

# Travel-weary to travel-worry: the epidemiology of injury-related traveller deaths in Australia, 2006-2017

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Injuries are a leading cause of travel-related mortality and morbidity globally.<sup>1,2</sup> While Australia is not typically considered a dangerous country for visitors, injuries and deaths occur.<sup>2,3</sup> In 2019, there were 8.7 million international visitor arrivals in Australia, with a trip expenditure of \$45.4 billion AUD.<sup>4</sup> In the same year, domestic interstate travel reached 38.3 million trips, with interstate visitors spending a total of \$45 billion AUD. International and domestic visitors come to and travel around Australia for a wide range of reasons. The different purposes of travel include: recreational/holiday, visiting friends and relatives, business, religion, study, migration, health/medical care and other.<sup>5</sup> Visitors (whether international or domestic) can also be classified as 'tourists' (those that are considered overnight visitors), or 'excursionists' (those that are same-day visitors to an area).

Injuries account for up to 25% of deaths in international travelers.<sup>1,2</sup> Globally, the majority of fatal injuries are from motor vehicle crashes and water-related incidents (such as drowning),<sup>6</sup> and these have also been identified as the leading cause of death for international travellers in Australia<sup>7-9</sup> as well as for domestic travelers.<sup>7,10-20</sup> The 2017 rate of drowning for international arrival visitors to Australia was 0.22 per 100,000 and beaches were the most common drowning location (39%).

The characteristics of injuries sustained by tourists differ by visitor type. A recent Australian study comparing international tourists and residents found that hospitalisation due to a water-related

## Abstract

**Objective:** To explore injury deaths in international and domestic interstate travellers, together with those newly arrived to Australia.

**Methods:** A population-based cohort study of all injury-related deaths between 1 January 2006 and 31 December 2017 registered with Births Death and Marriages in Australia was conducted using Australian Bureau of Statistics' (ABS) Cause of Death information. Population data on travellers were obtained from Tourism Research Australia.

**Results:** There were 4,503 injury-related traveller deaths (domestic interstate:3,055; international:934; new arrivals:514). The average annual age-standardised mortality rates in domestic interstate travellers was 0.75 per 100,000, compared with 2.22 per 100,000 in international travellers. Leading causes of injury-related death were land transport incidents (n=1495, 33.2%), self-harm (n=786, 17.5%) and falls (n=513, 11.4%), with differences in mechanism by state/territory, traveller type and age group. Intentional self-harm was common amongst all visitor types, however, it was the primary cause of death in new arrivals

**Conclusion:** Age-standardised mortality rates were almost three-fold higher in international than domestic travellers. New arrivals, international and domestic travellers have different injury profiles, and each require specific prevention strategies.

**Implications for public health:** While COVID has restricted travel to and within Australia, this has provided an opportunity for exploration, reflection, and consideration of risk factors for travellers, and to develop targeted injury prevention strategies for visitor types, so travel experience can be optimised and the magnitude of harm can be reduced.

**Key words:** injury, tourist, travel, epidemiology, incidence

transport injury or a drowning event was five times higher in international tourists, compared with residents, and hospitalisation due to pedestrian incidents was three times higher.<sup>15</sup>

Exposure is one of the biggest challenges when exploring the impact of injuries.<sup>15</sup> For example, investigating the risk of drowning is difficult as not all tourists who come to Australia travel to beaches or participate in aquatic activities. These visitors are therefore not exposed to the risk of drowning,

so including them in measures used to determine risk of drowning may result in underestimating the true risk of drowning for those who do participate in aquatic activity. Injuries resulting from less common events (e.g. contact with venomous animals, shark attacks, SCUBA diving, and snorkelling) can be exaggerated by the media.<sup>21,22</sup> Such overemphasis on these rare events misinforms visitors and distracts them from understanding actual risk factors that could result in injury.<sup>23</sup>

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Access to appropriate health information may differ between traveller types and therefore knowledge of certain risk factors may also differ. Some newly arrived residents (temporary or permanent) to Australia, especially students, are provided information once arriving to Australia on certain risks<sup>23,24</sup> and others are not. In the present study, new arrivals are defined as people born overseas who travelled to Australia with the intent to become temporary or permanent residents, or to visit Australia for a period of more than three and less than 12 months, and who died within 12 months of their arrival. In comparison to international travellers, new arrivals also come from diverse cultural backgrounds, making it important to understand these different traveller types to tailor different prevention strategies for the different risks. To date, there are a dearth of studies that focus on injuries in domestic travellers, nor are there studies that encompass both domestic interstate travellers and international visitors. Domestic travellers, although residents of Australia, are still known to experience injuries when travelling interstate.<sup>25</sup> With a pause in travel due to COVID-19 this is an opportune time to review mortality in tourists due to injuries and explore how similar future incidents may be prevented. Exploring differences in injury mortality between international visitors, new arrivals and domestic interstate travellers will aid in identifying those more at risk for certain injuries, and allow determination of risk profiles for these different traveller groups, which can subsequently inform the development/targeting of prevention strategies.

The aim of this study is to explore injury deaths in international travellers, new arrivals (temporary/permanent migrants) and domestic interstate travellers that occurred in Australia from 2006-2017.

## Methods

This is a population-based cohort study of all injury related deaths that were registered with Births Death and Marriages in the respective Australian jurisdictions between 1 January 2006 and 31 December 2017 (12 years) and provided to the Australian Bureau of Statistics (ABS) as part of the annual cause of deaths data.

Injury deaths were identified using external cause codes (V01-Y89) defined by the International Statistical Classification of

Disease and Related Health Problems 10<sup>th</sup> Revision (ICD-10).<sup>26</sup> There were three traveller groups of interest that were identified by postcode of usual residence: international travellers; new arrivals and (Australian) interstate travellers.

Interstate deaths were defined as (Australian) domestic travellers who died outside their usual state of residence. International traveller deaths were defined as those who died in Australia from an injury, and whose residential address was recorded as outside of Australia.

Age was categorised into three groups: children (0-14 years), working adults (15-59 years) and older adults (60+). Injuries were grouped into mechanism (falls, drowning, transport, assault, intentional self-harm, and due to low cell counts overexertion, electrocution and contact with venomous animals were combined into 'other'). Country of birth was categorised to reflect global burden of disease studies and included: Oceania & Antarctica; North-West Europe; Southern & Eastern Europe; North-East Asia, South-East Asia, Southern & Central Asia, North Africa and Middle-East, Americas, and Sub-Saharan Africa.

Alcohol-related deaths were identified using the ICD-10 codes and included: Y15 (Poisoning exposure to alcohol); X65 (Intentional self-poisoning by exposure to alcohol) and X45 (Accidental poisoning by exposure to alcohol).

In order to calculate age-standardised mortality rates, tourist population data were obtained from Tourism Research Australia (TRA) for each calendar year between 2006 and 2017, by tourist type (interstate & international), age group and gender.<sup>27</sup> Briefly, TRA conducts an annual International Visitor Survey (IVS) with short-term international visitors at departure gates of the eight major international airports in Australia. Data from the IVS is combined with international passenger arrivals and departures and weighted by various factors to estimate age- and gender-specific population data on international tourist visitors to each state/territory in Australia. A similar process is conducted by TRA for Australian residents (National Visitor Survey, NVS), facilitating the estimation of age and gender specific population data on interstate tourist visitors to each Australian state/territory.

Age-standardised mortality rates (ASMR) were calculated for interstate and international

travellers (including new arrivals). Because it was not possible to distinguish between new arrivals and temporary visitors using the TRA population data, these two groups were combined to calculate these rates. In addition, children aged 0-14 years were excluded as TRA do not collect these data. Rates were standardised to the most recent World Health Organization (WHO) standard population (2000-2025),<sup>28</sup> and are reported per 100,000 per annum for every calendar year of the study. Relative Risks (with 95% CI) were also calculated.

All analyses were conducted using SPSS (version 25). All variables were categorical, therefore chi-square tests of independence were used, unless assumptions were violated, when Fisher's Exact tests were used instead.

## Results

There were 4,503 traveller injury deaths during the 12-year study period; 3,248 of which were males (72.1%). Two-thirds of traveller deaths occurred in interstate domestic travellers ( $n=3,055$ ; 67.8%), 20.7% in international travellers ( $n=934$ , 20.7%), and 11.4% in new arrivals ( $n=514$ ). Among domestic interstate travellers, age-standardised mortality rates (ASMR) were consistently between 0.50 and 1 injury death per 100,000 travellers over the study period (2013-2017). For international travellers, there was slightly more variation across the study period (lowest: 1.69 per 100,000 in 2017; highest: 3.02 per 100,000 in 2009). Across the study period, the ASMR was nearly three times higher in international travellers (2.22 per 100 000) than domestic interstate travellers (0.75 per 100 000). (Figure 1a)

There was a significant difference between traveller type and age categories ( $\chi^2=22.92$ ;  $df=4$ ;  $p<0.001$ ). Among working adults, 66.0% were domestic interstate travellers ( $n=2,022$ ), compared with 22.6% international travellers ( $n=693$ ), and 11.3% new arrivals ( $n=347$ ); with the majority of injury-related deaths occurring in the 20-29 ( $n=1011$ , 22.5%), and 30-39 ( $n=686$ , 15.2%) year age groups. There was a significant difference between age categories and gender ( $\chi^2=112.26$ ;  $df=2$ ;  $p<0.001$ ). Among males, 71.8% ( $n=2357$ ) were working adults compared to 56.2% females ( $n=705$ ). (Table 1)

### Mechanism of injury

Over the study period, across all traveller types, land transport incidents were the

Table 1. Mechanisms of injury by traveller type and age category.

		Domestic interstate traveller deaths			International traveller deaths			New arrival deaths					
	Males (%) (n=2223)	95% CI	Females (%) (n=832)	Total (%) (n=3055)	Males (%) (n=661)	95% CI	Females (%) (n=273)	Total (%) (n=934)	Males (%) (n=364)	95% CI	Females (%) (n=150)	Total (%) (n=514)	95% CI
<b>Top 4 mechanisms of injury</b>													
Land transport <sup>a</sup>	751 (33.8%)	24.5-43.1	302 (36.3%)	1053 (34.5%)	195 (29.5%)	20.6-38.4	112 (41.0%)	307 (32.9%)	107 (29.4%)	20.5-38.3	36 (24.0%)	143 (27.8%)	19.0-36.6
Intentional self-harm	420 (18.9%)	11.2-26.6	111 (13.3%)	531 (17.4%)	130 (19.7%)	11.9-27.5	37 (13.5%)	167 (17.9%)	96 (26.4%)	17.8-35.0	39 (26.0%)	135 (26.3%)	17.7-34.9
Falls	232 (10.4%)	4.4-16.38	141 (16.9%)	373 (12.2%)	88 (13.3%)	6.6-20.0	24 (8.8%)	112 (12.0%)	34 (9.3%)	3.6-15.0	21 (14.0%)	55 (10.7%)	4.6-16.8
Accidental poisoning	211 (9.5%)	3.8-15.2	63 (7.6%)	274 (9.0%)	77 (11.6%)	5.3-17.9	26 (9.5%)	103 (11.0%)	40 (11.0%)	4.9-17.1	8 (3.2%)	48 (9.3%)	3.6-15.0
<b>Top mechanisms of injury resulting in death by age category and traveller type</b>													
<b>Children<sup>c</sup> (n=125; 2.8% of all deaths)</b>													
Land transport	24 (46.1%)	36.3-55.9	19 (55.9%)	43 (50.0%)	n.p.	n.p.	n.p.	9 (45.0%)	n.p.	n.p.	n.p.	8 (42.1%)	32.4-51.8
Drowning	13 (25.0%)	16.5-33.5	n.p.	13 (25.0%)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
<b>Working adults (n=3062; 68% of all deaths)</b>													
Land transport	557 (35.2%)	25.8-44.6	183 (41.7%)	740 (36.6%)	158 (30.4%)	21.4-39.4	87 (50.3%)	245 (35.4%)	81 (31.9%)	22.8-41.0	30 (32.3%)	111 (32.0%)	22.9-41.1
Intentional self-harm	362 (22.9%)	14.7-31.1	94 (21.4%)	456 (22.6%)	79 (15.2%)	8.2-22.2	19 (11.0%)	98 (14.1%)	72 (28.3%)	19.5-37.1	27 (29.0%)	99 (28.5%)	19.7-37.3
Accidental poisoning	200 (12.6%)	6.1-19.1	57 (13.0%)	257 (12.7%)	64 (12.3%)	5.9-18.7	22 (12.7%)	86 (12.4%)	36 (14.2%)	7.4-21.0	n.p.	36 (14.2%)	7.4-21.0
<b>Older adults (n=1316; 29.2% of all deaths)</b>													
Falls	162 (27.6%)	18.8-36.4	132 (36.8%)	294 (31.0%)	34 (26.8%)	18.1-35.5	25 (26.6%)	59 (26.7%)	24 (23.5%)	15.2-31.8	19 (41.3%)	43 (29.0%)	20.1-37.9
Land Transport	170 (28.9%)	20.0-37.8	100 (27.8%)	270 (28.5%)	37 (29.1%)	20.2-38.0	16 (17.0%)	53 (24.0%)	26 (25.5%)	17.0-34.0	6 (13.0%)	32 (21.6%)	13.5-29.7
Accidental exposure to other forces	47 (8.0%)	2.7-13.3	52 (14.5%)	99 (10.5%)	19 (15.0%)	8.0-22.0	26 (27.7%)	45 (20.4%)	19 (18.6%)	11.0-26.2	9 (19.6%)	28 (18.9%)	11.2-26.6

Notes:

<sup>a</sup> Land transport refers to deaths that occurred on land (ICD10 codes V01-V89), including cars, trucks, buses, motor bike (2, 3 and 4 wheeled), bicycles, pedestrians, animals

<sup>b</sup> Other transport refers to deaths that did not occur on land, including water, air, space and other transport mechanisms, but not due to road or land transport (ICD10 V90-V99)

<sup>c</sup> Only two mechanisms of injury are presented for children due to small cell counts

n.p. represents "not presented" due to low cell counts (cell counts ≤5) and is excluded from the total

Figure 1a: Age-standardised injury mortality rates in interstate and international travellers.

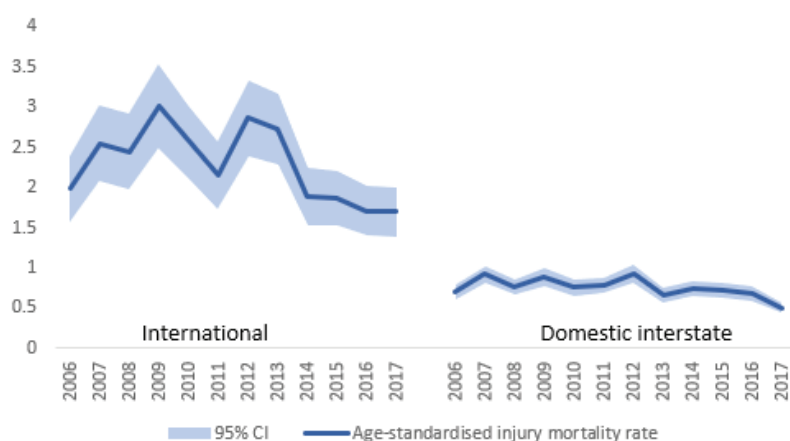
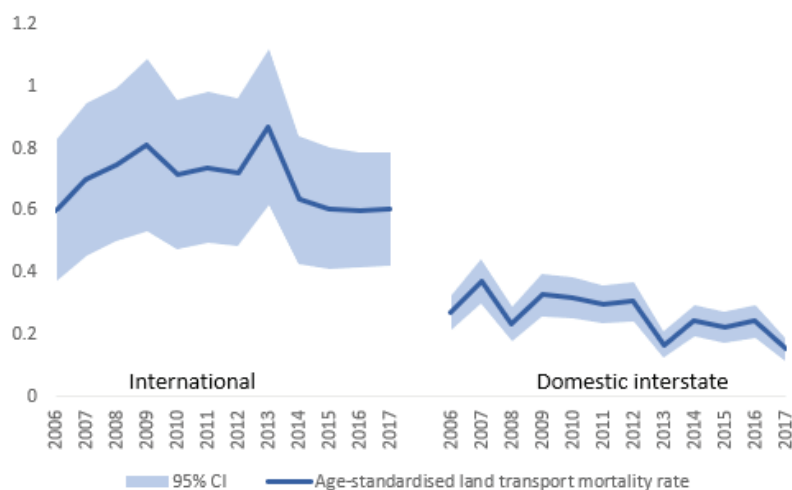


Figure 1b: Age-standardised land transport mortality rates in interstate and international travellers.



most frequent mechanism of injury-related deaths ( $n=1,495$ ), followed by intentional self-harm (17.5%), falls (11.4%), then drowning (8.4%). However, there were differences in injury mechanism by traveller type (Table 1). While land transport incidents were the most frequent cause of injury-related death for domestic interstate (34.5%) and international travellers (32.9%), intentional self-harm was the leading injury mechanism among new arrivals (27.8%). Among domestic interstate injury deaths, the next most frequent mechanisms of injury were intentional self-harm (17.4%), falls (12.2%) and accidental poisoning (9.0%). Among international travellers, the next most frequent mechanisms of injury-related death were drowning (17.9%), intentional self-harm (12.0%) and other transport-related injuries (11.0%). In new arrivals, land transport incidents (26.3%), falls (10.7%), and drowning (9.3%) were the next leading causes of injury-related death.

### Age categories by visitor type

Mechanism of injury-related death varied with age (Table 1). Children comprised 2.8% of injury-related deaths in travellers; almost half of these were due to land transport incidents (43.2%), close to one-fifth were due to drowning (17.6%) and more than 10% were due to other transport incidents (11.2%). Most deaths in children were in domestic interstate travellers (68.8%).

Working adults comprised more than two-thirds of all injury-related traveller deaths (68.0%), and most of these deaths (66%) occurred in domestic interstate travellers. Leading causes were land transport incidents (35.4%), intentional self-harm (21.7%) and accidental poisoning (10.2%) (Table 1). Among older adults (29.2% of deaths), the leading cause of injury-related death was falls (29.0%), followed by land transport incidents (27.1%) and accidental exposure to other forces (9.0%).

### Age categories by traveller type and injury mechanism

Within each traveller type, there were differences in injury mechanism by age group. For example, among working adults, 11.8% of injury-related deaths in those newly arrived were due to drowning, but this was not a leading cause of death in either domestic interstate or international travellers in this age group. Similarly, a leading cause of injury-related death in newly arrived older adults was intentional self-harm, but this mechanism was not among the top three for international and domestic interstate travellers in this age group.

### Land transport incidents

ASMRs for land transport incidents are shown in Figure 1b for international visitors and domestic interstate travellers. Over the 12-year study period, rates in international travellers did not vary significantly (0.59 per 100,000 in 2006 to 0.60 in 2017), though there were two distinct peaks during the study period (2009: 0.81 per 100,000; 2013: 0.87 per 100,000). Conversely, among interstate travellers, ASMRs decreased from 0.27 in 2006 to 0.15 in 2017. Across the study period, the average annual land transport ASMR was 2.6 times higher among international travellers (0.68) than in domestic interstate travellers (0.26). While rates are lower in interstate travellers, this group is responsible for the greatest magnitude of land transport deaths (1,053 deaths out of 1,495).

### Traveller deaths by state

Overall, the highest number of injury-related traveller deaths occurred in New South Wales (NSW) ( $n=1,287$ , 28.6%) followed by Queensland (QLD) ( $n=974$ , 21.6%) and Victoria (VIC) ( $n=722$ , 16.0%) (Figure 2). There were differences ( $\chi^2=844.98$ ,  $df=14$ ,  $p<0.001$ ) by traveller type. Interstate domestic deaths were highest in NSW ( $n=996$ , 32.6%) and lowest in Tasmania (TAS) ( $n=65$ , 2.1%), whereas international traveller injury deaths most frequently occurred in Western Australia (WA) ( $n=269$ ; 28.8%), and new arrival deaths occurred most frequently in South Australia (SA) ( $n=134$ , 26.1%). The leading cause of injury deaths in NSW for domestic interstate travellers was land transport incidents ( $n=356$ , 35.7%), and this was also the leading cause of death in international travellers in WA ( $n=86$ , 32%). Intentional self-harm was the leading cause of death for new arrivals in SA ( $n=41$ ,

30.6%). Traveller deaths within each state is suggestive of preferred travel destinations in relation to the different traveller types. Some differences were observed by gender and state/territory where death occurred ( $\chi^2=26.62$ ,  $df=7$ ,  $p<0.001$ ). (Figure 2)

**Region of birth**

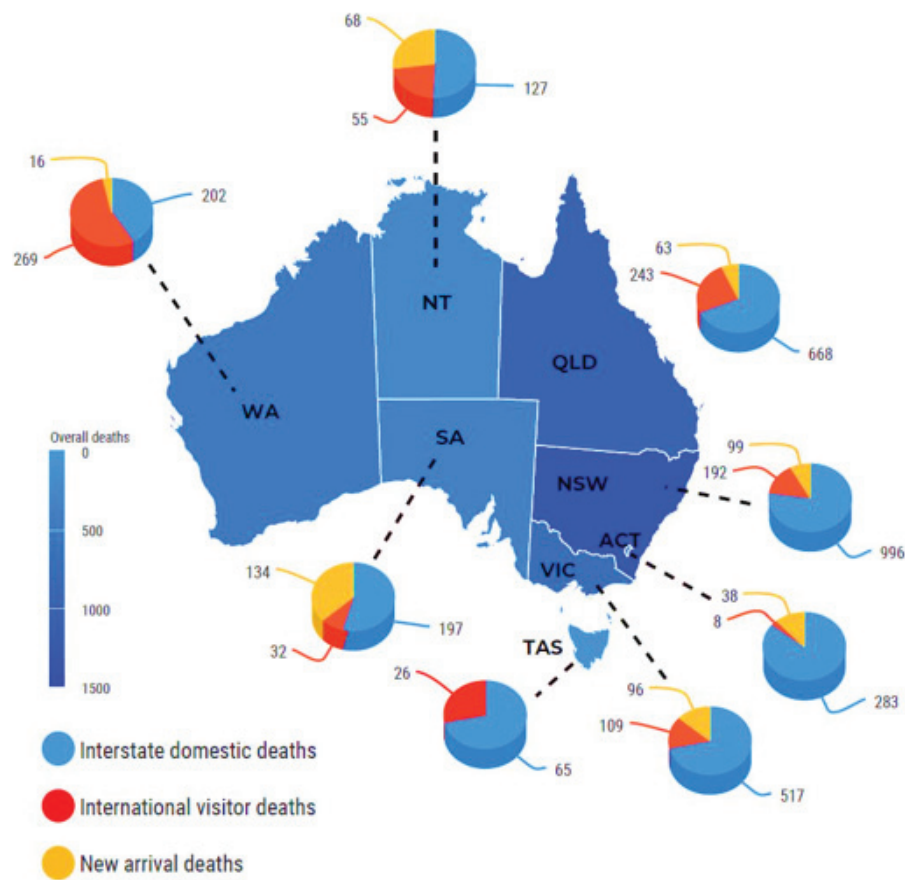
International travellers (37.1%) and new arrivals (25.1%) were mainly from North-West Europe, followed by North-East Asia (82.5%). There were differences in region of birth and mechanism of injury-related death (see supplementary Table 1). While land transport incidents and intentional self-harm were the leading causes of death for most regions, death due to drowning was a frequent cause in travellers from North-East Asia (28.7%). There was a significant difference between overseas traveller type (visitors vs new arrivals) and country of birth ( $\chi^2=92.60$ ,  $df=8$ ,  $p<0.001$ ).

**Discussion**

Travellers to Australia (new arrivals and tourists) experience injuries resulting in death at three times the rate of domestic interstate travellers. Land transport incidents are the leading mechanism of injury-related death for international visitors and domestic interstate travellers, but new arrivals most frequently died from intentional self-harm. Development of community-based prevention strategies should be an area of focus.<sup>9</sup> Domestic interstate tourists confer the greatest magnitude of injury-related death, but once population is considered, age-standardised mortality rates are higher among international visitors. The findings in this study are consistent with previous research that identified motor vehicle crashes<sup>1,7-9,15,29,30</sup> and drowning<sup>15,21,31-34</sup> as leading causes of death for international visitors, confirming the continued need for prevention strategies focusing on driving and aquatic activities for travellers in Australia.

This is the first study to the authors' knowledge that has focused on injury deaths among different traveller types (domestic interstate travellers, international travellers and new arrivals) in Australia. Previous studies of all-cause injury mainly focused on international visitors<sup>1,2,15,29,35</sup> and mainly used hospital data.<sup>15,29,36,37</sup> Results reported in studies that focused on all-cause injury-related death data<sup>1,2,35</sup> were similar to those described in the present study for

Figure 2: Traveller deaths by state.



international travellers, with land transport incidents being the primary causes of death followed by drowning. However, this is the first study where intentional self-harm has been identified as a mechanism of import. In addition, most previous studies focusing on traveller deaths have been drowning or water-related.<sup>14,25,31,34,38-43</sup> While some previous studies have reported crude death rates,<sup>2,41</sup> or age-adjusted (incidence) rates, these have mainly related specifically to drowning studies.<sup>25,31,40,42,44</sup> No previous studies on all-cause traveller injury deaths presented age-standardised mortality rates or incidence rates. The most comprehensive study published to date on tourist injuries in Australia was by Mitchell et al.<sup>15</sup> This compared the burden of injuries in international visitors to residents of New South Wales (NSW), and was based only on hospitalisation data. The reported findings were similar to our study in relation to age and mechanism of injury.

**Land transport incidents**

Land transport incidents were the leading cause of injury-related death for international

tourists and domestic interstate visitors, however, the rates are much lower than has been reported among Australian residents. In 2017 the annual death rate for road traffic crashes in Australian residents was 4.98 per 100,000,<sup>45</sup> which fell slightly to 4.7 per 100,000 in 2019. In contrast, transport-related injuries resulting in hospitalisation among Australian residents have increased by 3.3% per annum since 2013.<sup>46</sup> It may be expected that rates of hospitalisation due to land transport incidents may have increased among visitors to Australia commensurately, however this needs to be explored further. Hospitalisation data would help to inform the true burden of injury due to land transport among international visitors.

Further research is required to identify risk factors associated with land transport incidents among visitors and to determine whether there are specific driving issues/ challenges in this group, in order to develop and implement targeted risk prevention strategies. To date, information provided to international travellers includes<sup>8</sup>: driving on the left-hand side; lower blood alcohol limit than other countries; understanding road

signs and different road environments; and animal hazards.

Currently, international travellers and migrants are not mentioned or considered in the consultation draft Australia's National Road Safety Strategy for 2021-2030.<sup>47</sup> There is a need to address road safety in tourists/travellers in the national strategy, as these data confirm that they are potentially vulnerable and/or risky road users.

### **Intentional self-harm**

The number of deaths due to intentional self-harm in new arrivals is alarming and shows a visitor population that requires attention and further investigation around migrant suicides. In a literature review focusing on migrant suicide in Australia,<sup>48</sup> suicide rates were reported to be higher in immigrants than in their respective countries of birth, suggesting a link between moving to Australia and intentional self-harm. Reasons behind migration and travel suicide are complex and have previously been described as related to multiple factors such as culture, religion, reasons for migration, the deterioration of mental health once arriving in Australia, social aspects and socioeconomic status.<sup>49</sup> These results indicate that intentional self-harm in migrants requires further preventative action and investigation, with better monitoring, especially in identifying specific triggers and/or stressors when moving to a different country. Mental health advice for all visitors, whether domestic or international, should also be considered when giving pre-travel health advice. However, mental health information while travelling will have to be accessible outside of just medical clinics. Future research should identify those who are more at risk of intentionally harming themselves when travelling.

### **Implications for public health**

Despite recent travel changes due to COVID-19 the discussion of travel safety should not be delayed. For while there is current uncertainty about the future of international travel to Australia, this research still brings value. Firstly, in the short-term, interstate travel within Australia is likely to increase, therefore understanding injury risks for interstate travellers is important. Additionally, while travel to Australia from other countries may be in the distant future, the current travel restrictions provide an opportunity for exploration, reflection and

consideration of risk factors for international travellers. Identifying these risk factors will aid in developing injury prevention strategies for this visitor group so that when tourism returns, the travel experience can be optimised, and the magnitude of harm can be reduced.

There are very few tourist safety approaches directed toward international travellers in Australia. They include beach safety messages on Qantas flights to coastal and regional destinations in collaboration with Surf Life Saving Australia,<sup>50</sup> Tourist road safety strategy in Tasmania targeted through Hobart Airport involving travel hire companies and other tourism resource centres,<sup>51</sup> and a road safety campaign in Victoria focusing on delivering the 'Drive Safely Because' initiative by targeting tourists driving along the surf coast with blue signage and community involvement.<sup>52</sup> However, these have not been formally evaluated, so it is difficult to provide comment on their effectiveness.

Other ongoing community campaigns include Swim Between the Flags,<sup>53</sup> Don't Drink and Drown,<sup>54</sup> SafeWaters, Think! Road Safety-Fatal Five,<sup>55</sup> Stop it or Cop it,<sup>56</sup> StreetSmarts<sup>57</sup> and Fatality Free Friday<sup>58</sup> – however, these campaigns are targeted to the Australian public and not tourists specifically, and not all have been evaluated. The Don't Drink and Drown (DDD) campaign was targeted at school leavers to reduce alcohol consumption around water.<sup>59</sup> While recognition of the DDD campaign was reportedly high (90%), the effect the campaign on drinking decisions/behaviour was not addressed. The SafeWaters campaign has also been evaluated,<sup>60</sup> and while participants demonstrated good recall of the most common risk factors in drowning and reported they always or mostly practiced safe behaviour around water immediately post-campaign, at the 2<sup>nd</sup> follow-up (four months after the campaign) this information was not retained. There has also been the suggestion that reality television shows such as Bondi Rescue, which is filmed in conjunction with Surf Lifesaving Australia and shows the real-life rescue attempts of visitors to one of Australia's most popular beaches, may function as safety campaigns. In a survey of those who'd watched Bondi Rescue, participants self-reported improvement in water safety knowledge after they had watched the show.<sup>61</sup>

Smaller community approaches that have undergone some level of evaluation include warning signs at certain visitor locations,

such as at the Mount Cougal waterfall/rock pool, or at coastal cliff faces.<sup>62,63</sup> At these locations, warning signs were found to improve knowledge about the risks, which either deterred people from swimming and/or being around risky areas, but did not always translate to behaviour change or influence their choices. It is unlike that safety campaigns can change mass behaviour, however, they are a useful outlet to provide information about risks. As above, most community approaches to date are targeted broadly to the Australian public and not to tourists. Campaigns that have been targeted to tourists have mainly focused on infectious disease.<sup>64,65</sup> There is a definite opportunity for approaches to focus on other forms of travel-related risks such as injury.

Overall, prevention strategies are important in travel safety, however, require a multi-faceted approach using various resources and outlets, perhaps outside traditional approaches, in order to reach all travellers.<sup>66</sup> These data showed that there are differences in mechanism of injury-related death due to tourist type and age group; prevention strategies should reflect this complexity. The findings presented here on international visitors and new arrivals specifically, could usefully assist tourism establishments and health authorities on who to target for appropriate health information and safety strategies. These data confirm that health information and safety prevention strategies should differ by visitor and age group. Importantly, effort is required to identify how best to target these specific groups. Prevention strategies include but are not limited to mental health services, better patrolled beaches, the accessibility and distribution of safety information in appropriate languages, water-safety advice, knowledge of road rules and pre-travel health advice from country of origin.<sup>1</sup>

### **Strengths and limitations**

This study is the first to our knowledge to explore age-standardised mortality rates for international and interstate traveller deaths in Australia. Tourist population data provided by Tourism Research Australia are an estimate and may not accurately capture the true magnitude of international visitors to Australia and may not truly represent the international travelling population within each State/Territory in Australia due to constant movement across the country (after arrival and before departure). Further

information about the reliability of the estimates for interstate<sup>67</sup> and international<sup>68</sup> tourist populations is available on the TRA website. An alternative source of information on international tourist population is the Overseas Arrivals and Departures data from Australian Bureau of Statistics,<sup>69</sup> which is based on passport documents, visa information, and incoming passenger cards. While it is possible that these data may be more accurate than the TRA estimates, there is no equivalent for interstate tourist population data held by ABS. For consistency, we chose to use TRA estimates for both interstate and international tourist populations. Additionally, using TRA estimated population data allowed comparability with the only other published study on injuries among tourists in Australia where population estimates have been included.

A second limitation relates to the difficulty in differentiating between 'new arrivals' (defined here as people born overseas who travelled to Australia with the intent to become temporary or permanent residents, or to visit Australia for a period of more than three and less than 12 months) versus a person from another country visiting Australia for recreation purposes. It is possible (but unavoidable) that misclassification of international visitors as new arrivals, and vice versa, occurred. In addition, 'new arrivals' are not identified as a group by Tourism Research Australia (TRA), so temporary migrants are combined with short-term visitors in the TRA population data. Future research would benefit from more accurate denominator data to calculate fatality rates in different tourist group types.

Alcohol-related injury deaths were explored, however, only 29 (0.64%) out of the 4,503 injury deaths were identified as being related to alcohol. This number seems low and may be a result of a coding issue. In this study, only those cases where alcohol was identified as the primary cause of death (poisoning due to alcohol, intentional self-harm, and undetermined intent) could be defined as cases with alcohol-involvement. It is possible (and likely) that alcohol contributed to injury-related deaths but was not recorded as such. Alcohol is known to be a contributing factor in fatal crashes with international drivers,<sup>9</sup> therefore expected alcohol-related deaths in land transport incidents should be higher, especially in domestic interstate deaths.<sup>70,71</sup> International backpackers are

also known to drink and partake in risky behaviour, resulting in hospitalisation.<sup>72,73</sup> Hence, absence of recording of alcohol as a contributing factor in these injury-related deaths does not necessarily infer absence of alcohol involvement in these deaths. Using linked data from across the continuum of care, including coroners' reports, could overcome this limitation and assist to more accurately determine the potential risk factors (alcohol and others) involved.

Finally, this study focused only on mortality from injuries among tourists, hence injuries resulting in visits to Emergency Department and/or resulting in hospitalisation were outside the scope of this study. Additionally, it was not possible to fully explore temporal trends (other than annual incidence) because the information available in the dataset was limited to 'day of death' which does not always accurately represent day of injury event. To examine the burden of injury more comprehensively in tourists, including temporal trends, other data sources (ambulance, Emergency Department, hospital admission) are required, ideally linked together. Alternatively, a prospective study design could be used. This would allow examination of individual time at risk (for example, from arrival in Australia of an international tourist to time of injury) and would also allow better investigation of exposure to risk activities, and better measurement of the nature of injuries sustained (e.g. was the injury sustained while completing work-related activities by a backpacker, or recreational?).

## Conclusion

Australia is an internationally renowned travel destination and is known to attract different types of visitors, encouraging domestic travel and international migration. Most injury-related deaths in domestic interstate travellers and international visitors are due to land transport incidents, however, intentional self-harm is also common among all visitor types, especially in new arrivals. Domestic interstate travellers comprise the largest mortality burden, after adjusting for population. The ASMR was almost three times higher among international visitors than domestic interstate travellers, indicating that this group remains a priority for injury prevention campaigns, with a focus on driving risks when visiting Australia.

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Table 1:** Top Region of birth by traveller type and mechanism of injury.