# Ten-Year Incidence of Sport and Recreation Injuries Resulting in Major Trauma or Death in Victoria, Australia, 2005-2015

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**Background:** Sports injuries that result in major trauma or death are associated with significant health care burden and societal costs. An understanding of changes in injury trends, and their drivers, is needed to implement policy aimed at risk reduction and injury prevention. To date, population-level reporting has not been available regarding trends in serious sport and recreation injuries anywhere in Australia over such an extended period, nor have any studies of this length captured comprehensive, long-term data on all sports-related major trauma internationally.

**Purpose:** To describe the incidence of sport and active recreation injuries resulting in major trauma or death over a 10-year period (July 2005 to June 2015) in the state of Victoria, Australia.

**Study Design:** Descriptive epidemiological study.

**Methods:** All sport and active recreation–related major trauma cases and deaths in Victoria, Australia, over a 10-year period were extracted from the population-level Victorian State Trauma Registry and the National Coroners Information System. Poisson regression analysis was used to examine trends in the incidence of sport and active recreation–related major trauma and death.

**Results:** The 10-year study period entailed 2847 nonfatal major trauma cases and 614 deaths (including 96 in-hospital deaths). The highest frequencies of major trauma cases and deaths were in cycling, motor sports, and equestrian activities. The participation-adjusted major trauma and death rate was 12.2 per 100,000 participants per year over the study period. An 8% increase was noted in the rate of nonfatal major trauma (incident rate ratio [IRR], 1.08; 95% CI, 1.06-1.10; $P < .001$) and a 7% decrease in the death rate (IRR, 0.93; 95% CI, 0.90-0.97; $P < .001$). Significant increases were found in the rates of major trauma (including deaths) in equestrian activities, motor sports, and cycling.

**Conclusion:** The death rate from sport and active recreation decreased by more than half over the course of 10 years in Victoria, while the rate of nonfatal major trauma almost doubled. This increase is largely attributable to equestrian activities, motor sports, and cycling. Study findings highlight the need to prioritize investments in the prevention of trauma in these activities.

**Keywords:** sports; recreation; wounds and injuries; death; trends

Regular participation in sport and recreation has clear health benefits, contributing substantially to total physical activity levels.[4,16] Despite these benefits, participation carries an associated risk of injury that, in certain sports and recreational activities, may entail serious injury or even death.[1] Considerable health care costs are involved in treating these serious injuries, and individuals may experience significant long-term disability and loss of function.[19] Disability and loss of function can add to the socioeconomic burden of injury for adults of working age and can reduce their ability to contribute productively to society. Furthermore, when previously active individuals are no longer able to participate in sport, the burden of injury is heightened because of the potentially increased risk of inactivity-related chronic diseases such as type 2 diabetes and heart disease.[14]

Sports participation trends are influenced by cultural and demographic shifts, leading to changes in sports injury patterns over time. An understanding of these changes, and their drivers, is needed to implement policy aimed at risk reduction and injury prevention. In Victoria, Australia, the major trauma registry has had population coverage and stable operation since 2005, enabling reliable monitoring of 10-year injury trends.[21] To date, no population-level reporting has been available regarding trends in serious sport and recreation injuries anywhere in Australia over

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such an extended period. Internationally, long-term population-level reporting of sports-related trauma has been restricted to specific sports,[23] specific injuries,[11] or specific populations.[25] The aim of this study was to describe the incidence of all sport and active recreation–related injuries resulting in major trauma or death for a 10-year period from July 2005 to June 2015 in Victoria, Australia.

## METHODS

Victoria is a state of Australia with a population of more than 6 million, comprising 25% of the national population.[5] The population-based Victorian State Trauma Registry (VSTR) captures all major trauma cases and deaths from all trauma hospitals within the state.[21] Major trauma is defined as an event that meets any of the following criteria: death after an injury, an Injury Severity Score higher than 12,[2] admission to an intensive care unit for more than 24 hours along with use of mechanical ventilation, and urgent surgery. Information collected by the registry includes injury event details (using International Classification of Diseases, 10th revision, Australian Modification [ICD-10-AM] codes for activity and place and cause of injury), injury management, and discharge information. A text narrative of the injury event is also collected. The VSTR uses an opt-out consent process; the opt-out rate has remained below 1% each year for the past decade, and the current opt-out rate is ~0.3%. The VSTR undergoes significant automated and manual quality control and data validation procedures to ensure the data are as complete and accurate as possible.[28] The registry has recently undergone national external quality assessment and been rated highly for its data coverage and quality.[15] Registry protocols and this study were approved by Monash University Human Research Ethics Committee and the Human Research Ethics Committee of each participating hospital.

All sport and active recreation–related major trauma cases and in-hospital deaths occurring in patients aged 15 years and older within Victoria were extracted from the VSTR, for the period July 1, 2005, to June 30, 2015. Cases were required to meet 1 or more of the following criteria:

1. Activity at the time of injury coded as either "sports" or "leisure"
2. Place of injury coded as either "athletics and sports area" or "place for recreation"
3. Cause of injury coded as "motorcycle driver," "motorcycle passenger," "pedal cyclist," or "horse-related"

Off-road motorcycle-related activities, such as trail bike riding, all-terrain vehicle (ATV) use, and motocross, were included in the study. However, because it was not possible to determine whether on-road motorcyclists and passengers were riding for transport or recreation, these cases were excluded. In the case of cycling, evidence indicates that a large proportion of on-road pedal cyclists choose to ride for sport or leisure/fitness,[12] and therefore all pedal cyclists were included.

To ensure comprehensive case identification, injury text narratives were checked for all cases. Additionally, each participant's sport or active recreation at the time of injury was determined from the relevant ICD-10-AM activity code, which includes more than 200 options for specific sport and recreational activities. Each injury was categorized according to the sporting types used in the latest version of the Australian Bureau of Statistics (ABS) report on participation in sports and recreation.[4] Demographic data, including age and sex, were collected on each case. Injured body regions were recorded by use of the Abbreviated Injury Scale (AIS) and described for the whole sample as well as for individual sports. Only body regions with injuries scoring 2 or higher on the AIS were counted (2005 version, 2008 update), thereby excluding body regions with injuries classified as "minor."[2]

The registry receives regular updates from the National Coroner's Information Service (NCIS), which is a comprehensive national data storage and retrieval system recording every Victorian death reported to the coroner. Prehospital deaths were extracted from the NCIS for people aged 15 years or older whose death was the direct result of injuries that were sustained during participation in "informal sport and active recreation," "organized sport and active recreation," or "leisure activity," or that were attributable to cycling. These cases were retained if sustained while people were participating in an ABS sport or active recreational activity.[4] Injury event details and data on specific cause of death were provided. Because the NCIS and VSTR both contain identifiable data, double counting of cases across the 2 data sets was avoided.

Denominator values for participation-adjusted injury rates were obtained from the ABS, which has collected information on participation in sports and active recreation via the Household Survey in 4 of the 10 years studied: 2005-2006, 2009-2010, 2011-2012, and 2013-2014.[4] Via this telephone survey, a random sample of Australians 15 years or older are asked about any sport or active recreational activity in which they participated at least once during the previous year. Victoria-specific participation data were obtained via the ABS Remote Access Data Laboratory for

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TABLE 1
Numbers and Rates for Sport and Active Recreation–Related Major Trauma Cases and Deaths in Victoria, Australia, July 1, 2005, to June 30, 2015 (Inclusive)[a]

| | Nonfatal Major Trauma Cases | | Deaths | | Major Trauma Cases and Deaths | |
|---|---|---|---|---|---|---|
| Sport | n | Rate | n | Rate | n | Rate |
| Cycling | 1154 | 34.5 | 126 | 3.8 | 1280 | 38.3 |
| Motor sports | 588 | 208.9 | 32 | 11.4 | 620 | 220.3 |
| Equestrian activities | 373 | 102.2 | 12 | 3.3 | 385 | 105.5 |
| Australian football | 190 | 15.0 | 13 | 1.0 | 203 | 16.0 |
| Swimming/diving | 59 | 1.8 | 92 | 2.8 | 151 | 4.7 |
| Power boating | 89 | 50.6 | 5 | 2.8 | 94 | 53.5 |
| Snow/ice sports | 74 | 17.9 | 7 | 1.7 | 81 | 19.6 |
| Aerosports | 43 | N/A | 20 | N/A | 63 | N/A |
| Fishing | 4 | 0.9 | 46 | 10.4 | 50 | 11.3 |
| Other | 273 | 1.0 | 261 | 1.1 | 534 | 2.1 |
| All sports | 2847 | 10.1 | 614 | 2.2 | 3461 | 12.2 |

[a]Rates are expressed as number per 100,000 participants per year. N/A, not available.

2005-2006 and 2009-2010 and the ABS Table Builder for 2011-2012 and 2013-2014.

To account for the intermittent participation data, values for missing years were predicted from the 4 available years by use of a line of best-fit estimate via linear regression. These inputted values, expressed as a proportion of the state's population, were standardized to yearly age- and sex-specific population data for Victoria, available via the ABS.[5] As a working assumption, we treated the denominator values estimated in this manner as if they were constants and used standard large-scale procedures for estimating the confidence intervals of the rates and rate ratios.

Age was categorized into 10-year groups: 15-24, 25-34, 35-44, 45-54, 55-64, and $\geq$65. We then calculated major trauma and death rates for each age group and by sex by dividing the number of major trauma cases and deaths by the total number of participants in any sport for that age group and sex. We also calculated major trauma and death rates for the 10 sports with the highest frequency of cases over the 10-year period by dividing sport-specific injury cases by sport-specific participation numbers. Annual injury rates were calculated per Australian fiscal year (July 1 to June 30) rather than calendar year, in accordance with the format of VSTR and ABS data. High concordance between crude and age- and sex-adjusted annual incidence rates was observed for the total sample ($\rho = 0.995$ [95% CI, 0.99-1.00; $P < .001$]), and therefore only crude rates are reported. Poisson regression, with a robust variance estimator, was used to determine trends in major trauma and death rates over the 10-year period, for all sports combined and for the 10 sports with the highest frequency of cases (using sport-specific participation values). These trends were represented by incident rate ratios (IRRs), which reflect the average annual change in incident rates between consecutive years, with the accompanying $P$ value testing the null hypothesis of no linear trend against the alternative hypothesis of a linear increase or decrease in the incidence rate. Rates were not calculated for aerosports (including parachuting, hang gliding, and paragliding) because these sports are not included in ABS participation data. Stata version 13 (StataCorp) was used for all analyses. A $P$ value of less than .05 was considered significant.

## RESULTS

From July 2005 to June 2015, there were 2847 nonfatal major trauma cases and 614 deaths (including 96 in-hospital deaths) related to sport and active recreation (Table 1). The participation-adjusted nonfatal major trauma rate was 10.1 per 100,000 participants per year, the death rate was 2.2 per 100,000 participants per year, and the combined rate of major trauma and deaths was 12.2 per 100,000 participants per year. The highest numbers of both nonfatal major trauma cases and deaths were in cycling activities, followed by motor sports and equestrian activities (including horse racing, eventing, and trail riding) (Table 1). The most common specific cause of death attributable to sports and active recreation was drowning (n = 126). The highest participation-adjusted rates of major trauma and death were in motor sports, followed by equestrian activities and power boating (including jet-skiing and water-skiing) (Table 1). Annual numbers and annual participation-adjusted major trauma and death rates for specific sports and overall are provided in Appendix Table A1.

Although 51% of all sports and recreation participants were female, they represented only 16% of all major trauma cases (including deaths) (Appendix Table A2). Male participants had a higher rate of major trauma and death than female participants across all age groups, with male participants aged 15 to 24 years having the highest rate (Appendix Table A2). A high rate of major trauma and death was also found among 45- to 54-year-old male participants.

A total of 6134 body regions were injured (to at least moderate severity) in 2920 major trauma cases (including 92 in-hospital deaths), with a median (interquartile range) of 4 (3-7) body regions injured per case (Appendix Table

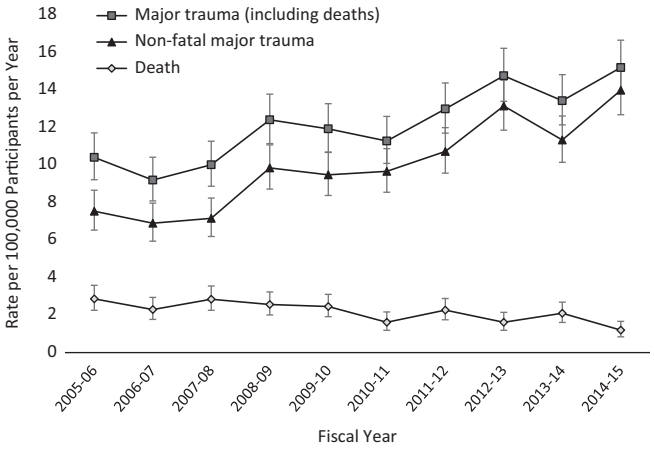


**Figure 1.** Changes in rates of sport and active recreation–related major trauma cases and deaths in Victoria, Australia, July 1, 2005, to June 30, 2015 (inclusive), including 95% CIs.

A3). The thoracic region was most commonly injured, followed by the head and spine. In cycling and motor sports, injuries to the thoracic region were the most prevalent, while in equestrian activities, swimming and diving, power boating, snow and ice sports, and aerosports, spine injuries were the most common. Head injuries were highly prevalent in cycling and power boating.

From 2005-2006 to 2014-2015, a 2.3-fold increase occurred in the annual number of cycling-related major trauma cases and deaths, with the proportion of all major traumas and deaths attributable to cycling rising from 30% to 42% (Appendix Table A1). The annual number of major trauma cases and deaths for motor sports and equestrian activities also increased over this period (Appendix Table A1).

Over the 10-year study period, a 5% average yearly increase was noted in the rate of sport and active recreation–related major trauma, including deaths (IRR = 1.05; 95% CI, 1.03-1.07; $P < .001$), predominantly due to the nonfatal major trauma rate almost doubling over 10 years from 7.55 (95% CI, 6.54-8.67) cases per 100,000 participants per year in 2005-2006 to 14.01 (95% CI, 12.7-15.42) in 2014-2015. An 8% yearly increase was noted in the rate of nonfatal major trauma alone (IRR = 1.08; 95% CI, 1.06-1.10; $P < .001$), while the death rate declined by an average of 7% per year (IRR = 0.93; 95% CI, 0.90-0.97; $P < .001$) (Figure 1).

Equestrian activities (IRR = 1.07; 95% CI, 1.03-1.11; $P = .001$), cycling (IRR = 1.06; 95% CI, 1.04-1.07; $P < .001$), and motor sports (IRR = 1.05; 95% CI, 1.03-1.07; $P < .001$) also showed significant increases in major trauma rates (including deaths) (Table 2). For fishing, there was a significant increase in the rate of death (IRR = 1.10; 95% CI, 1.05-1.16; $P < .001$), although the total number of fishing-related deaths was low and remained fairly constant over time. A significant decline in the major trauma rate (including deaths) was seen for power boating (IRR = 0.87; 95% CI, 0.83-0.90; $P < .001$). As well, a decline was noted in the death rate for cycling of 9% per year (IRR = 0.91; 95% CI, 0.87-0.95; $P < .001$).

## DISCUSSION

Over the 10-year study period in Victoria, Australia, the death rate from sport and active recreation more than halved, while the rate of nonfatal major trauma almost doubled. These changes are largely due to increases in the rates of cycling, motor sports, and equestrian-related trauma. Year-on-year increases seen in other sports were accounted for by increasing participation, but in cycling, motor sports, and equestrian, the increase in trauma cases outstripped changes in participation. Death rates stabilized in motor sports and equestrian activities and declined in cycling activities during the 10-year study period, suggesting that the increase in the overall rate of major trauma may have been driven by growth in the incidence of nonfatal major trauma and improvements in trauma care.

Our figures are higher than those of both Gabbe et al[20] and Andrew et al,[1] who reported rates of major trauma and death in Victoria of 1.8 and 0.6 cases per 100,000 participants per year and 5.2 and 1.1 cases per 100,000 participants per year, respectively. These differences are largely attributable to those investigators' use of the now-defunct Australian Exercise, Recreation and Sport Survey, which, despite using the same method, reported higher participation values than the ABS Household Survey[35]; in addition, the study by Gabbe et al excluded on-road cyclists. While not directly comparable because of differing methods, recent data from the National Center for Catastrophic Sport Injury Research in the United States showed rates of up to 1.24 serious injuries per 100,000 participants in 2014-2015, although participants included high school and university-level athletes only.[25]

The increase in the rate of cycling-related major trauma in our study is consistent with the increase in the population-adjusted hospitalization rate for cycling injuries at a national level.[6] Serious injuries in cyclists are most commonly associated with motor vehicle collisions[7,29]; as traffic and on-road commuter cycling increase in major cities of Australia,[9] so too may the risk of cycling-related injury. Although we may have captured several commuter cyclists in this study (rather than only sporting or recreational cyclists), our decision to include all cyclists, including those injured on roads, was based on research findings that the majority of injured cyclists,[12] and even the majority of cyclists injured on roads,[7] do not cycle solely for transport purposes.

An alternative explanation for the increased rate of cycling trauma is that despite adjustment for participation, our current participation data have deficiencies. For example, because ABS sports participation data are derived from a survey about any level of participation over the previous 12 months, the data do not account for the frequency of that participation. Consequently, for a sport such as cycling, which is commonly performed with high frequency (eg, in cycling commuters), the exposure-adjusted risk may be exaggerated.[7,12,32] The need for improved sources of cycling

TABLE 2
Incidence Rate Ratios and *P* Values for Sport and Active Recreation–Related Major Trauma Cases and Deaths in Victoria, Australia, July 1, 2005, to June 30, 2015 (Inclusive)[a]

| | Nonfatal Major Trauma Cases | | Deaths | | Major Trauma Cases and Deaths | |
|---|---|---|---|---|---|---|
| Sport | IRR (95% CI) | *P* Value | IRR (95% CI) | *P* Value | IRR (95% CI) | *P* Value |
| Cycling | 1.07 (1.05-1.09) | <.001[b] | 0.91 (0.87-0.95) | <.001[b] | 1.06 (1.04-1.07) | <.001[b] |
| Motor sports | 1.06 (1.03-1.08) | <.001[b] | 0.93 (0.80-1.09) | .37 | 1.05 (1.03-1.07) | <.001[b] |
| Equestrian activities | 1.07 (1.03-1.12) | <.001[b] | 0.90 (0.74-1.11) | .33 | 1.07 (1.03-1.11) | .001[b] |
| Australian football | 1.03 (1.00-1.06) | .06 | 0.88 (0.71-1.10) | .26 | 1.02 (0.99-1.05) | .15 |
| Swimming/diving | 0.97 (0.93-1.02) | .21 | 0.97 (0.88-1.06) | .44 | 0.97 (0.91-1.03) | .29 |
| Power boating | 0.87 (0.84-0.91) | <.001[b] | 0.74 (0.60-0.92) | .007[b] | 0.87 (0.83-0.90) | <.001[b] |
| Snow sports | 1.10 (0.99-1.22) | .07 | 1.18 (0.93-1.50) | .17 | 1.11 (1.00-1.22) | .05 |
| Fishing | 1.05 (0.82-1.34) | .68 | 1.10 (1.05-1.16) | <.001[b] | 1.10 (1.05-1.15) | <.001[b] |
| Other[c] | 1.11 (1.10-1.13) | <.001[b] | 0.91 (0.85-0.98) | .009[b] | 1.01 (0.99-1.03) | .30 |
| All sports[c] | 1.08 (1.06-1.10) | <.001[b] | 0.93 (0.90-0.97) | <.001[b] | 1.05 (1.03-1.07) | <.001[b] |

[a]Incident rate ratios (IRRs) reflect the average annual change in incident rates between consecutive years, and *P* values test the null hypothesis of no linear trend against the alternative hypothesis of a linear increase or decrease in the incidence rate.
[b]$P < .05$.
[c]Aerosports not included.

participation data, for example those that account for the number and distance of cycling trips, has been previously recognized.[7,29] Nonetheless, given the substantial increases in the number of cycling-related major trauma cases, preventive strategies such as separate cycling lanes, lower speed limits, alcohol limits, and improved cyclist visibility are still warranted.[7,24,27] Also, while helmet use was mandatory in Victoria during the entire study period, enforcement of helmet use is encouraged.[30]

Across all sports, the highest rate of major trauma and the highest annual rate of growth were in motor sports. A recent Victorian report on motorcycle injuries in children also reported high rates of motorcycle-related hospital admissions and emergency department (ED) presentations relative to other sports and recreational activities; a preponderance of these admissions and presentations were caused by noncollision events, involving racing and jumps.[13] Providing evidence of the severity of motor sports injuries, a recent study in a United States ED setting reported ATV (eg, quad bike) riding to be accountable for the most hospital admissions out of all sports injury presentations (46%).[31] High numbers of traumatic brain injuries resulting from ATV riding have also been reported among ED presentations for traumatic brain injury.[11] Proposed risk factors for serious injury in motor sports include high speeds, inexperience, alcohol use, lack of protective equipment and helmets, and overcrowding in popular riding areas.[10] Evidence indicates increased motor sports participation in Australia[3,17]; thus, efforts to improve safety, such as wearing protective clothing and helmets, enforcing laws around alcohol use and minimum age limits for riders, and discouraging risky behavior while riding, are strongly recommended.[10,13]

As in previous studies, equestrian activities were associated with high rates of major trauma and high annual rates of growth.[1,20] In United States ED settings, horseback riding was associated with one of the highest hospitalization rates of any sport.[31] Evidence indicates a high risk of spinal cord injury and traumatic brain injury hospitalizations for equestrian activities compared with other sports.[11] To address these recognized risks, safety promotion strategies have been developed recently in Australia, including a guide for understanding behavioral and environmental dangers associated with horse interactions.[34]

In adults 55 years and older, fishing was the most common cause of drowning, itself the most common cause of death. Although deaths due to fishing were fewer than those associated with swimming and remained fairly constant over time, further investigation is warranted to understand risks associated with fishing and water sports in general. Public health messaging to wear life jackets and avoid alcohol consumption around water has been heightened recently owing to high numbers of drowning deaths across Australia.[33] Although drowning was the single most common cause of death, most deaths are multifactorial in nature, leading to difficulty making specific causal attributions.

Over time, the rate of death attributable to sports and recreation overall has significantly decreased. This finding is not unique to sports and recreational injuries; numerous studies have reported declining death rates both locally and internationally for trauma of any cause.[22,26] While improvements such as new safety equipment, changes to sports rules, and public awareness campaigns may have reduced the severity of injuries, a reduction in the rate of death is also a well-recognized outcome of improvements in trauma care and the introduction of regionalized or inclusive trauma systems. Such systems have integrated care across prehospital and acute care settings, ensuring that the right patient is transported to the right center in the shortest possible time. Victoria has had a statewide, inclusive trauma system in place since 2000, which likely contributed to the declining death rates observed in this study.[22]

Certain study limitations hamper the generalizability of findings. First, sports participation trends vary across different parts of the world. Therefore, these Victorian data may not be generalizable to other states or other countries, particularly in relation to football codes. However, similarities with literature from other jurisdictions nationally and internationally support the validity of many of our results. Second, limitations in participation data, including the inability to account for frequency of participation as well as potential sampling errors and the need to estimate for missing years of participation data, may have influenced the accuracy of our participation-adjusted rates. The participation threshold of "at least once per year" would have captured more participants than a threshold requiring more frequent participation (eg, weekly). Using a higher participation threshold would have resulted in lower numbers of participants and higher injury rates. At present, these are the best available population-level sports and recreational participation data for the time period covered by this study. Efforts to improve participation data in certain sports are currently underway in Victoria and will improve our future understanding of sport and recreation–related risks.[8,18] The database did not contain information about age-specific participation for individual sports at a state-level or on-road versus off-road participation. Therefore, we were unable to analyze injury rates based on these variables.

## CONCLUSION

While the rate of death related to sport and active recreation declined in Victoria, Australia, during the 10-year study period, the rate of nonfatal major trauma increased, thus strategies to understand and reduce associated risks are needed. Specifically, male participants aged 18 to 24 should be the subject of safety strategies. As well, given the rapidly increasing numbers and rates of traumatic injuries related to cycling, motor sports, and equestrian activities, research aiming to understand injury mechanisms is essential. Such research is likely to have the most impact if carried out in collaboration with clinicians, sports bodies, and policy makers. Sports injuries are a major drawback of recreational activity and sport participation; efforts to increase overall physical activity levels must be accompanied by investment in making participation safer.

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## APPENDIX

TABLE A1
Frequency and Rate of Sport and Active Recreation–Related Major Trauma Cases and Deaths in Victoria, Australia, July 1, 2005, to June 30, 2015, by Sporting Group and Overall[a]

| | | Fiscal Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sport | | 2005-2006 | 2006-2007 | 2007-2008 | 2008-2009 | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 |
| Cycling | n | 82 | 82 | 83 | 111 | 133 | 131 | 149 | 165 | 152 | 192 |
| | Rate | 30.28 | 28.83 | 27.85 | 35.23 | 40.29 | 38.72 | 42.25 | 44.82 | 39.56 | 48.00 |
| Motor sports | n | 48 | 43 | 56 | 59 | 54 | 49 | 62 | 90 | 78 | 81 |
| | Rate | 189.11 | 165.26 | 210.36 | 214.47 | 191.57 | 173.28 | 214.78 | 304.79 | 258.13 | 262.48 |
| Equestrian activities | n | 35 | 26 | 31 | 38 | 31 | 38 | 39 | 50 | 38 | 59 |
| | Rate | 95.71 | 70.91 | 84.51 | 102.55 | 83.55 | 104.51 | 107.60 | 138.14 | 105.14 | 163.87 |
| Australian football | n | 19 | 20 | 14 | 25 | 22 | 18 | 23 | 18 | 20 | 24 |
| | Rate | 14.88 | 15.63 | 10.95 | 19.36 | 17.03 | 14.23 | 18.26 | 14.32 | 15.95 | 19.23 |
| Swimming/ diving | n | 21 | 8 | 16 | 21 | 17 | 12 | 16 | 14 | 15 | 11 |
| | Rate | 6.65 | 2.51 | 4.99 | 6.45 | 5.18 | 3.71 | 4.93 | 4.29 | 4.58 | 3.35 |
| Power boating | n | 6 | 9 | 10 | 11 | 12 | 7 | 7 | 9 | 11 | 12 |
| | Rate | 105.92 | 111.19 | 94.33 | 82.52 | 74.66 | 37.79 | 32.81 | 37.05 | 40.21 | 39.39 |
| Snow/ice sports | n | 6 | 4 | 7 | 14 | 2 | 10 | 10 | 15 | 2 | 11 |
| | Rate | 12.15 | 8.36 | 15.15 | 31.18 | 4.64 | 24.76 | 26.10 | 41.38 | 5.86 | 34.58 |
| Aerosports | n | 5 | 4 | 6 | 2 | 9 | 4 | 5 | 9 | 11 | 8 |
| | Rate | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Fishing | n | 4 | 5 | 4 | 2 | 8 | 4 | 5 | 7 | 6 | 5 |
| | Rate | 7.51 | 9.69 | 8.04 | 4.14 | 17.29 | 9.25 | 12.21 | 18.12 | 16.56 | 14.86 |
| Other | n | 31 | 33 | 35 | 52 | 44 | 35 | 42 | 43 | 44 | 37 |
| | Rate | 1.76 | 1.84 | 1.93 | 2.79 | 2.33 | 1.86 | 2.21 | 2.23 | 2.25 | 1.86 |
| All sports | n | 276 | 248 | 274 | 348 | 340 | 320 | 373 | 430 | 397 | 455 |
| | Rate | 10.42 | 9.21 | 10.03 | 12.43 | 11.95 | 11.30 | 13.01 | 14.78 | 13.45 | 15.22 |

[a]Rates are expressed as number per 100,000 participants per year. N/A, not available.

TABLE A2
Rates of Sport and Active Recreation–Related Major Trauma Cases and Deaths in Victoria, Australia, by Age Group and Sex, July 1, 2005, to June 30, 2015 (Inclusive)

| | Male | | Female | | |
|---|---|---|---|---|---|
| Age Group, y | Major Trauma Cases and Deaths, n (%) | Rate[a] | Major Trauma Cases and Deaths, n (%) | Rate[a] | Total Rate[a] |
| 15-24 | 713 (87) | 24.7 | 106 (13) | 4.1 | 15.0 |
| 25-34 | 462 (83) | 16.7 | 95 (17) | 3.4 | 10.0 |
| 35-44 | 534 (83) | 21.0 | 109 (17) | 4.0 | 12.2 |
| 45-54 | 530 (82) | 24.1 | 120 (19) | 4.9 | 14.0 |
| 55-64 | 365 (84) | 19.5 | 70 (16) | 3.7 | 11.5 |
| ≥65 | 315 (88) | 19.1 | 42 (12) | 2.2 | 10.0 |
| Total | 2919 (84) | 21.0 | 542 (16) | 3.8 | 12.2 |

[a]Rates are expressed as number per 100,000 participants per year.

TABLE A3
Body Regions Injured, by Sporting Group and Percentage of Hospitalized Major Trauma Patients (Including In-Hospital Deaths) That Sustained an Injury to That Body Region in Victoria, Australia, July 1, 2005, to June 30, 2015 (Inclusive)[a]

| Sport | Head | Face | Neck | Thorax | Abdomen and Pelvic Contents | Spine | Upper Limb | Lower Limb | Other |
|---|---|---|---|---|---|---|---|---|---|
| Cycling (n = 2766) | 564 (20.4) | 255 (9.2) | 19 (0.7) | 590 (21.3) | 132 (4.8) | 439 (15.9) | 515 (18.6) | 248 (9.0) | 4 (0.1) |
| Motor sports (n = 1452) | 201 (13.8) | 53 (3.7) | 14 (1.0) | 362 (24.9) | 133 (9.2) | 254 (17.5) | 286 (19.7) | 147 (10.1) | 2 (0.1) |
| Equestrian activities (n = 745) | 126 (16.9) | 39 (5.2) | 2 (0.3) | 166 (22.3) | 62 (8.3) | 171 (23.0) | 83 (11.1) | 96 (12.9) | 0 |
| Australian football (n = 217) | 34 (15.7) | 7 (3.2) | 7 (3.2) | 23 (10.6) | 105 (48.4) | 31 (14.3) | 5 (2.3) | 5 (2.3) | 0 |
| Swimming/diving (n = 87) | 6 (6.9) | 2 (2.3) | 3 (3.4) | 8 (9.2) | 3 (3.4) | 49 (56.3) | 2 (2.3) | 3 (3.4) | 11 (12.6) |
| Power boating (n = 168) | 35 (20.8) | 11 (6.5) | 5 (3.0) | 26 (15.5) | 9 (5.4) | 43 (25.6) | 16 (9.5) | 18 (10.7) | 5 (3.0) |
| Snow/ice sports (n = 133) | 21 (15.8) | 6 (4.5) | 1 (0.8) | 21 (15.8) | 21 (15.8) | 35 (26.3) | 10 (7.5) | 18 (13.5) | 0 |
| Aerosports (n = 108) | 6 (5.6) | 6 (5.6) | 1 (0.9) | 19 (17.6) | 4 (3.7) | 32 (29.6) | 12 (11.1) | 28 (25.9) | 0 |
| Fishing (n = 5) | 2 (40.0) | 0 | 0 | 1 (20.0) | 0 | 0 | 0 | 0 | 2 (40.0) |
| Other (n = 453) | 150 (33.1) | 30 (6.6) | 5 (1.1) | 49 (10.8) | 47 (10.4) | 94 (20.8) | 40 (8.8) | 35 (7.7) | 3 (0.7) |
| All sports (N = 6134) | 1145 (18.7) | 409 (6.7) | 57 (0.9) | 1265 (20.6) | 516 (8.4) | 1148 (18.7) | 969 (15.8) | 598 (9.7) | 27 (0.4) |

[a]Values are expressed as n (%).