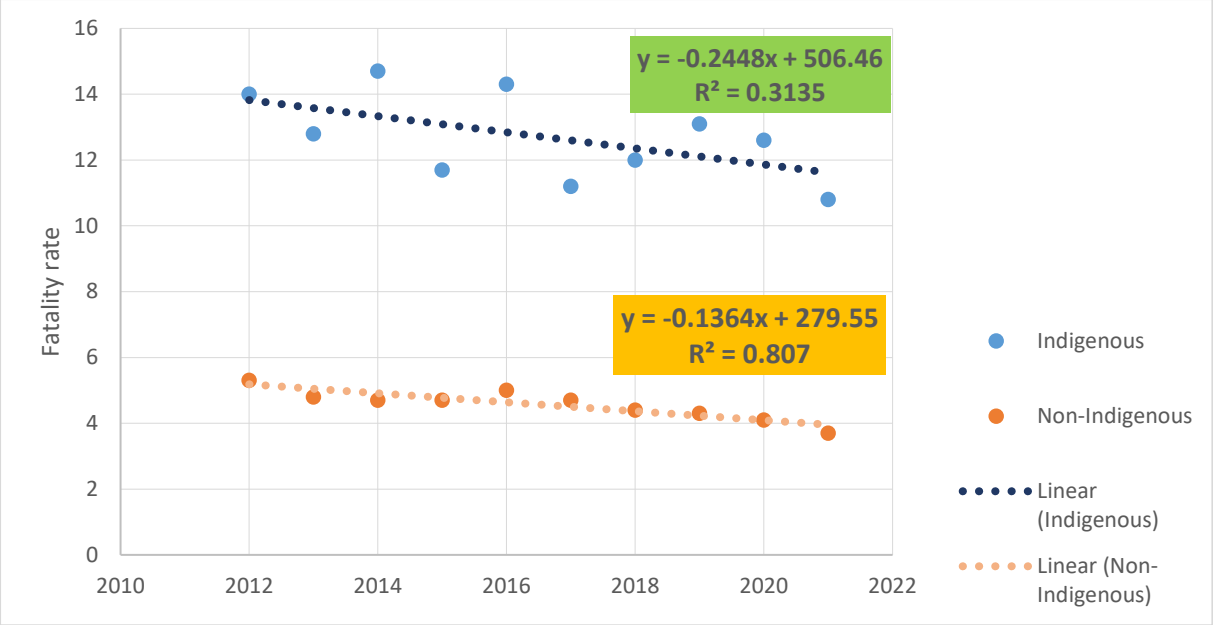


Figure 1: Road crash fatality rates and predictor regression equations.

Figure 2 reveals a concerning trend, particularly when compared across Australian states. Across the years 2012 to 2021, Indigenous Australians consistently exhibit higher vulnerability and fatality rates in road crashes compared to non-Indigenous Australians across all states. Notably, Western Australia (WA) and the Northern Territory (NT) displayed the highest rates for Indigenous Australians, with fatality rates attaining 19.9 and 27.2 fatalities/100,000 people respectively in 2012-2021. By contrast, New South Wales (NSW) consistently reported comparatively lower rates, of around 8.2 fatalities/100,000 people during the same period.

Examining the yearly data reveals varying patterns across states. For Indigenous Australians, NT consistently reported the highest rates, followed by WA, while NSW generally had lower rates throughout the decade. However, despite fluctuations, there is no discernible consistent decrease in vulnerability and fatality rates for Indigenous Australians across states over the years. This persistent disparity underscores systemic issues that must be addressed comprehensively.

Conversely, the trend for non-Indigenous Australians also varies across states, but with generally lower vulnerability and fatality rates compared to Indigenous counterparts. For instance, NT and WA report higher rates among non-Indigenous Australians as well, but the disparity between Indigenous and non-Indigenous rates remains significant across all states.

For Indigenous Australians, during the decade 2012-2022 there was a total of 791 fatalities. NT reported the highest number of fatalities amongst Indigenous Australians, totalling 192 fatalities, followed closely by QLD with 184 fatalities. These figures underscore the substantial impact of road crashes on Indigenous communities, particularly in regions with higher vulnerability rates. Conversely, non-Indigenous Australians experienced a much higher number of fatalities, totalling 7,715 deaths over the same period. NSW reported the highest number of fatalities amongst non-Indigenous Australians, with 2,971 fatalities, followed by QLD with 2,337 fatalities.

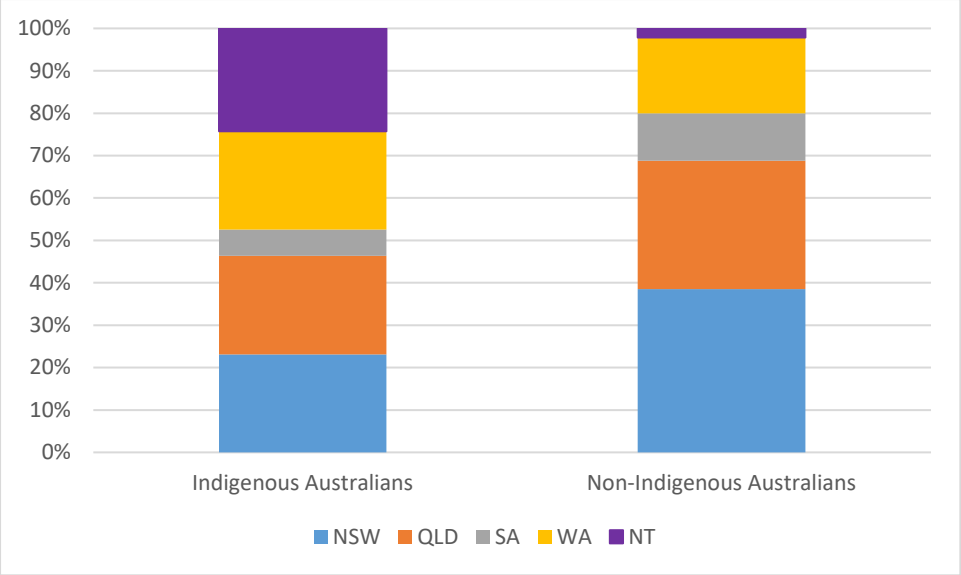


Figure 2: The share of Australian States in terms of road crash fatalities for Indigenous and Non-Indigenous Australians*.

*no data is available for other three states: Victoria, ACT and Tasmania.

Table 2 shows that amongst male Indigenous individuals, the highest number of fatalities occurred as car occupants (353 deaths), followed by car drivers (218 deaths) and pedestrians (106 deaths). Notably, motorcycle-related fatalities (63 deaths) also represent a significant proportion of male road deaths. Conversely, the mode of road use associated with the lowest number of fatalities among male Indigenous individuals was pedal cycling, with only 11 reported deaths over the decade.

Table 2: The comparative share of road crash fatalities (2012-2021) by gender and type of road user.

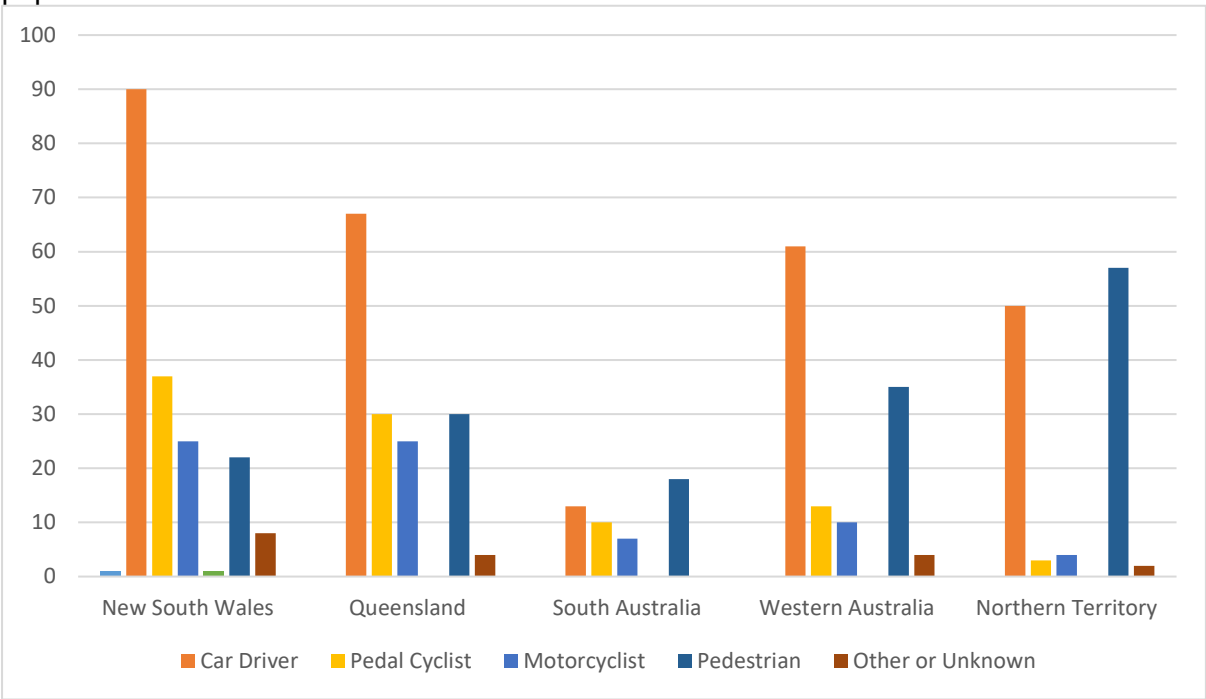
2021	Gender	Car Driver (percent)	Car Passenger (percent)	Motorcyclist (percent)	Pedal Cyclist (percent)	Pedestrian (percent)
Indigenous Australians	Male	78	52	91	100	65
	Female	22	48	9	0	35
Non-Indigenous Australians	Male	59	55	82	68	53
	Female	41	45	18	32	47

By contrast, whilst the share of female road fatalities is lower than that of males, the distribution across road user categories still reveals areas of concern. Female Indigenous individuals primarily experienced road fatalities as car occupants (182 deaths) and car passengers (112 deaths), with pedestrian-related fatalities (56 deaths) also being notable.

Furthermore the result from Ch-Square test (Indigenous Australians: Chi-Square Statistic: 84.92; p-value<0.000; Degrees of Freedom: 4; Non-Indigenous Australians: Chi-Square Statistic: 24.36; p-value<0.000; Degrees of Freedom: 4), show that both p-values are much smaller than the common significance level of 0.05, indicating that there are significant differences between male and female road crash fatalities for both Indigenous and non-

Indigenous Australians across the different categories (car driver, car passenger, motorcyclist, pedal cyclist, pedestrian). This suggests that the distribution of fatalities is significantly associated with gender in both groups.

Figure 3 presents road crash fatality rates for Indigenous Australians summed from 2012 to 2021, categorized by state and road user type. The Northern Territory recorded the highest rates, particularly for car passengers and pedestrians, with an average of 35.4 fatalities per 100,000 population for car passengers and 27.0 fatalities per 100,000 population for pedestrians. Western Australia also had significant fatality rates, especially for car drivers and passengers, averaging 15.4 and 16.9 fatalities per 100,000 population respectively. South Australia had the highest number of pedestrian and pedal cyclist fatalities, with rates of 10.6 and 7.2 per 100,000 population. New South Wales and Queensland generally had lower fatality rates, with the highest being for car passengers in Queensland at 7.2 per 100,000 population.



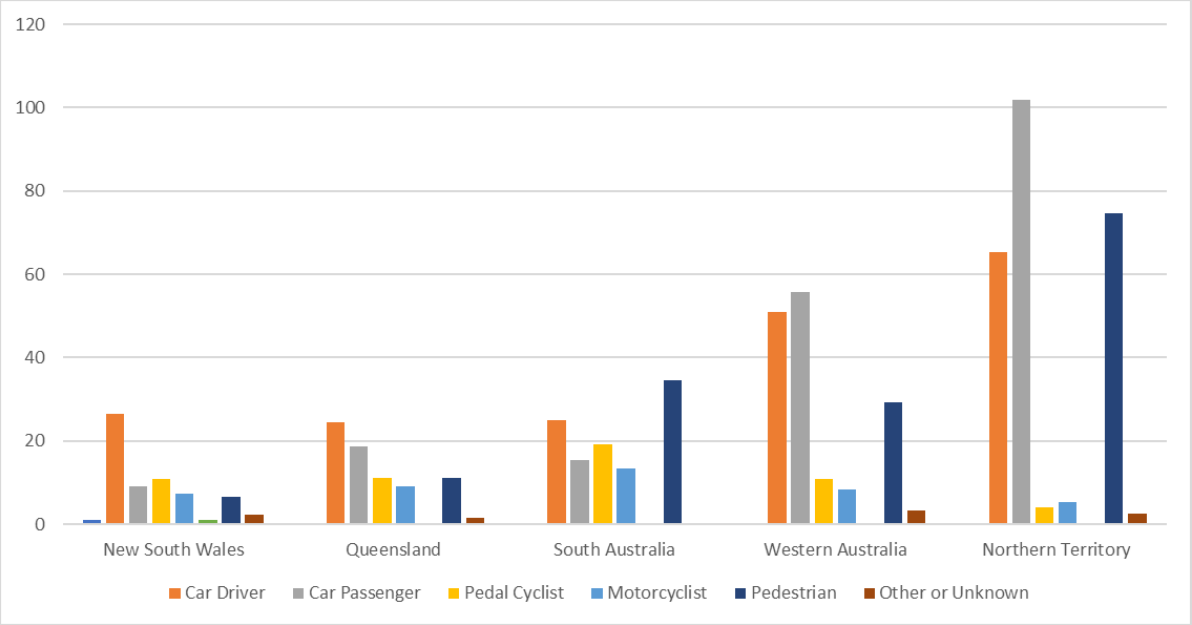


Figure 3: Road fatalities compared by state and road crash type for Indigenous Australians (2012-2021)*.

*no data is available for other three states: Victoria, ACT and Tasmania.

As shown in Table 5, the chi-square statistic of 106.30 and the p-value of 9.24e-14 strongly suggest that there are significant differences in the distribution of road crash fatalities across states and crash types for Indigenous Australians. These findings are supported by the large discrepancies between the observed and expected frequencies, particularly for the Northern Territory.

Table 5: Results of Ch-Square test for the road crash fatalities of Indigenous Australians (2012-2021) by region.

	State	Car Drivers	Car Passengers	Pedal Cyclists	Motorcyclists	Pedestrians	Other/U
Expected frequencies	New South Wales	17.85	18.69	5.21	3.91	14.51	
	Queensland	22.24	23.29	6.49	4.87	18.07	
	South Australia	31.32	32.79	9.13	6.85	25.45	
	Western Australia	46.24	48.41	13.49	10.12	37.57	
	Northern Territory	74.34	77.83	21.68	16.26	60.4	
Observed frequencies	New South Wales	26	9	11	7	6	
	Queensland	25	19	11	9	11	
	South Australia	25	15	19	13	35	
	Western Australia	51	56	11	8	29	
	Northern Territory	65	102	4	5	75	

Chi-Square Statistic (χ^2): 106.30

p-value: 9.24e-14

Degrees of Freedom: 20

Furthermore, the data highlights specific areas of concern within each state, informing targeted interventions to mitigate risks and improve road safety outcomes for Indigenous communities.

For instance, in Western Australia, motorcycle-related fatalities appear notably higher compared to other states, indicating a potential need for enhanced motorcycle safety measures and awareness campaigns tailored to Indigenous riders. Similarly, in the Northern Territory, where pedestrian-related fatalities are disproportionately high, strategies to improve pedestrian infrastructure and road safety education may be warranted. By leveraging state-specific data insights, policymakers and community stakeholders can collaborate to develop comprehensive and culturally sensitive road safety initiatives that address the diverse needs and challenges faced by Indigenous Australians across different regions of Australia.

Figure 4 illustrates disparities in the percentage of fatalities across different age cohorts between Indigenous and non-Indigenous Australians, broken down by gender. Among younger age groups, particularly children (0-7 years) and adolescents (8-16 years), Indigenous Australians, both males and females, exhibit significantly higher percentages of fatalities compared to their non-Indigenous counterparts. This disparity is most pronounced in Indigenous females aged 0-7, where the percentage is more than double that of non-Indigenous females. As individuals age into the young adult (17-25 years) and adult (26-39 years) cohorts, Indigenous males and females continue to show elevated percentages of fatalities compared to non-Indigenous Australians, although the gap begins to narrow, particularly among young adults.

By contrast, among middle-aged (40-64 years) and older adults (65-74 years), non-Indigenous Australians generally display higher percentages of fatalities than their Indigenous peers, reversing the trend observed in younger cohorts. This reversal is particularly notable among middle-aged non-Indigenous males, who have a substantially higher percentage of fatalities than Indigenous males. By the time individuals reach the elderly cohort (≥75 years), the percentage of fatalities among non-Indigenous Australians remains higher than that of Indigenous Australians, with the disparity being more marked among males. These patterns suggest that while Indigenous Australians are more vulnerable to fatality at younger ages, non-Indigenous Australians face higher fatality risks as they age, pointing to differing health and social challenges across the lifespan. (Figure 4).

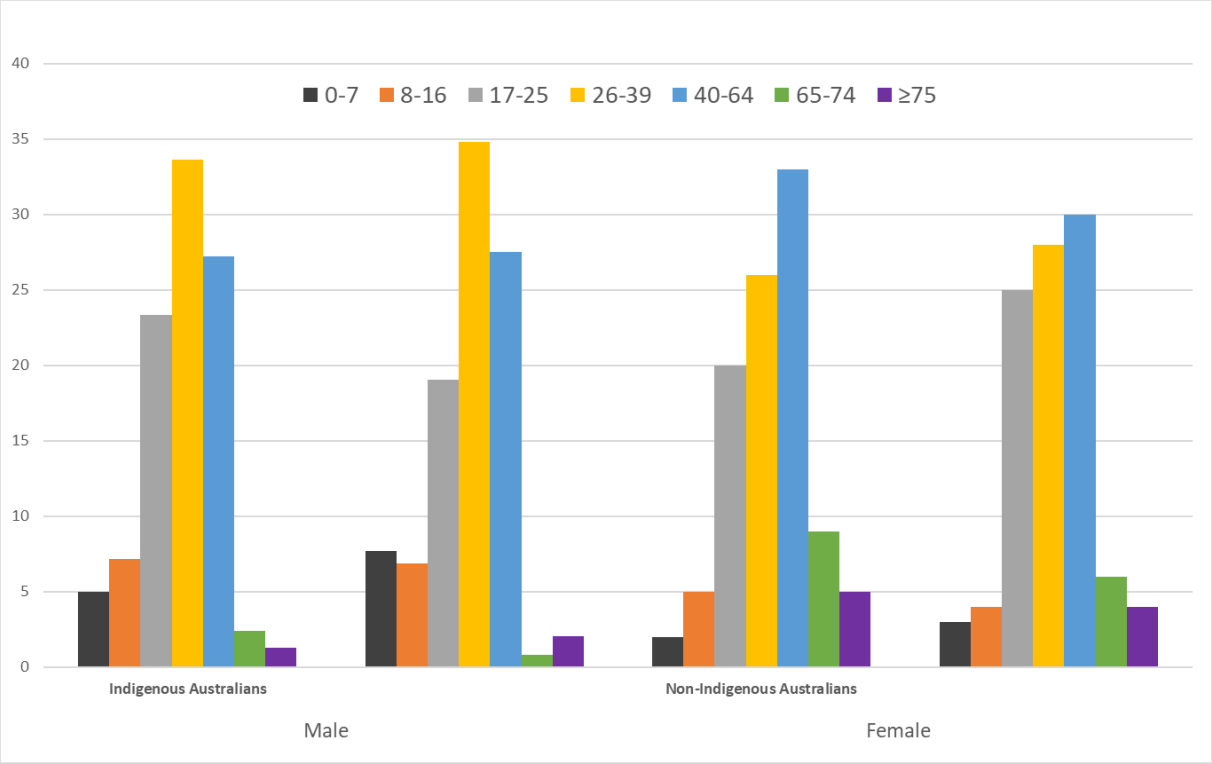


Figure 4: Fatalities by gender and age for Indigenous Australians versus non-**Indigenous Australians (2012-2021).**

The graph above compares the fatality numbers between males and females in Indigenous Australians due to road crashes from 2012 to 2021 across different age groups:

Amongst males, the highest number of fatalities occurred in the 26-39 age group, with 183 fatalities, followed by the 40–64-year age group with 148 fatalities, and the 17–25-year age group with 127 fatalities. Fatality numbers decrease substantially in older age groups, with only 13 fatalities among males aged 65-74 years and 7 fatalities among those aged 75 years and above.

By comparison, amongst females, the highest number of fatalities occurred in the 26–39-year age group as well, but with a lower count of 86 fatalities. Similarly, the 40–64-year age group also had fewer fatalities among females, with 68 reported deaths. The trend of decreasing fatality numbers with age is consistent among females, with only 2 fatalities in the 65–74-year age group and 5 fatalities in the 75 year and above age group.

Overall, the graph suggests that males in the 26–39-year age group experienced the highest number of fatalities due to road crashes among Indigenous Australians from 2012 to 2021, followed by males in the 40–64-year age group. While females also experienced fatalities in these age groups, the numbers were comparatively lower. Additionally, the data highlights a general decrease in fatality numbers with increasing age for both males and females, with older age groups experiencing fewer road crash fatalities.

Table 6 highlights significant variations in both the number of road deaths and the fatality rates across different remoteness areas, emphasising the differential risks and challenges faced by Indigenous communities and Non-Indigenous Australians based on their geographic location.

Table 6: Road crash fatalities compared for Indigenous Australians (2012-2021) by region.

Calendar Year	Region	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote	Inner regional/ Outer regional	Remote/ Very remote
Indigenous Australians	Rate per 100 000 population	5.1	10.2	14.2	19.1	29.9	12.2	25.7
Non-Indigenous Australians	Rate per 100 000 population	3.7	5.6	9.4	14.1	19.4	8.1	17.8

The rate of road crash fatalities among Indigenous Australians is consistently higher than that of non-Indigenous Australians in Australia. This disparity is most pronounced in remote and very remote areas. In major cities, Indigenous Australians have a fatality rate of 5.1 deaths per 100,000 population, compared to 3.7 for non-Indigenous Australians. While this difference is significant, it becomes more pronounced in regional areas. In inner regional areas, the rates are 10.2 for Indigenous Australians and 5.6 for non-Indigenous Australians. The disparity widens further in outer regional, remote, and very remote areas, with Indigenous Australians experiencing fatality rates of 14.2, 19.1, and 29.9 respectively, compared to 9.4, 14.1, and 19.4 for non-Indigenous Australians. When combining regional areas, the trend persists. In inner regional and outer regional areas combined, Indigenous Australians have a fatality rate of 12.2 compared to 8.1 for non-Indigenous Australians. In remote and very remote areas combined, the rates are 25.7 for Indigenous Australians and 17.8 for non-Indigenous Australians.

Table 7 illustrates the distribution of road deaths among Indigenous Australians across various remote areas in Australian states from 2012 to 2021. The data highlights significant disparities in the number of fatalities between inner regional/outer regional areas and remote/very remote regions. For instance, in New South Wales, while 138 road deaths occurred in inner regional/outer regional areas over the specified period, only 9 fatalities were recorded in remote/very remote regions. Similarly, Queensland had a total of 99 road deaths in inner regional/outer regional areas compared to 47 fatalities in remote/very remote regions during the same period. Western Australia presents a stark contrast, with 37 road deaths in inner regional/outer regional areas and 109 fatalities in remote/very remote regions. The Northern Territory experienced a notable absence of data for inner regional/outer regional areas, with 162 road deaths recorded in remote/very remote regions.

Table 7: Road crash fatalities compared for Indigenous Australians (2012-2021) by state and territory*.

Calendar Year	State	Inner Regional/Outer Regional	Remote/Very Remote
2012 2021	New South Wales	138	9
	Queensland	99	47
	South Australia	11	19
	Western Australia	37	109
	Northern Territory	n/a	162

*no data is availabe for other three states: Victoria, ACT and Tasmania.

An analysis of hospitalization data as an index of crash severity from 2011 to 2021 reveals significant disparities in the proportions of severe road injury cases across different geographic areas (Table 8).

Indigenous Australians experienced a slight increase in road crash hospitalizations, with a 5% rise over the decade. Non-Indigenous Australians were subject to a more significant increase of 8% during the same period. Both groups experienced relatively stable rates of road crash hospitalizations, with a slight decline of 2% for Indigenous Australians and a 1% increase for non-Indigenous Australians. Indigenous Australians benefitted from a 12% decrease in road crash hospitalizations compared with a 15% decrease for non-Indigenous Australians, which whilst an improvement, presents a concerning discrepancy between these two population cohorts. These improvements potentially indicate improved road safety measures or other factors such as reduced risk exposure. Overall, whilst Indigenous Australians in major cities experienced a slight increase in road crash hospitalizations, the trend in remote areas is positive, suggesting that targeted interventions may be improving road safety in these regions. Further analysis is needed to understand the underlying factors contributing to these changes.

Table 8: Road crash hospitalisations compared for Indigenous and non-Indigenous Australians (2012-2021) by gender and type of road user.

Calendar Year	Indigenous Australians			Non-Indigenous Australians		
	Major Cities (percent)	Regional (percent)	Remote (percent)	Major Cities (percent)	Regional (percent)	Remote (percent)
2011	31.9	39.5	28.6	66.6	30.9	2.5
2012	30.6	38.9	30.4	66.9	30.6	2.6
2013	31.7	38.4	29.9	69.0	28.6	2.4
2014	33.7	39.2	27.2	69.1	28.7	2.3
2015	32.1	38.8	29.1	69.5	28.5	2.0
2016	33.3	39.2	27.5	70.7	27.4	1.9
2017	36.0	41.1	22.9	70.0	28.2	1.8
2018	33.7	41.8	24.5	69.7	28.4	2.0
2019	38.8	36.7	24.5	70.1	28.1	1.8
2020	35.8	41.9	22.3	69.2	28.9	1.9
2021	36.4	40.5	23.0	69.8	28.6	1.7

The data further reveals the changing trends of road safety disparities between Indigenous and Non-Indigenous Australians over the past decade. While hospitalization rates due to severe road injuries among Non-Indigenous Australians remained relatively stable across Major Cities, Regional, and Remote areas, Indigenous Australians experienced fluctuations in hospitalization rates, with notable variations occurring between geographic regions.

Table 9 displays the average number of road injuries by type of collisions with for Indigenous and Non-Indigenous Australians for the period from 2011 to 2021. Comparing the percentages between the two groups reveals several notable differences by type of collision. Non-

Indigenous Australians experienced a higher percentage of injuries from collisions involving cars, pick-up trucks, or vans, at 41.78% compared to 32.58% for Indigenous Australians. Conversely, Indigenous Australians have a higher percentage of injuries from non-collision transport crashes, at 33.57%, compared to 26.06% for Non-Indigenous Australians. Additionally, Indigenous Australians also experience a higher percentage of injuries from collisions with fixed or stationary objects, at 17.85%, compared to 14.05% for Non-Indigenous Australians.

Table 9: Road crash fatality rates compared for Indigenous and non-Indigenous Australians (2012-2021) by type of road crash.

Calendar Year (average of 10 years)	Car, pick-up truck, or van	Fixed or stationary object	Non-collision transport crash	Other
Indigenous Australians	32.58	17.85	33.57	16.00
Non-Indigenous Australians	41.78	14.05	26.06	18.11

6 Discussion

Table 10 shows a summary of the above section, comparing two studied groups.

Table 10: Summary of comparison between Indigenous Australians and Non-Indigenous Australians.

Attribute	Indigenous Australians	Non-Indigenous Australians
Fatality Rates	Consistently higher rates compared to non-Indigenous Australians	Relatively lower rates compared to Indigenous counterparts
Yearly Fluctuations	Fluctuations observed, but no consistent decrease over the decade	Generally stable patterns observed
State Disparities	Higher rates across all states, with some states showing peaks	Generally lower rates, with fluctuations across states
Gender and Age Differences	Males exhibit higher fatality numbers, especially in 26-39 group	Gender differences less pronounced, lower fatality numbers overall
Types of Road Users	Various categories affected, including motorcycle riders	Higher percentage of injuries from collisions with cars for non-Indigenous Australians
Regional Disparities	Higher vulnerability in remote areas compared to major cities	Disparities less pronounced, with overall lower fatality rates in major cities
Age Group Disparities	Higher fatality rates observed in young adults and middle-aged groups	Generally lower fatality rates across all age groups

Collision Types	More injuries from non-collision transport crashes and collisions with fixed objects	More injuries from collisions involving cars for non-Indigenous Australians
Hospitalization Rates as an index of crash severity	Higher rates of hospitalization in Regional and Remote areas	Lower rates of hospitalization across all geographic areas
Age Group Disparities	Higher fatality rates observed in young adults and middle-aged groups	Generally lower fatality rates across all age groups

In relation to the findings, it is essential to consider the Safe System framework and Vision Zero approach, both of which are highly relevant to the discussion of road fatalities, particularly in rural and remote areas. The Safe System acknowledges that human error is inevitable but emphasizes that the consequences of crashes should not result in death or serious injury. This is particularly pertinent given the over-representation of Indigenous Australians in fatal crashes, especially in rural and remote locations where higher speeds often lead to more severe outcomes. The findings of this study align with the core principles of the Safe System, highlighting the need to reduce speed limits, improve road infrastructure, and ensure that vehicles are equipped with safety features that mitigate the severity of crashes. Moreover, Vision Zero advocates for a holistic approach to road safety that involves engineering safer roads, promoting safer vehicles, and ensuring effective emergency response systems. Given the higher vulnerability of Indigenous Australians in remote areas, these strategies are crucial to minimizing crash consequences and achieving equitable road safety outcomes.

For instance, enhancing road infrastructure in rural and remote regions to accommodate the potential for human error, implementing lower speed limits, and providing culturally tailored road safety education programs could significantly reduce the risk of fatal crashes. Furthermore, improving emergency response times and trauma care in remote areas aligns with the Safe System's goal of limiting the consequences of crashes to prevent serious injury or death. These measures would address the systemic inequalities highlighted in this study and help reduce the over-representation of Indigenous Australians in road crash fatalities. Integrating the Safe System approach and Vision Zero principles into policy recommendations can help bridge the gap in road safety outcomes between Indigenous and non-Indigenous Australians. Future research should also focus on evaluating the effectiveness of these strategies in reducing road fatalities in rural and remote regions, ensuring that interventions are culturally appropriate and address the specific needs of Indigenous communities.

The preliminary comparative research conducted in this study marks just the beginning of a potentially extensive exploration into this highly significant topic. However, it is important to acknowledge several limitations within the research presented. Firstly, the reliance on existing AIHW brief data sources may introduce potential biases and inaccuracies. This is due to variations in data collection methods and reporting practices across jurisdictions, often necessitating confidentiality management. Accessing more detailed data would require obtaining ethics approval and dedicating additional time and resources, which are beyond the scope of this paper. Therefore, while this study provides valuable insights, further in-depth research is warranted to fully grasp the complexities of the subject matter.

Under-reporting of road crash incidents among Indigenous Australian populations and misclassification of Indigenous Australians' status on driving licenses and medical records could result in an underestimation of the true burden of road trauma. Moreover, the study's focus on trends over a 10-year period may not capture longer-term patterns or changes in

road safety outcomes among Indigenous Australians. Limited scope in analysing the underlying factors driving disparities, geographic variations, and effective interventions further restricts the strength of conclusions provided by this research. Detailed data on the particular circumstances for all phases of a crash involving motor vehicles (i.e., the lead-up to a crash, during the crash and post-crash) such as: whether a person was wearing a seat-belt in a vehicle crash; the driver's sobriety and attention; determining the actions of a driver; whether adverse road conditions played a role; whether there was an unexpected intrusion of an animal or person into the road environment; and the performance of the safety features of the vehicles involved in the crash through all phases of the crash (and the effectiveness of the deployment of safety features such as airbags, autonomous emergency braking, vehicle stability controls). Moreover, whether the timeliness of emergency medical responses and trauma management affected the health outcomes of road crash victims is important to know, because regional road users are often severely disadvantaged in road crash incidents, particularly in remote locations of Australia, particularly where air ambulance retrieval may be required.

Moving forward, future research endeavours should address these limitations to advance our understanding of road safety outcomes for Indigenous Australians. Longitudinal studies spanning several decades based on the linked data of crash data and hospital data (Soltani et al., 2024) could provide insights into evolving trends and the impact of policy interventions over time. Complementing quantitative analyses with qualitative research methods would offer a more holistic understanding of the social, cultural, and structural factors influencing road safety outcomes. Additionally, intersectional analyses and community-based participatory research approaches can help identify population subgroups at higher risk and inform the development of culturally appropriate and effective interventions. Rigorous evaluation studies are needed to assess the effectiveness of interventions and inform evidence-based policy development aimed at promoting equity in road safety outcomes for Indigenous communities. For example, the "On The Right Track" program assists Aboriginal people living in the Aṉangu Pitjantjatjara Yankunytjatjara (APY) and Maralinga Tjarutja (MT) Lands in obtaining their driver's licenses. Evaluating the successes and challenges of such programs, particularly in how they can reduce severe crashes in Indigenous communities, could be a compelling topic for future studies (Figure 5).

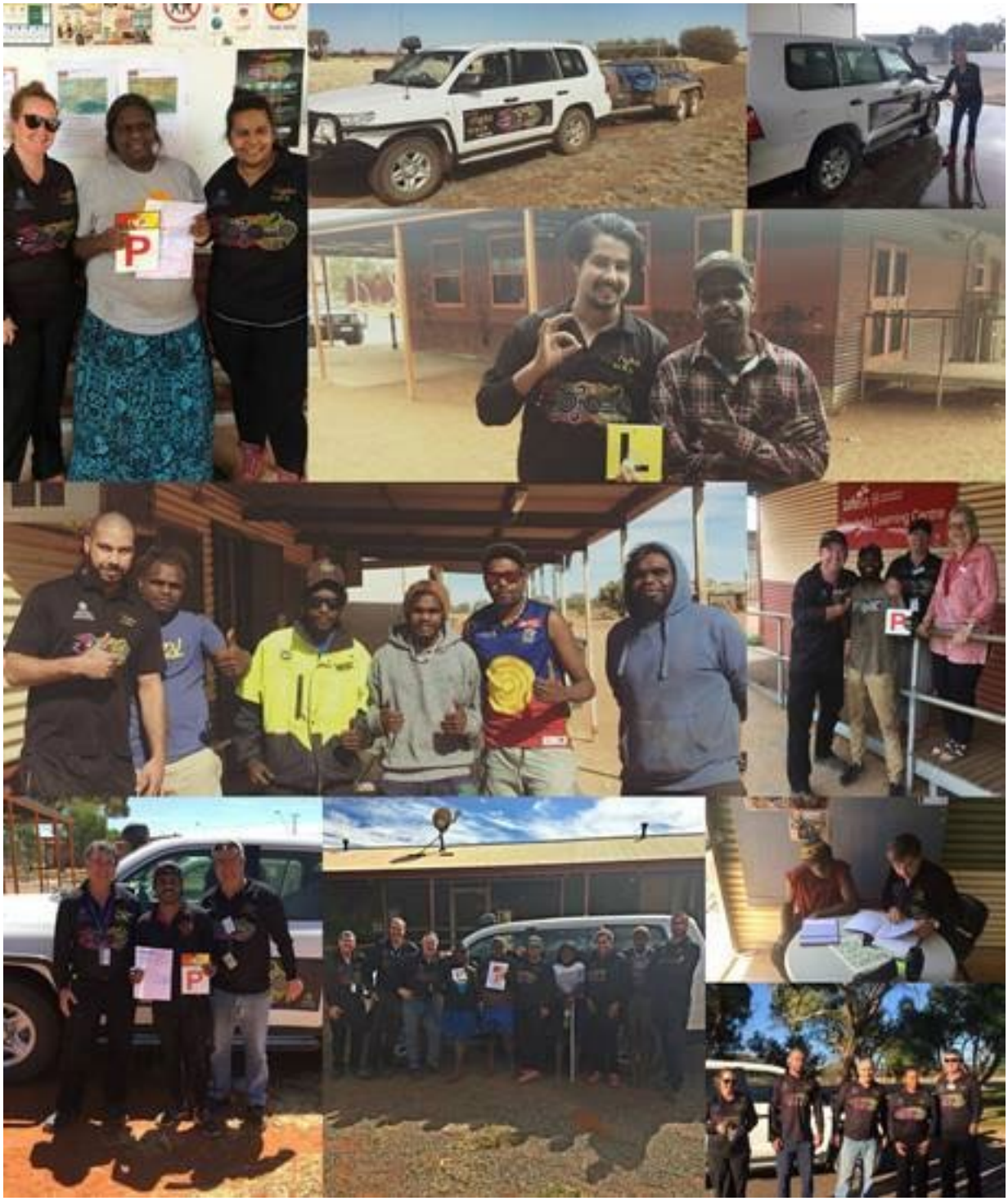


Figure 5: "On The Right Track" program. Photo courtesy of the Department for Infrastructure and Transport, South Australia.

7 Conclusion

The disparities in road crash vulnerability and fatality rates between Indigenous and non-Indigenous Australians underscore systemic issues that must be urgently addressed. Despite road safety being a longstanding policy priority, the rates of road transport injuries in Australia continue to persist, with hospitalisation rates on the rise over the past decade, particularly in regions with higher traffic injury risks such as regional and remote areas. The

data presented in this paper paints a concerning picture of the persistent disparities faced by Indigenous Australians in road safety outcomes. Indigenous people are 25% to 30% more likely to suffer transport-related fatal and severe injuries than their non-Indigenous counterparts, with transport injuries being the second leading cause of death and the fourth leading cause of injury for Indigenous communities. Moving forward, addressing the root causes of road safety disparities requires a multi-faceted approach that encompasses targeted policy interventions, community engagement, infrastructure improvements, and culturally sensitive initiatives. If a large share of road crash fatalities are due to persons not travelling in a designated passenger seat with a fastened seat belt (i.e. as vehicle "occupants") and/or poor driver control and behaviour, then education and driver training schemes may be helpful in improving road safety amongst Indigenous Australians. Collaborative efforts between government entities, researchers, community organizations, and other stakeholders are essential to develop and implement effective strategies that address the unique needs and challenges faced by Indigenous communities across different regions of Australia. By prioritising Indigenous road safety and investing in long-term solutions, we can work towards achieving equitable road safety outcomes for all Australians. Investing in improving the quality of road safety data in terms of capturing all relevant road safety attributes in crash events and road trauma management post-crash is also essential.

Data availability: the data for this research is taken from the Australian Institute of Health and Welfare.

Conflict of interest: The authors declare no conflict of interest.

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