



**Australian Government**

**Australian Institute of  
Health and Welfare**

# **Serious injury due to transport accidents involving a railway train, Australia 2004–05 to 2008–09**



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UNIVERSITY

INJURY RESEARCH AND STATISTICS SERIES NUMBER 68



**Australian Government**

**Australian Institute of  
Health and Welfare**

*Authoritative information and statistics  
to promote better health and wellbeing*

INJURY RESEARCH AND STATISTICS SERIES

Number 68

# **Serious injury due to transport accidents involving a railway train, Australia**

**2004–05 to 2008–09**

Australian Institute of Health and Welfare  
Canberra

Cat. no. INJCAT 144

**The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is authoritative information and statistics to promote better health and wellbeing.**

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# Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ARA	Australian Railway Association
ATC	Australian Transport Council
ATSB	Australian Transport Safety Bureau
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CI	confidence interval
ICD	International Classification of Diseases
ICD-10-AM	International statistical classification of diseases and related health problems, 10th revision, Australian modification
NHMD	National Hospital Morbidity Database

# Symbols

n.p.	not published (data cannot be released due to quality issues, confidentiality, or permission not granted)
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# Summary

This report presents information on cases of serious injury resulting in hospitalisation due to transport accidents involving a train for the five year period 2004–05 to 2008–09.

## Serious injury due to transport accidents involving a railway train

Over the 5-year period, 868 persons were seriously injured in Australia due to transport accidents involving a train, an average of 174 per year.

Victoria (37.6%), New South Wales (30.0%) and Queensland (20.2%) accounted for almost 88% of these cases.

Age-standardised rates of serious injury due to transport accidents involving a train declined by an annual average of 5.1% over the 9-year period from 2000–01 to 2008–09.

Based on rail user data, approximately one rail user was seriously injured per 100 million passenger kilometres travelled in 2008–09.

Over the 5-year period, age-specific serious injury rates tended to be higher for those aged 70 years and over, for both sexes.

Rail users made up two-thirds (66.5%) of all serious injury cases due to transport accidents involving a train, with the most common circumstance of injury being injury while boarding or alighting from a train (27.3% of all serious injury cases) over the 5-year period of interest. Pedestrians injured in a collision with a train (15.1%) and car occupants injured in a collision with a train (12.1% of all serious injury cases) accounted for most of the non-rail user cases.

The mean length of stay in hospital for a transport accident involving a train was 7.0 days, which was markedly longer than the mean length of stay for all community injury hospitalisations (4.0 days).

## Serious injury due to level crossing accidents

Over the 5-year period, 248 persons were seriously injured in Australia due to a level crossing accident, an average of 50 per year.

Victoria accounted for just over half (50.4%) of level crossing-related serious injury cases, followed by Queensland (24.2%), South Australia (10.1%) and New South Wales (9.7%).

Age-standardised rates of serious injury due to level crossing accidents declined by an annual average of 7.5% over the 9-year period from 2000–01 to 2008–09.

Over the 5-year period, serious injury rates, on an age-specific basis, were highest among young adults (20–24 years).

The most common circumstances of injury involved car occupants injured in a collision with a train (40.3%) and pedestrians injured in a collision with a train (31.5%).

The mean length of stay in hospital for a level crossing accident was 9.2 days, which was more than double the mean length of stay for all community injury hospitalisations (4.0 days).

# 1 Introduction

The primary purpose of this publication is to provide a national overview of serious non-fatal injury in Australia due to transport accidents involving a railway train in the period 2004–05 to 2008–09, including level crossing accidents. Trends in non-fatal injury rates are examined over a 9-year period, 2000–01 to 2008–09. This report includes all injuries that were serious enough to require hospitalisation but did not result in death.

The definition of transport injury used in this report includes only unintentional injuries. Hence, cases given an external cause of intentional self-harm, assault or undetermined intent are excluded (see Table A2 in the Data issues section for further information on how many of such cases may be rail-related). Readers should consult the Data issues section for notes on the methodology employed and for the meaning of technical terms used in this report such as ‘separations’.

This is the fourth report on the topic of serious non-fatal injury in Australia due to transport accidents involving a railway train, using a rolling 5-year observational period. It has a similar scope to the previous reports (Berry & Harrison 2008; Flood et al. 2007; Henley & Harrison 2009a). The literature review of the earliest of these reports (Flood et al. 2007) considers in detail the characteristics of major railway disasters, level crossing accidents, suicide and attempted suicides, railway trespassers and boarding and alighting injuries. Thus, these issues are either not examined here or only mentioned briefly.

Confidence intervals around single estimates are provided in some tables to show non-sampling variation. Confidence intervals are also provided for estimated trends in rates, which are also subject to non-sampling variation. In both instances, variation can be large when case numbers are small. Further information is provided in Data issues.

## Railway accidents

In 2008–09, state rail authorities recorded 136 derailments, 22 train-train collisions, 2 train-rolling stock collisions, 50 train-person collisions (not at level crossings), 131 train-infrastructure collisions and 6 train-road vehicle collisions (not at level crossings) (ATSB 2011).

Between 2001–02 and 2008–09 there were 327 Australian rail fatalities, of which 136 (42%) occurred in New South Wales and 119 (36%) occurred in Victoria (ATSB 2011).

## Level crossing accidents

Between 2000 and 2009 there were 695 collisions between road vehicles and trains at level crossings resulting in 97 fatalities (ITSR 2011). Just less than half (45%) of these collisions occurred at passive level crossings (For a definition of different types of level crossings, refer to the Data issues section). Over 8,000 rail level crossings in Australia have passive protection measures or less. Between 2008–09 and 2009–10, the Australian Government provided funding for the installation of boom gates and other safety measures at 300 high risk rail level crossing sites across Australia (DIT 2011).



## 2 Serious injury due to transport accidents involving a railway train

### Number and rate of serious injury

From 2000–01 to 2008–09, 1,659 persons were seriously injured in Australia due to transport accidents involving a train (Table 4.1.1). For the period of interest for this report, 2004–05 to 2008–09, 868 persons were seriously injured, an average of 174 per year. (In total, there were 952 admissions to hospital for rail-related injuries for an estimated 891 persons, of whom 23 died whilst in hospital. These deaths are included in estimates of fatal rail-related injury provided elsewhere by organisations such as the Australian Transport Safety Bureau and are omitted from the seriously injured counts in Table 4.1.1 and throughout the report.) This includes persons seriously injured due to level crossing accidents.

Victoria (37.6%,  $n = 326$ ), New South Wales (30%,  $n = 260$ ) and Queensland (20.2%,  $n = 175$ ) accounted for almost 88% of seriously injured cases due to a transport accident involving a train. For the period from 2004–05 to 2008–09, New South Wales accounted for 38% of passenger train kilometres, Victoria 30% and Queensland 13% (ATSB 2011). Case counts and trends over nine years in the rates of serious injury due to transport accidents involving a train are shown in Table 4.1.2 and Figure 4.1.1. Trends must be interpreted with caution as there is potential for variation over time in admission practice, especially for lower severity cases.

Age-standardised rates of serious injury due to transport accidents involving a train declined by an annual average of 5.1% [95%CI: 3.3%, 6.9%] over the 9-year period from 2000–01 to 2008–09. For males, rates declined by an annual average of 7.0% [95%CI: 4.7%–9.2%] over the 9-year period, with most of this decline occurring between 2000–01 and 2002–03. For females, rates increased between 2000–01 and 2002–03 before declining at an annual average of 5.8% [95%CI: 1.8%, 9.6%] between 2002–03 and 2008–09.

Table 4.1.3 presents the number of serious injury cases per 100 million passenger kilometres travelled over the five years for which data on this exposure measure are available (ARA 2011). In 2008–09, 0.83 persons were seriously injured in a transport accident involving train per 100 million passenger kilometres travelled. A comparison of risk for other major forms of land transport is provided in another report in the series (Henley & Harrison 2009b). In 2006–07 (the latest year for which estimates of kilometres travelled in different types of motor vehicles are available), 10.3 car occupants were seriously injured per 100 million kilometres travelled. It would be preferable that a comparison of serious injury rates for the major forms of land transport be made on a passenger-kilometre basis, but the relevant data are only available for rail transport. Nevertheless, based on 2006–07 data, the risk of serious injury, based on passenger kilometres travelled, assuming a car occupancy rate of somewhere between one and two occupants on average, is at least 5 to 6 times as great for passengers travelling by car compared with passengers travelling by rail.

For the period from 2004–05 to 2008–09, the total number of serious injury cases by age group peaked at 20–24 years with 89 cases (Figure 4.1.2). For males, the peak was also in the 20–24 year age group with 59 serious injury cases and for females, the peak was in the 75–79 year age group with 45 serious injury cases. Age-specific serious injury rates for males were highest in the 85 years and over age group and for females were highest in the 80–84 year age group (Figure 4.1.3).

## **Circumstances of injury**

Nationally, for the period 2004–05 to 2008–09, rail users made up two-thirds (66.5%) of the serious injury cases due to transport accidents involving a train (Table 4.1.4). The most common circumstances of injury for all persons involved in rail transport accidents (rail users, pedestrians and occupants of other vehicles) were:

- a person injured while boarding or alighting from a train (27.3%)
- a pedestrian injured in a collision with a train (15.1%)
- an occupant of a train injured by a fall in a train (12.7%)
- a car occupant injured in a collision with a train (12.1%).

More than half (51.9%) of all serious injuries sustained due to a collision between a pedestrian and a train occurred in Victoria. For New South Wales, just over 86% of those seriously injured due to a transport accident involving a train were rail users.

Males accounted for 56.7% of persons seriously injured due to transport accidents involving a train (Table 4.1.5).

The most prominent circumstances of serious injury due to a transport accident involving a train vary with age (Table 4.1.6). Ninety-two per cent of those aged 65 years and over who were seriously injured were rail users, compared to only around half of those aged 15–44 years. Those aged 65 years and over also accounted for over half (53.2%) of those seriously injured while boarding and alighting from a train and over 60% of those seriously injured due to a fall in a train.

Table 4.1.7 shows the five most frequent circumstances of injury by age group and sex.

## **Length of hospital stay**

From 2004–05 to 2008–09, there were 6,091 patient days in hospital due to a transport accident involving a train, at an average of 1,218 patient days per year. Serious injury due to a transport accident involving a train accounted for less than 0.1% of all injury-related patient days in hospital for the same period (9,961,082) and 0.52% of all transport-related patient days (1,171,242).

Mean length of stay can be used as a crude indicator of severity of injury. The mean length of stay for persons seriously injured due to transport accidents involving a train was 8.0 days for males, 5.7 days for females and 7.0 days for persons. These are longer than the mean length of stay of 3.4 days for males, 5.0 days for females and 4.0 days for all community injury cases where separation occurred in 2005–06 (Kreisfeld & Harrison 2010).

# 3 Serious injury due to level crossing accidents

## Scope

The intersection between a public or private roadway or footpath and a railway track at the same level ('at-grade intersection') in Australia is commonly called a level crossing. This section focuses on serious non-fatal unintentional injury cases due to a collision between a train and a pedestrian or road vehicle where a public roadway, with or without an adjoining footpath, crosses one or more railway tracks at grade. Such cases form a subset (28.6%) of the cases examined in the earlier part of this report dealing with all rail transport accidents, as only cases with a first reported external cause code which specifies a traffic accident have been included. For a full definition of 'level crossing' and a list of the codes included, see the 'Data issues' section.

## Number and rate of serious injury

From 2000–01 to 2008–09, 465 persons were seriously injured in Australia due to transport accidents involving a railway train at a level crossing (Table 4.2.1). For the period of interest for this report from 2004–05 to 2008–09, 248 persons were seriously injured, an average of 50 per year. There was a relatively even spread of serious injury cases over the twelve-month periods. Over the period of interest, Victoria accounted for just over half (50.4%) of level crossing serious injury cases with 125, followed by Queensland (24.2%,  $n = 60$ ), South Australia (10.1,  $n = 25$ ) and New South Wales (9.7%,  $n = 24$ ).

Over the period from 2000–01 to 2008–09, more than one-third of rail-related serious injury cases for Victoria (37.5%) and Queensland (37%) involved accidents at a level crossing compared to 10% for New South Wales.

The proportion of included cases that were specified as occurring in traffic differed by jurisdiction and, notably, was lowest for New South Wales. Cases that were not specified as either traffic or non-traffic might include some cases in which a person was seriously injured in a level crossing traffic accident. So the counts and proportions of those occurring in traffic may be underestimates.

Case counts and trends over nine years in the rates of serious injury due to a transport accident involving a collision with a train at a level crossing are shown in Table 4.2.2 and Figure 4.2.1. Results must be interpreted with caution as there is potential for variation over time in admission practice, especially for lower severity cases.

Age-standardised rates of serious injury due to transport accidents involving a train at a level crossing declined by an annual average of 3.7% [95%CI: 0.2%, 7.0%] over the 9-year period from 2000–01 to 2008–09. For males, rates declined by an annual average of 7.5% [95%CI: 3.3%–11.5%] over the 9-year period, while for females there was no significant change in rates over the period of interest.

The number of persons seriously injured in a level crossing accident was low in children and at ages 65 years and older, and highest at ages 20–24 years, with 41 cases (Figure 4.2.2).

Age-specific serious injury rates due to level crossing accidents were highest in the 20–24 year age group with 0.55 cases per 100,000 population (Figure 4.2.3). Similar patterns were observed for both males and females.

### **Circumstances of injury**

From 2004–05 to 2008–09, 40.3% ( $n = 100$ ) of persons seriously injured due to level crossing accidents were car occupants injured in collision with train and 31.5% ( $n = 78$ ) were pedestrians injured in collision with train (Table 4.2.3). Of car occupants, 41% were injured in Victoria and 30% in Queensland, while for pedestrians, 60.3% were injured in Victoria.

Over the 5-year period, 58.9% ( $n = 146$ ) of persons seriously injured due to level crossing accidents were male (Table 4.2.4). Males predominated in most circumstances except for car occupants (similar numbers) and train occupants.

The majority (86.7%) of persons seriously injured due to a level crossing accident were of 'working age' (aged 15–64 years) (Table 4.2.5). Unlike all rail-related injuries where those aged 65 years and over comprised almost one-third of persons injured, people in this age group accounted for 9.3% of those seriously injured due to a level crossing accident.

### **Length of hospital stay**

In the period 2004–05 to 2008–09, there were 2,282 patient days in hospital due to a transport accident involving a collision with a train at a level crossing, at an average of 456 patient days per year.

The mean length of stay for persons seriously injured in a level crossing accident was 12.2 days for males, 4.9 days for females and 9.2 days for persons. This was longer than the mean length of stay for all transport accidents involving a train (8.0, 5.7 and 7.0 days for males, females and persons respectively), and much longer than that reported for community injuries overall, 2005–06, where the mean length of stay was 3.4, 5.0 and 4.0 days for males, females and persons respectively (Kreisfeld & Harrison 2010).

## 4 Tables and charts

### 4.1 Serious injury due to accidents involving a railway train

#### Number and rate of serious injury

Table 4.1.1: Persons seriously injured due to transport accidents involving a railway train, Australia 2000–01 to 2008–09, by state or territory of hospitalisation

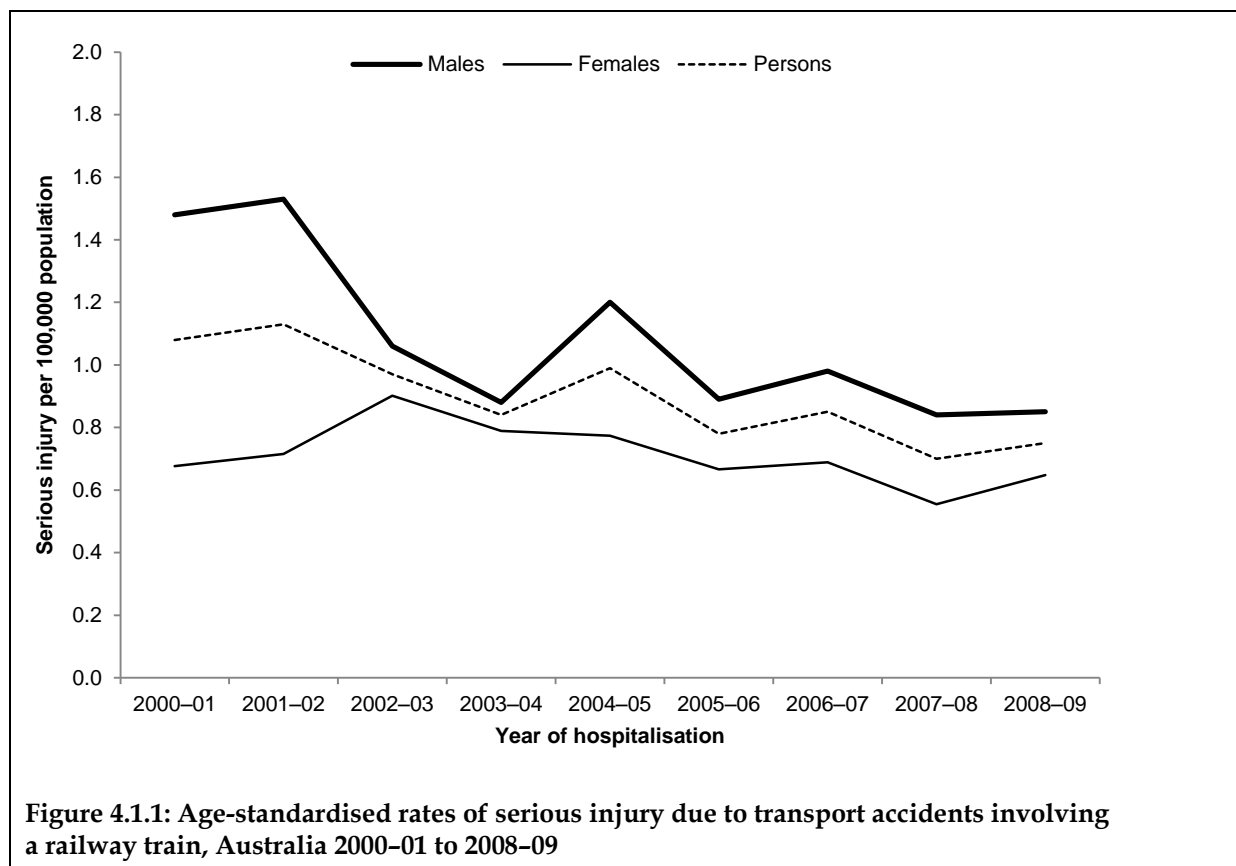
Year	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2000–01	78	77	37	8	n.p.	n.p.	0	0	208
2001–02	88	79	25	14	12	n.p.	0	n.p.	220
2002–03	85	69	19	n.p.	17	0	n.p.	0	193
2003–04	59	75	25	n.p.	n.p.	n.p.	n.p.	n.p.	170
2004–05	61	53	67	n.p.	15	n.p.	n.p.	n.p.	202
2005–06	53	65	24	n.p.	14	n.p.	n.p.	0	164
2006–07	54	76	24	8	14	n.p.	n.p.	n.p.	181
2007–08	37	64	30	n.p.	10	n.p.	0	n.p.	151
2008–09	55	68	30	7	7	0	n.p.	n.p.	170
<b>Total</b>	<b>570</b>	<b>626</b>	<b>281</b>	<b>54</b>	<b>98</b>	<b>14</b>	<b>6</b>	<b>10</b>	<b>1,659</b>

Note: For counts by calendar year refer to the 'Data issues' section.

**Table 4.1.2: Age-standardised rates per 100,000 population and case numbers of serious injury due to transport accidents involving a railway train, Australia 2000–01 to 2008–09**

Seriously injured	Age-standardised rate per 100,000 population (95% CI <sup>(a)</sup> )								
	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09
Males	1.48 (1.24–1.73)	1.53 (1.28–1.77)	1.06 (0.85–1.27)	0.88 (0.69–1.06)	1.2 (0.99–1.42)	0.89 (0.7–1.07)	0.98 (0.79–1.18)	0.84 (0.66–1.01)	0.85 (0.68–1.03)
Females	0.68 (0.52–0.84)	0.72 (0.55–0.88)	0.9 (0.72–1.09)	0.79 (0.62–0.96)	0.77 (0.61–0.94)	0.67 (0.51–0.82)	0.69 (0.53–0.84)	0.55 (0.42–0.69)	0.65 (0.5–0.79)
Persons	1.08 (0.93–1.23)	1.13 (0.98–1.27)	0.97 (0.84–1.11)	0.84 (0.71–0.97)	0.99 (0.85–1.12)	0.78 (0.66–0.9)	0.85 (0.72–0.97)	0.7 (0.59–0.81)	0.75 (0.64–0.86)
Seriously injured	Case numbers								
	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09
Males	140	148	101	87	118	90	102	89	92
Females	68	72	92	83	84	74	79	62	78
Persons	208	220	193	170	202	164	181	151	170

(a) Confidence intervals are provided to show by about how much rates might be expected to vary (between years, for example) in view of the number of cases. See Data issues for further information.



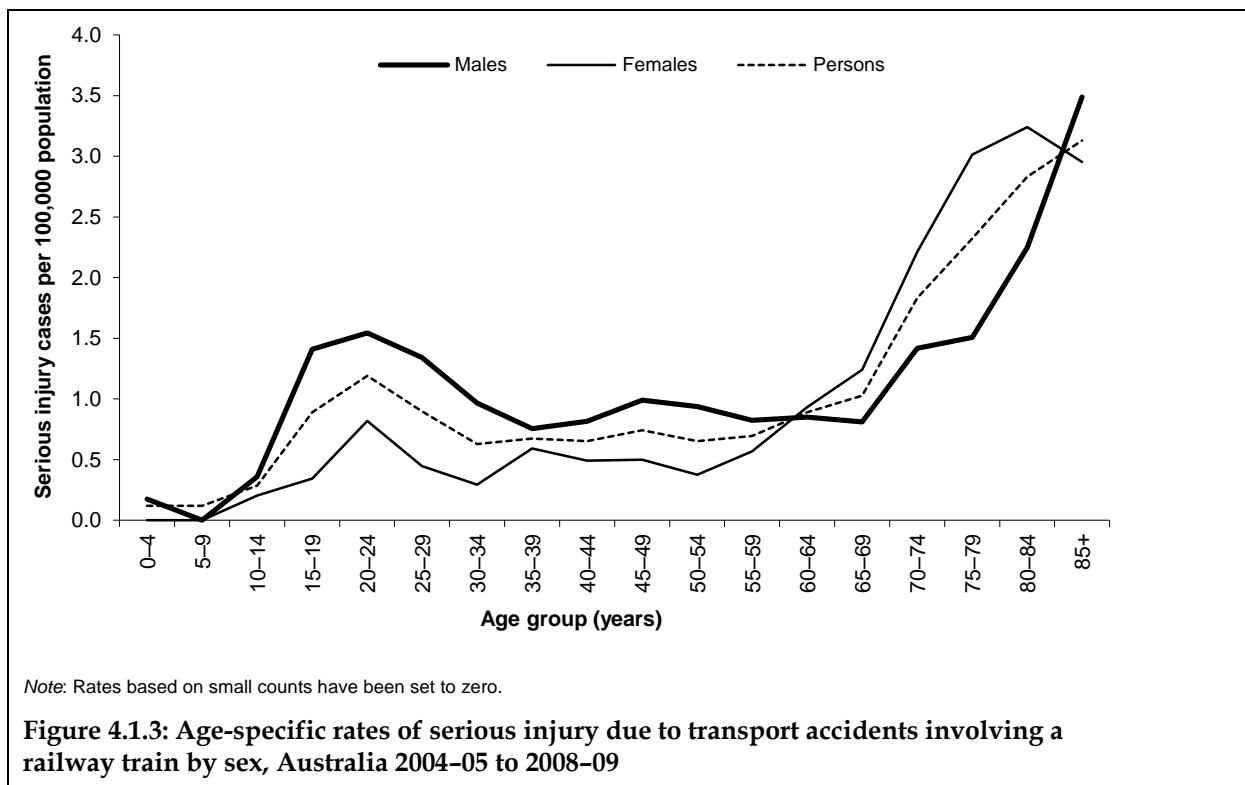
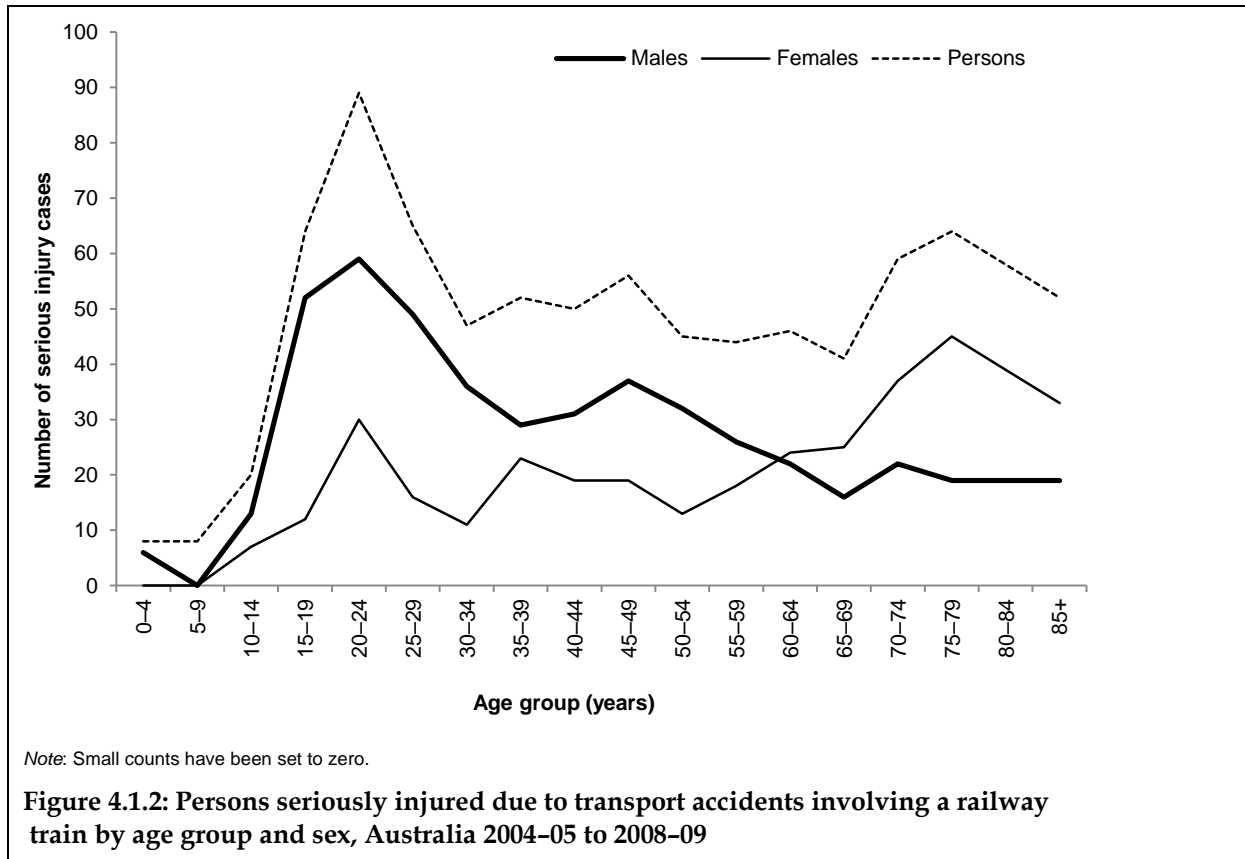
**Table 4.1.3: Serious injury rate per 100 million passenger kilometres travelled for transport accidents involving a railway train; Australia 2004-05 to 2008-09**

Seriously injured	Case numbers for rail users <sup>(a)</sup>	Passenger kilometres <sup>(a)</sup> (billion) <sup>(b)</sup>	Injury rate per 100 million passenger kilometres travelled (95% CI <sup>(c)</sup> )
2004-05	132	10.88	1.21 (1.02-1.44)
2005-06	116	11.36	1.02 (0.85-1.23)
2006-07	116	12.31	0.94 (0.79-1.13)
2007-08	97	13.27	0.73 (0.60-0.89)
2008-09	116	13.95	0.83 (0.69-1.00)

(a) 'Rail users' encompasses any occupant of a train, including a passenger, a railway employee, a person on or outside of a train or a person boarding or alighting from a train.

(b) Sourced from the Australasian Railway Association Industry Report 2010 (ARA 2011).

(c) Confidence intervals are provided to show by about how much rates might be expected to vary (between years, for example) in view of the number of cases. See Data issues for further information.





## Circumstances of injury

**Table 4.1.4: Persons seriously injured due to transport accidents involving a railway train, Australia 2004–05 to 2008–09, circumstances of injury by state or territory of hospitalisation**

Circumstance of injury	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
Pedestrian injured in collision with train	25	68	18	7	10	n.p.	0	n.p.	131
Pedal cyclist injured in collision with train	0	11	n.p.	0	0	0	n.p.	0	15
Motorcyclist injured in collision with train	n.p.	n.p.	n.p.	0	n.p.	0	0	0	14
Car occupant injured in collision with train	n.p.	42	32	n.p.	16	n.p.	n.p.	n.p.	105
Occupant of other motor vehicle injured in collision with train <sup>(a)</sup>	n.p.	8	10	0	n.p.	0	0	n.p.	26
Animal-rider or occupant of an animal-drawn vehicle injured in collision with train	0	0	0	0	0	0	0	0	0
Occupant of train <sup>(b)</sup> injured:									
in collision with motor vehicle	n.p.	13	7	0	0	0	0	n.p.	23
in collision with or hit by rolling stock	n.p.	0	n.p.	0	0	0	0	0	n.p.
in collision with other object	n.p.	n.p.	n.p.	0	0	0	0	n.p.	n.p.
while boarding or alighting from train	107	83	23	10	12	0	n.p.	n.p.	237
by fall in train	49	47	6	n.p.	n.p.	n.p.	0	n.p.	110
by fall from train	33	29	14	n.p.	6	n.p.	0	0	86
in derailment without antecedent collision	n.p.	6	35	0	n.p.	0	0	0	45
in unknown transport accident	29	11	16	n.p.	n.p.	n.p.	0	0	64
Person (mode of transport unknown) injured in collision between train and car	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>260</b>	<b>326</b>	<b>175</b>	<b>26</b>	<b>60</b>	<b>8</b>	<b>n.p.</b>	<b>n.p.</b>	<b>868</b>

(a) 'Occupant of other motor vehicle' includes any occupant of a heavy transport vehicle, pick-up truck or van, bus or three-wheeled motor vehicle.

(b) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train or a person boarding or alighting from train. Persons waiting at a station for a train ('intending passengers') are excluded.

Note: Shaded areas indicate the highest 5 figures for each column.

**Table 4.1.5: Persons seriously injured due to transport accidents involving a railway train, Australia 2004–05 to 2008–09, circumstances of injury by sex**

<b>Circumstance of injury</b>	<b>Males</b>	<b>Females</b>	<b>Persons</b>
Pedestrian injured in collision with train	86	45	131
Pedal cyclist injured in collision with train	13	n.p.	n.p.
Motorcyclist injured in collision with train	13	n.p.	n.p.
Car occupant injured in collision with train	56	49	105
Occupant of other motor vehicle injured in collision with train <sup>(a)</sup>	23	n.p.	n.p.
Animal-rider or occupant of an animal-drawn vehicle injured in collision with train	0	0	0
Occupant of train <sup>(b)</sup> injured:			
in collision with motor vehicle	6	17	23
in collision with or hit by rolling stock	n.p.	n.p.	5
in collision with other object	n.p.	n.p.	7
while boarding or alighting from train	111	126	237
by fall in train	46	64	110
by fall from train	65	21	86
in derailment without antecedent collision	20	25	45
in unknown transport accident	42	22	64
Person (mode of transport unknown) injured in collision between train and car	0	0	0
<b>Total</b>	<b>491</b>	<b>377</b>	<b>868</b>

(a) 'Occupant of other motor vehicle' includes any occupant of a heavy transport vehicle, pick-up truck or van, bus or three-wheeled motor vehicle.

(b) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train or a person boarding or alighting from train. Persons waiting at a station for a train ('intending passengers') are excluded.

Note: Shaded areas indicate the highest 5 figures for each column.

**Table 4.1.6: Persons seriously injured due to transport accidents involving a railway train, Australia 2004–05 to 2008–09, circumstances of injury by age group**

<b>Circumstance of injury</b>	<b>0–14</b>	<b>15–24</b>	<b>25–44</b>	<b>45–64</b>	<b>65+</b>	<b>Total</b>
Pedestrian injured in collision with train	6	37	55	25	8	131
Pedal cyclist injured in collision with train	n.p.	n.p.	7	n.p.	n.p.	15
Motorcyclist injured in collision with train	n.p.	7	6	n.p.	0	14
Car occupant injured in collision with train	n.p.	25	34	33	n.p.	105
Occupant of other motor vehicle injured in collision with train <sup>(a)</sup>	0	n.p.	7	15	n.p.	26
Animal-rider or occupant of an animal-drawn vehicle injured in collision with train	0	0	0	0	0	0
Occupant of train <sup>(b)</sup> injured:						
in collision with motor vehicle	n.p.	n.p.	n.p.	6	6	23
in collision with or hit by rolling stock	0	0	n.p.	n.p.	0	n.p.
in collision with other object	0	n.p.	n.p.	n.p.	0	n.p.
while boarding or alighting from train	9	28	33	41	126	237
by fall in train	4	5	13	21	67	110
by fall from train	4	18	21	19	24	86
in derailment without antecedent collision	n.p.	n.p.	n.p.	16	22	45
in unknown transport accident	6	18	22	11	7	64
Person (mode of transport unknown) injured in collision between train and car	0	0	0	0	0	0
<b>Total</b>	<b>36</b>	<b>153</b>	<b>214</b>	<b>191</b>	<b>274</b>	<b>868</b>

(a) 'Occupant of other motor vehicle' includes any occupant of a heavy transport vehicle, pick-up truck or van, bus or three-wheeled motor vehicle.

(b) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train or a person boarding or alighting from train. Persons waiting at a station for a train ('intending passengers') are excluded.

Note: Shaded areas indicate the highest 5 figures for each column.

**Table 4.1.7: Persons seriously injured due to transport accidents involving a railway train, Australia 2004–05 to 2008–09, top five circumstances of injury by age group and sex**

<b>Circumstance of injury</b>	<b>0–14</b>	<b>15–24</b>	<b>25–44</b>	<b>45–64</b>	<b>65+</b>	<b>Total</b>
Person injured whilst boarding or alighting from train						
Males	6	25	18	23	39	111
Females	n.p.	n.p.	15	18	87	126
Pedestrian injured in collision with train						
Males	n.p.	24	40	18	n.p.	86
Females	n.p.	13	15	n.p.	n.p.	45
Occupant of train injured by fall in train <sup>(a)</sup>						
Males	n.p.	n.p.	7	8	25	46
Females	n.p.	n.p.	n.p.	13	42	64
Car occupant injured in collision with train						
Males	n.p.	15	19	18	n.p.	56
Females	n.p.	10	15	15	n.p.	49
Occupant of train injured by fall from train <sup>(a)</sup>						
Males	n.p.	17	17	16	n.p.	65
Females	n.p.	n.p.	n.p.	n.p.	12	21
<b>Total</b>	<b>27</b>	<b>113</b>	<b>156</b>	<b>139</b>	<b>234</b>	<b>669</b>

(a) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train or a person boarding or alighting from train. Persons waiting at a station for a train ('intending passengers') are excluded.

Note: This table shows the major circumstances accounting for 77.1% of transport accidents involving a railway train or vehicle.

## 4.2 Serious injury due to level crossing accidents

### Number and rate of serious injury

Table 4.2.1: Persons seriously injured due to level crossing accidents, Australia 2000–01 to 2008–09: by state or territory of hospitalisation

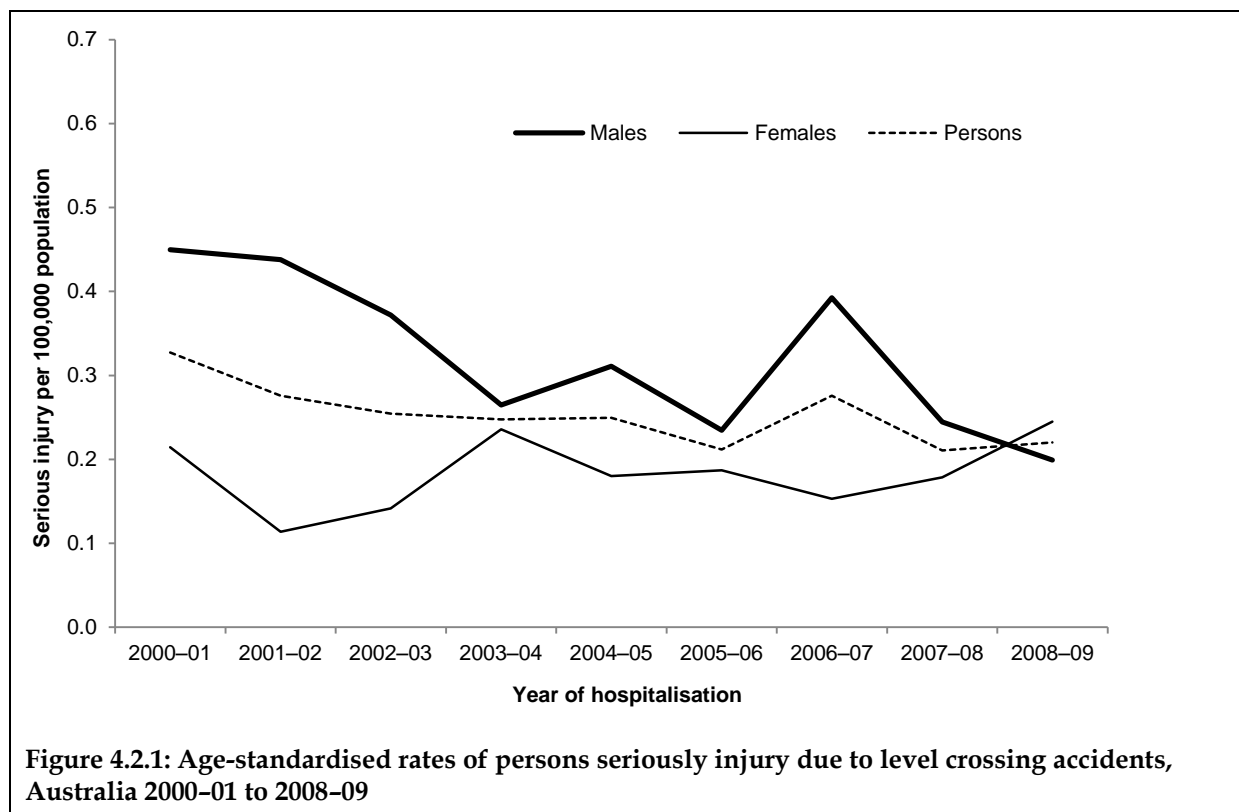
Year	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2000–01	11	32	16	n.p.	n.p.	n.p.	0	0	63
2001–02	9	25	9	7	n.p.	n.p.	0	0	54
2002–03	n.p.	25	10	0	12	0	n.p.	0	50
2003–04	10	28	9	n.p.	0	n.p.	0	n.p.	50
2004–05	n.p.	29	12	0	6	n.p.	n.p.	n.p.	51
2005–06	n.p.	22	10	n.p.	7	n.p.	n.p.	0	44
2006–07	9	30	7	n.p.	7	n.p.	0	n.p.	58
2007–08	n.p.	24	12	n.p.	n.p.	n.p.	0	n.p.	45
2008–09	8	20	19	n.p.	n.p.	0	n.p.	0	50
<b>Total</b>	<b>57</b>	<b>235</b>	<b>104</b>	<b>13</b>	<b>42</b>	<b>6</b>	<b>n.p.</b>	<b>n.p.</b>	<b>465</b>
<b>Proportion of all rail transport cases (%)</b>	<b>10.0</b>	<b>37.5</b>	<b>37.0</b>	<b>24.1</b>	<b>42.9</b>	<b>42.9</b>	<b>n.p.</b>	<b>n.p.</b>	<b>28.0</b>

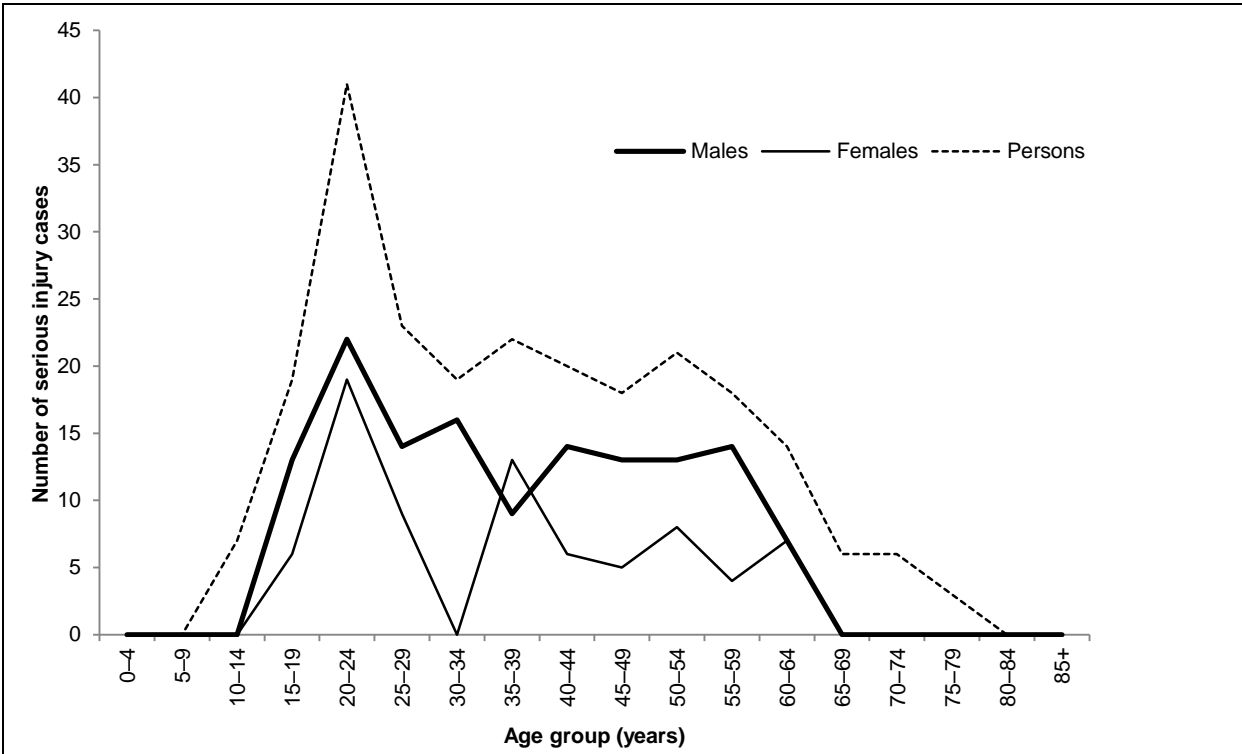
Note: For counts by calendar year refer to the 'Data issues' section.

**Table 4.2.2: Age-standardised rates per 100,000 population and case numbers of persons seriously injured due to level crossing accidents, Australia 2000–01 to 2008–09**

<b>Age-standardised rate per 100,000 population (95% CI<sup>(a)</sup>)</b>									
<b>Seriously injured</b>	<b>2000–01</b>	<b>2001–02</b>	<b>2002–03</b>	<b>2003–04</b>	<b>2004–05</b>	<b>2005–06</b>	<b>2006–07</b>	<b>2007–08</b>	<b>2008–09</b>
Males	0.45 (0.31–0.59)	0.44 (0.31–0.57)	0.37 (0.25–0.49)	0.26 (0.16–0.37)	0.31 (0.2–0.42)	0.23 (0.14–0.33)	0.39 (0.27–0.51)	0.24 (0.15–0.34)	0.20 (0.12–0.28)
Females	0.21 (0.12–0.31)	0.11 (0.05–0.18)	0.14 (0.07–0.22)	0.24 (0.14–0.33)	0.18 (0.1–0.26)	0.19 (0.1–0.27)	0.15 (0.08–0.23)	0.18 (0.1–0.26)	0.24 (0.15–0.34)
Persons	0.33 (0.25–0.41)	0.28 (0.2–0.35)	0.25 (0.18–0.33)	0.25 (0.18–0.32)	0.25 (0.18–0.32)	0.21 (0.15–0.27)	0.28 (0.20–0.35)	0.21 (0.15–0.27)	0.22 (0.16–0.28)
<b>Case numbers</b>									
<b>Seriously injured</b>	<b>2000–01</b>	<b>2001–02</b>	<b>2002–03</b>	<b>2003–04</b>	<b>2004–05</b>	<b>2005–06</b>	<b>2006–07</b>	<b>2007–08</b>	<b>2008–09</b>
Males	42	43	36	26	32	25	41	26	22
Females	21	11	14	24	19	19	17	19	28
Persons	63	54	50	50	51	44	58	45	50

(a) Confidence Intervals are provided to show by about how much rates might be expected to vary (between years, for example) in view of the number of cases. See Data Issues for further information.

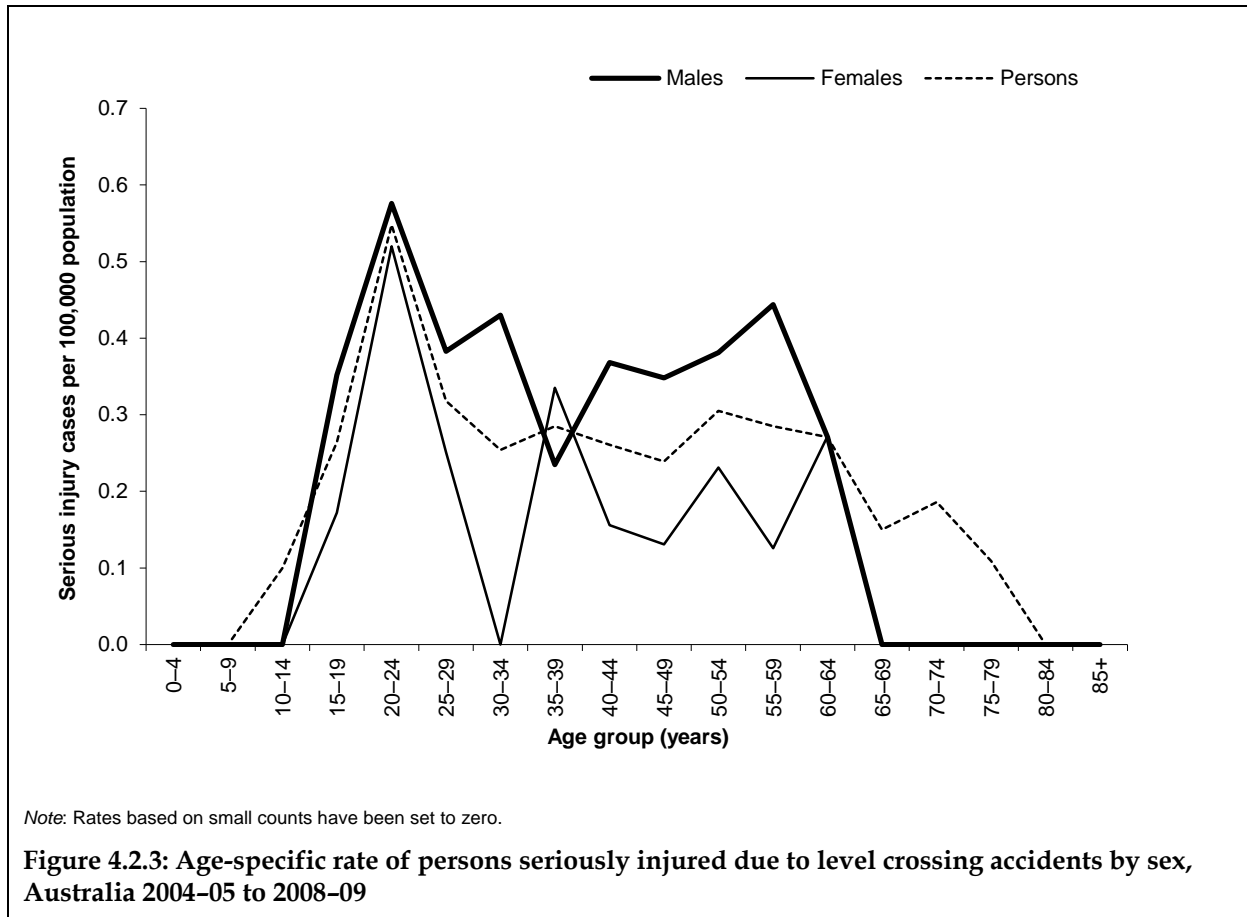




Note: Small counts have been set to zero.

**Figure 4.2.2: Persons seriously injured due to level crossing accidents by age group and sex, Australia 2004-05 to 2008-09**





## Circumstances of injury

**Table 4.2.3: Persons seriously injured due to level crossing accidents, Australia 2004–05 to 2008–09: circumstances of injury by state or territory of hospitalisation**

Circumstance of injury	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
Pedestrian injured in collision with train	14	47	9	n.p.	6	n.p.	n.p.	0	78
Pedal cyclist injured in collision with train	0	11	n.p.	0	n.p.	0	n.p.	0	14
Motorcyclist injured in collision with train	n.p.	n.p.	n.p.	0	n.p.	0	0	0	9
Car occupant injured in collision with train	n.p.	41	30	n.p.	15	n.p.	n.p.	n.p.	100
Occupant of pick-up truck or van injured in collision with train	n.p.	n.p.	n.p.	0	0	0	0	0	6
Occupant of heavy transport vehicle injured in collision with train	n.p.	n.p.	n.p.	0	n.p.	0	0	n.p.	14
Bus occupant injured in collision with train	n.p.	n.p.	n.p.	0	0	0	0	0	n.p.
Occupant of three-wheeled motor vehicle injured in collision with train	0	n.p.	0	0	0	0	0	0	n.p.
Occupant of train injured in collision with motor vehicle <sup>(a)</sup>	n.p.	13	7	0	0	0	0	n.p.	23
Person (mode of transport unknown) injured in collision between train and car	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>24</b>	<b>125</b>	<b>60</b>	<b>n.p.</b>	<b>25</b>	<b>n.p.</b>	<b>n.p.</b>	<b>n.p.</b>	<b>248</b>

(a) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train. Persons waiting at a station for a train ('intending passengers') and persons boarding and alighting from a train are excluded.

Note: Shaded areas indicate the highest 2 figures for the Australia column.

**Table 4.2.4: Persons seriously injured due to level crossing accidents, Australia 2004–05 to 2008–09, circumstances of injury by sex**

<b>Circumstance of injury</b>	<b>Males</b>	<b>Females</b>	<b>Persons</b>
Pedestrian injured in collision with train	48	30	78
Pedal cyclist injured in collision with train	12	n.p.	n.p.
Motorcyclist injured in collision with train	8	n.p.	n.p.
Car occupant injured in collision with train	51	49	100
Occupant of pick-up truck or van injured in collision with train	6	0	6
Occupant of heavy transport vehicle injured in collision with train	13	n.p.	n.p.
Bus occupant injured in collision with train	n.p.	n.p.	n.p.
Occupant of three-wheeled motor vehicle injured in collision with train	n.p.	n.p.	n.p.
Occupant of train injured in collision with motor vehicle <sup>(a)</sup>	6	17	23
Person (mode of transport unknown) injured in collision between train and car	0	0	0
<b>Total</b>	<b>146</b>	<b>102</b>	<b>248</b>

(a) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train. Persons waiting at a station for a train ('intending passengers') and persons boarding and alighting from a train are excluded.

Note: Shaded areas indicate the highest 2 figures for the Persons column.

**Table 4.2.5: Persons seriously injured due to level crossing accidents, Australia 2004–05 to 2008–09, circumstances of injury by age group**

<b>Circumstance of injury</b>	<b>0–14</b>	<b>15–24</b>	<b>25–44</b>	<b>45–64</b>	<b>65+</b>	<b>Total</b>
Pedestrian injured in collision with train	n.p.	25	29	16	n.p.	78
Pedal cyclist injured in collision with train	n.p.	n.p.	7	n.p.	n.p.	14
Motorcyclist injured in collision with train	0	n.p.	n.p.	n.p.	0	9
Car occupant injured in collision with train	n.p.	23	31	33	n.p.	100
Occupant of pick-up truck or van injured in collision with train	0	0	n.p.	n.p.	n.p.	6
Occupant of heavy transport vehicle injured in collision with train	0	n.p.	n.p.	8	0	14
Bus occupant injured in collision with train	0	0	0	n.p.	n.p.	n.p.
Occupant of three-wheeled motor vehicle injured in collision with train	0	0	n.p.	0	0	n.p.
Occupant of train injured in collision with motor vehicle <sup>(a)</sup>	n.p.	n.p.	n.p.	6	6	23
Person (mode of transport unknown) injured in collision between train and car	0	0	0	0	0	0
<b>Total</b>	<b>10</b>	<b>60</b>	<b>84</b>	<b>71</b>	<b>23</b>	<b>248</b>

(a) 'Occupant of train' includes any occupant of a train, including a passenger, a railway employee, a person on the outside of a train. Persons waiting at a station for a train ('intending passengers') and persons boarding and alighting from a train are excluded.

Note: Shaded areas indicate the highest 2 figures for the Total column.

# Appendix 1: Data issues

National hospital separations data were sourced from the Australian Institute of Health and Welfare's (AIHW) National Hospital Morbidity Database (NHMD). The data were coded according to the fourth, fifth and sixth editions of *International statistical classification of diseases and related health problems, 10th revision, Australian modification* (ICD-10-AM) (NCCH 2004, 2006, 2008). A 'separation' is a term used in Australian hospitals to refer to a formal, or statistical process, by which an episode of care for an admitted patient ceases (AIHW 2001). An 'episode of care' is a period of health care characterised by only one care type. For the lay person, this is perhaps best understood as a stay in a particular ward in a hospital. For example, a person who is in an intensive care ward and is then transferred to a rehabilitation ward will have undergone two episodes of care and hence two separations within the hospital.

'Seriously injured' is defined for this report as an injury which results in the person being admitted to hospital, and subsequently discharged alive either on the same day or after staying for one or more nights in a hospital bed (i.e. deaths in hospital are excluded). As discharge from hospital can include transfer to home, to another acute care hospital and to another form of care (e.g. rehabilitation), a method has been used in this report to reduce over-counting of injury cases by omitting separations in which the mode of admission is recorded as being by transfer from another acute-care hospital, on the grounds that such cases are likely to result in two or more separation records for the same injury.

Records that met the following criteria are included in this report:

- Australian hospital separations occurring 1 July 2004 to 30 June 2009
- Principal Diagnosis in the ICD-10-AM range S00–T98 using Chapter XIX *Injury, poisoning and certain other consequences of external causes* codes
- first reported external cause of morbidity containing one of the following ICD-10-AM 'Rail transport accident' codes: V05, V15, V25, V35, V45, V55, V65, V75, V80.6, V81, V87.6 & V88.6
- mode of admission has any value except the one indicating that transfer from another acute-care hospital has occurred
- mode of separation has any value except the one indicating that the person died while in hospital.

Cases with a Principal Diagnosis other than injury and cases in which an external cause code for rail transport only appears as an additional external cause code were excluded on the grounds that injury due to a rail transport accident was not recorded as being the main reason for admission to hospital, resulting in a starting file of 952 records (Table A1).

**Table A1: Selection criteria for hospital records of rail-related transport injury**

Record occurring from 1 July 2004 to 30 June 2009	Persons
Records with an ICD-10-AM 'Rail Transport Accident' code <sup>(a)</sup> as external cause anywhere in the record <sup>(b)</sup>	1,232
Records with a 'Rail Transport Accident' as first reported external cause <sup>(c)</sup> , and injury as a Principal Diagnosis (S00–T98), and	1,193
excluding cases transferred from another acute-care hospital, and	952
excluding deaths in hospital	891
	868

- (a) A record is a 'Rail Transport Accident' if it has an external cause of V05, V15, V25, V35, V45, V55, V65, V75, V80.6, V81, V87.6, V88.6.
- (b) There were 39 records with a first reported external cause code of another type of injury (e.g. complications of surgical and medical care, a transport accident without mention of being rail-related, other unintentional injuries, falls, assault etc.) but a 2nd or subsequent external cause code of rail-related transport.
- (c) There were 241 cases with a first reported external cause code of a 'Rail Transport Accident' but a Principal Diagnosis outside of the injury range (S00–T98). The most common Principal Diagnosis was Care involving use of rehabilitation procedure, unspecified (Z50.9, n = 148) and Examination and observation following transport accident (Z04.1, n = 10).

Hospital cases were defined as being due to level crossing accidents if they contained a Principal Diagnosis in the range S00–T98 and a first reported external cause code of: V05.1, V15.[4,5,9], V25.[4,5,9], V35.[5,6,7,9], V45.[5,6,7,9], V55.[5,6,7,9], V65.[5,6,7,9], V75.[5,6,7,9], V81.1 or V87.6.

Key: In the list shown above, V15.[4,5,9] includes all cases where the first reported external cause code is V15 and having a fourth character of either 4, 5 or 9.

These codes should only be used for 'traffic' accidents, in which a road vehicle or a pedestrian had collided with a railway vehicle on a public road (i.e. originating on, terminating on, or involving a vehicle partially on a public road). This combination of circumstances is most likely to occur for level crossing crashes. It could, however, also occur in other circumstances e.g. if a railway runs along a road reserve (A road reserve is defined as an area of land between property boundaries, including roads, lanes, carparks, footpaths, bridges, reserves and nature strips). Note that in the inclusion criteria for a level crossing accident, all but V05.1 specify that a collision occurred between a road vehicle and a railway train or railway vehicle. The code V05.1 specifies a collision between a pedestrian and a railway train or railway vehicle in traffic, i.e. on a public road.

The calculation of rail transport accidents as a percentage of all injury-related or transport-related hospital separations and the calculation of total patient days (including same day, which are assigned a stay of one day) included all separations (i.e. not omitting separations in which the mode of admission is recorded as being by transfer from another acute-care hospital or separations in which the person died in hospital).

National hospital separations data include information on the state and territory of hospitalisation for the person admitted to hospital and the state and territory of usual residence, but not the location of the crash or where the injury was sustained. There are pluses and minuses for choosing either state and territory of hospitalisation or state and territory of usual residence when reporting jurisdiction. In this report, we have chosen to report serious injury counts by state and territory of hospitalisation.

There are a number of cases which may be rail-related but which are not included in the selection criteria as specified in Table A1. In such instances, the person may have been injured as a result of a collision with a train but the intent has been ascribed as intentional self-harm, assault, or undetermined.

Table A2 lists the number of serious injury cases due to self-harm, assault and undetermined intent that involve a collision between a person and a moving object or by crashing a motor vehicle with another specified vehicle (the ICD-10-AM inclusion notes state this can include a railway train or tram). It should be noted that the ICD-10-AM codes listed in Table A2 do not identify the vehicle type. It is likely that a proportion of these cases are rail-related, but it is not possible to distinguish such detail from the ICD-10-AM codes.

**Table A2: Serious injury cases due to intentional self-harm, assault or undetermined intent that resulted from a collision with a moving object or vehicle, Australia 2004–05 to 2008–09**

External cause of injury		No. of cases
X81	Intentional self-harm by jumping or lying before moving object	229
X82.2	Intentional self-harm by other specified crashing of motor vehicle, non-traffic	7
X82.8	Intentional self-harm by other specified crashing of motor vehicle, traffic	40
Y02	Assault by pushing or placing victim before moving object	44
Y03.2	Assault by other specified crashing of motor vehicle, non-traffic	37
Y03.8	Assault by other specified crashing of motor vehicle, traffic	81
Y31	Falling, lying or running before or into moving object, undetermined intent	43
Y32.2	Other specified crashing of motor vehicle, undetermined intent, non-traffic	0
Y32.8	Other specified crashing of motor vehicle, undetermined intent, traffic	0
<b>Total</b>		<b>481</b>

## Serious injury counts by calendar year

Tables A3 and A4 below are equivalent to Tables 4.1.1 and 4.2.1 in this report, except that data are reported for calendar years instead of financial years.

**Table A3: Persons seriously injured due to transport accidents involving a train, Australia, 2000 to 2008, by state or territory of hospitalisation**

Year	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2000	96	65	32	7	10	n.p.	n.p.	n.p.	216
2001	76	82	33	10	8	0	0	0	209
2002	70	71	13	8	19	n.p.	0	n.p.	183
2003	76	80	30	n.p.	4	n.p.	n.p.	0	197
2004	69	59	63	n.p.	11	n.p.	0	n.p.	209
2005	54	62	26	n.p.	14	n.p.	n.p.	n.p.	163
2006	54	67	27	9	13	n.p.	0	n.p.	174
2007	42	75	22	5	13	n.p.	n.p.	n.p.	161
2008	50	64	33	n.p.	9	n.p.	n.p.	n.p.	167
<b>Total</b>	<b>587</b>	<b>625</b>	<b>279</b>	<b>53</b>	<b>101</b>	<b>16</b>	<b>7</b>	<b>11</b>	<b>1,679</b>

**Table A4: Persons seriously injured due to level crossing accidents, Australia, 2000 to 2008, by state or territory of hospitalisation**

Year	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2000	15	21	14	0	n.p.	n.p.	n.p.	0	56
2001	7	36	16	5	n.p.	0	n.p.	0	67
2002	6	23	5	n.p.	9	n.p.	0	0	47
2003	n.p.	26	10	0	n.p.	n.p.	0	0	45
2004	9	30	11	n.p.	n.p.	0	0	n.p.	56
2005	n.p.	24	13	0	7	n.p.	n.p.	0	49
2006	6	22	8	n.p.	7	0	0	n.p.	48
2007	6	33	7	n.p.	n.p.	n.p.	0	0	52
2008	n.p.	20	17	0	n.p.	0	n.p.	n.p.	47
<b>Total</b>	<b>59</b>	<b>235</b>	<b>101</b>	<b>12</b>	<b>45</b>	<b>6</b>	<b>n.p.</b>	<b>n.p.</b>	<b>467</b>

## Population and other denominators

Case count data were combined for a 5-year observational period and rates were calculated using, as the denominator, the combined total of the estimated resident populations between 31 December 2005 and 31 December 2008. The rates in Tables 4.1.2, 4.2.2, Figures 4.1.1 and 4.2.1 were calculated using, as the denominator, the final estimate of the estimated resident population as at 31 December in the relevant year (e.g. 31 December 2006 for 2006–07 data). Direct standardisation was used to age-standardise rates, using the Australian population in 2001 as the standard (ABS 2003). Age-standardised rates and trend analysis were calculated in Stata version 12.0 statistical software using the `-dstdize-` and `-poisson-` commands respectively (StataCorp 2011).

## Quantifying variability in the counts presented in this report

The data presented in this report are subject to two types of statistical error, non-random and random. (A third type of statistical error, sampling error, does not apply here because none of the data sources used involved probability sampling.)

**Non-random error:** Some amount of non-random error is to be expected in administrative data collections such as the hospital inpatient data on which this report relies. For example, non-random error could occur if the approach to assigning cause codes to cases were to differ systematically between jurisdictions or over time. Systems are in place to encourage uniform data collection and coding and scrutiny of data during analysis includes checking for patterns that might reflect non-random error. Nevertheless, some non-random error is likely to remain. Identified or suspected non-random errors large enough to materially affect findings are mentioned in reports.

**Random error:** The values presented in the report are subject to random error, or variation. Variation is relatively large when the case count is small (especially if less than about 10) and small enough to be unimportant in most circumstances when the case count is larger (i.e. more than a few tens of cases).

Some of the topics for which results are reported compare groups that vary widely in case count, largely due to differences in population size (e.g. the population of NSW is more than

30 times as large as the NT population). In this situation, year-to-year changes in counts or rates for the smaller-population groups may be subject to large random variation. There is potential to misinterpret such fluctuations as meaningful rises or falls in occurrence.

In this situation, and similar ones, guidance is provided to readers concerning how much variation of values can be expected due to random variation of small counts. Confidence intervals (CIs) are calculated for this purpose. In this report CIs were calculated using the Stata `-stdize-` command (CIs around single estimates) and `-poisson-` command (CIs around slope of trend) (Statacorp 2011).

## **Confidence intervals**

The AIHW is currently undertaking a review to assess the provision of confidence intervals and statistical tests when data arise from sources that provide information on all subjects, rather than from a sample survey. This review will include analysis of the methods used to calculate confidence intervals, as well as the appropriateness of reporting confidence intervals and undertaking statistical testing for such data. This review aims to ensure that statistical methods used in AIHW reports remain robust and appropriately inform understanding and decision making. As a consequence, the type of information reported in future editions of this publication may change.

## **Suppression of small cell counts in tables**

Cell counts in tables that are four cases or fewer have been suppressed as have rates derived from them, to protect confidentiality and because values based on very small numbers are sometimes difficult to interpret. In the instances where only one cell in a row or column has a count of four or less, counts of one or more other cells in the same row or column have generally also been suppressed.

## **Types of level crossings**

The intersection between a public or private roadway or footpath and a railway track at the same level ('at-grade intersection') in Australia is commonly called a level crossing. There are several types of level crossing:

- active level crossings with automatic warning systems such as flashing lights, bells and/or boom gates; as well as static signage
- passive level crossings that usually have a crossbuck (railway crossing sign) and a 'Give Way' sign, inverted red triangle or stop sign
- occupational or accommodation crossings between private property and public roads
- maintenance crossings
- illegal crossings (Standing Committee on Transport and Regional Services 2004).

## **Comparability with other reports**

Australian hospitals use an international standard classification called the International Statistical Classification of Diseases (ICD) when compiling data on persons injured and subsequently admitted to hospital (morbidity data). ICD provides a nationally consistent basis for looking at morbidity due to transport accidents of all kinds (road, rail, water and air). However, it is not necessarily consistent with the approach taken by the Australian



Transport Safety Bureau (ATSB) or others in looking at safety in each transport mode individually. For example, road safety statistics compiled by the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government are focused on crashes on public roads, whereas ICD covers road crashes both on and off public roads. Aviation statistics compiled by the ATSB do not cover hang-gliders, gliders and other forms of non-powered aircraft, whereas ICD does. For information on deaths involving railway transport, readers should refer to the 'Rail statistics' part of the ATSB website <[www.atsb.gov.au/rail/rail-statistics.aspx](http://www.atsb.gov.au/rail/rail-statistics.aspx)>.

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