



TRAM RELATED INJURY STATISTICS

VICTORIA 2005/06 TO 2014/15

*Report prepared by the Victorian Injury Surveillance Unit (VISU, Accident Research Centre) for
Transport Safety Victoria (TSV)*

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Summary of Key Statistics

Tram related injury hospital admissions

- There were 521 admissions to Victorian hospitals as a result of tram related injuries in the ten-year period from 2005/6 to 2014/15: an average of 52 admissions per year
- 60.3% of those admitted to hospital for tram-related injuries were female
- Almost three-quarters (74.1%, n=386) of the tram-related injury admissions were by persons aged 60 years and over
- 88.7% of tram-related injury admissions were residents of the Melbourne metropolitan area
- Rates of tram-related injury admissions increased by an average 6.1% per year over the study period

Tram related injury cause and injury type

- Almost half (48.8%, n=254) of all tram-related injury admissions resulted from a passenger falling whilst aboard a tram
- 49.7% (n=259) of admitted injuries suffered were fractures
- The lower extremities (36.5%, n=190) was the body region most commonly affected by tram-related injuries

Tram related injury burden: hospital admission bed days, discharge destination and cost

- Tram-related injury admissions most commonly resulted in fewer than two bed days (46.6%, n=243)
- Tram-related injury admissions resulted in an average of 5.2 bed days per admission
- Rates of bed day occupation did not change statistically significantly during the study period
- The hospital admission cost of tram-related injuries over the two-year period 2011/12-2012/13 totalled \$894,240
- Two-thirds (67.6%, n=352) of separations from hospital were to private residence/accommodation

Tram related injury narrative information, from ED presentations that resulted in admission

- With regard to ED presentations subsequently admitted, almost a third (32.4%, n=258) of situations involved a passenger or person boarding or alighting a tram; a further 24.7% (n=197) were pedestrians injured as a result of being hit by a tram
- In 10.6% (n=84) of ED presentations subsequently admitted the person injured in the tram-related incident was the occupant of another vehicle
- 34.3% (273) of ED presentations subsequently admitted involved a tram collision resulting in injury

Introduction

In 2016, there were 187.9 million tram boardings, and 1,558 reported incidents involving trams (Transport Safety Victoria, 2017). A small amount of published research is available regarding tram-related injuries. However, the available research focuses solely on emergency department

presentations. In 2010, Mitra et al. examined a number of databases and found that rates of ED presentations increased significantly over the period 2001-2008 with falls accounting for 48% of cases. It was also found that rates of major trauma (defined as death due to injury; an injury severity score (ISS) >15; injury requiring urgent surgery; or an injury requiring intensive care unit stay of more than 24 hours requiring mechanical ventilation) significantly increased over the same period, with pedestrians accounting for the majority of traumatic injuries. Recently, tram safety has received media attention. The ABC published an article in November 2016 in which it was reported that tram drivers were experiencing “great anxiety” due to motorists pulling out in front of them. Being on a fixed rail, tram drivers do not have a significant amount of control or options in the face of such situations. It often comes down to a choice between stopping suddenly, which may result in injuries to passengers, or stopping slowly which may result in a collision with another vehicle. The issue is exacerbated by the fact that 75% of the tram network in Melbourne is shared roadway. The Herald Sun in May of 2016 reported that civil lawsuits related to tram injuries, including Transport Accident Commission claims, were becoming more common.

The report which follows utilises the Victorian Admitted Episodes Dataset (VAED) and Victorian Emergency Minimum Dataset (VEMD) to investigate tram-related injury admissions over the period 2005/6-2014/15. Cause of Death Unit Record Files (COD URF) were also analysed to provide insight into deaths resulting from tram-related injury over the period 2007-2012. This report aims to:

- investigate the nature, cause, and mechanism of tram-related injuries and deaths
- determine demographic risk factors relating to tram-related injuries
- determine the burden of tram-related injuries in terms of hospital bed days and direct hospital costs
- integrate the findings and propose a number of recommendations to reduce the impact of tram-related injuries in Victoria

Tram related hospital admissions, 2005/06-2014/15

Over the period 2005/6 to 2014/15 there were 521 admissions to Victorian hospitals as a result of tram related injuries, of which 60.3% (n=314) were female. Older persons made up a large proportion of those admitted to hospital as a result of tram-related injuries: 48.8% (n=254) of injuries were suffered by those aged 75 years and over, while a further 25.3% (n=132) of cases occurred among those aged 60-74 years. A breakdown by geographic region revealed that 88.7% (n=462) of injuries were suffered by residents of the Melbourne Metropolitan area.

Table 1. Demographic data for 2005/6-2014/16

Characteristic	N	%
Sex		
Female	314	60.3
Male	207	39.7
Age		
0-14 yrs	8	1.5
15-29 yrs	27	5.2
30-44 yrs	38	7.3
45-59 yrs	62	11.9
60-74 yrs	132	25.3
75+ yrs	254	48.8
Geographic Region		
Melbourne Metropolitan Area	462	88.7
Regional/Rural Victoria	36	6.9
Interstate	19	3.6
Overseas	*	*
Unknown	*	*

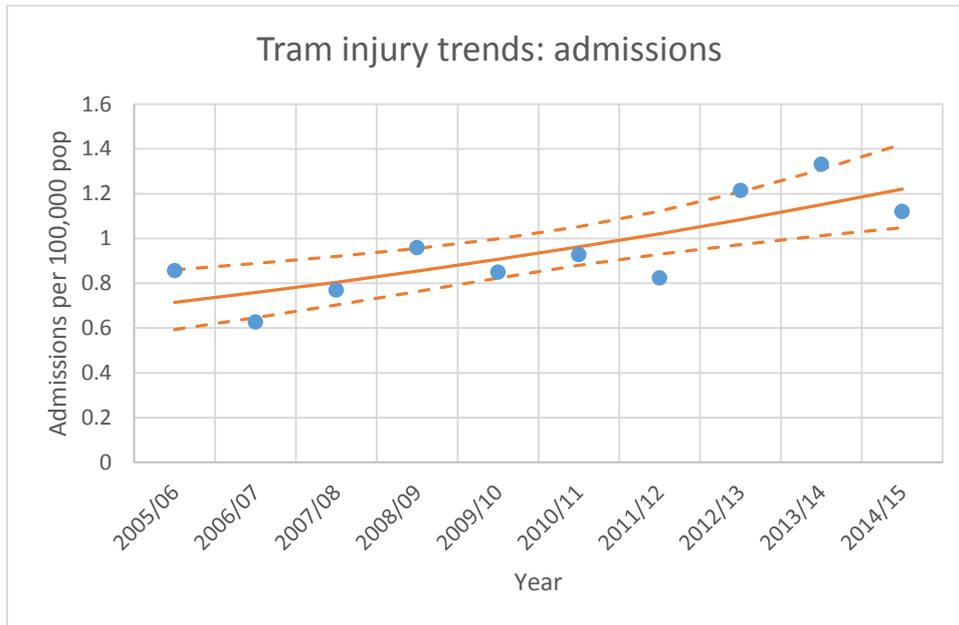
The crude figures for tram-related injuries have generally risen over the ten-year observation period. A low of 32 injuries was observed in 2006/7 and a peak of 77 was witnessed in 2013/14. However, in order to determine if this change represents an increase in tram-related injury rates, a trend analysis was conducted using this data and the population data for Victoria at a specific time point each year over the study period. The trend analysis revealed that tram-related injury admissions per 100,000 population significantly increased by an average 6.1% (p=0.0002) per year over the period 2005/6-2014/15.

Table 2. Number of injury admissions per financial year, 2005/06-2014/15

Financial Year	N	%
2005/06	43	8.3
2006/07	32	6.1
2007/08	40	7.7
2008/09	51	9.8
2009/10	46	8.8
2010/11	51	9.8

2011/12	46	8.8
2012/13	69	13.2
2013/14	77	14.8
2014/15	66	12.7

Figure 1. Trends for admissions for tram-related injuries (per 100,000 population), 2005/06-2014/15



Of the 521 hospital admissions due to tram-related injuries, in terms of traffic type, 95.4% (n=497) were classified as 'Other' with only 1.7% (n=9) initially classified as traffic accidents. However, according to the ICD-10-AM, cases classified as 'Other' or 'Unspecified' should, in the case of the specific injury codes assigned to these cases, be identified as traffic accidents. As such, it is assumed that those cases occurred on public roads, as would be expected of tram-related injuries.

Table 3. Incident traffic type, 2005/06-2014/15

Traffic Type	N	%
Other	497	95.4
Traffic	9	1.7
Unspecified	*	*
Non-traffic	*	*

An analysis of the circumstances of the injury revealed that almost half (48.8%, n=254) of all tram-related injuries resulting in hospital admission were a result of a passenger falling whilst aboard the tram, and another 39.3% (n=205) of injuries occurred when an individual attempted to board or alight from a tram. Very few injuries occurred as a result of a collision (3.1%, n=16) or through intentional means (2.5%, n=13).

Table 4. Circumstances of injury, 2005/06-2014/15

Circumstances of Injury	N	%
Occupant of streetcar injured in fall on or from tram	254	48.8
Person injured while boarding or alighting	205	39.3
Occupant injured due to other or unspecified transport accident	33	6.3
Occupant injured in collision with motor vehicle	10	1.9
Person injured after falling lying or being pushed in front of tram with undetermined intent	9	1.7
Occupant injured in collision with other object	*	*
Person injured by placing themself in front of tram	*	*

Almost half of all tram-related injuries were fractures (49.7%, n=259) whilst the next most commonly observed type of injury was open wound (9.6%, n=50). Injuries were most commonly inflicted upon the lower extremities (36.5%, n=190) although the specific body site most frequently injured was the head (20.3%, n=106) followed by the knee or lower leg (18%, n=94).

Table 5. Nature and location of injury, 2005/06-2014/15

	N	%
Nature of Injury		
Fracture	259	49.7
Other & unspecified injury	84	16.1
Open wound	50	9.6
Superficial injury	45	8.6
Intracranial injury	35	6.7
Dislocation, sprain & strain	31	6.0
Injury to muscle & tendon	8	1.5
Injury to internal organs	*	*
Injury to blood vessels	*	*
Crushing injury	*	*
Traumatic amputation	*	*
Burns	*	*
Other effects of external cause/complications/late effects	*	*
Body Region		
Lower extremity	190	36.5
Head/face/neck	127	24.4
Trunk	106	20.3
Upper extremity	98	18.8
Body Location		
Head	106	20.3
Knee & lower leg	94	18.0
Hip & thigh	83	15.9

Abdomen, lower back, lumbar spine & pelvis	54	10.4
Shoulder & upper arm	53	10.2
Thorax	52	10.0
Elbow & forearm	28	5.4
Neck	21	4.0
Wrist & hand	17	3.3
Ankle & foot	*	*
Burn- lower limb	*	*
Body region not relevant	*	*

Over the ten-year period, tram-related injuries resulted in a total of 2,960 admitted hospital days at an average 5.2 bed days per admission. There was a proportion of cases in which the injury resulted in a bed day total of eight or more days (17.9%, n=93). Tram-related injuries most commonly resulted in a bed day total of fewer than two days (46.6%, n=243). Tram-related injury bed days peaked in 2010/11 with 458 and a minimum was observed in 2014/15 with 342 bed days. To determine the change in tram related injury admission bed days over time, a trend analysis was conducted using this data, and the population data for Victoria at a specific time point each year over the study period. The trend analysis revealed that tram-related injury hospital bed days per 100,000 population increased over the ten-year period but the change was not statistically significant (p=0.55).

Table 6. Number of hospital bed days per financial year, 2005/06-2014/15

Financial Year	N	%
2005/06	245	8.28
2006/07	255	8.61
2007/08	266	8.99
2008/09	237	8.01
2009/10	239	8.07
2010/11	458	15.47
2011/12	303	10.24
2012/13	331	11.18
2013/14	383	12.94
2014/15	243	8.21

Figure 2. Trends for hospital bed days (per 100,000 population), 2005/06-2014/15

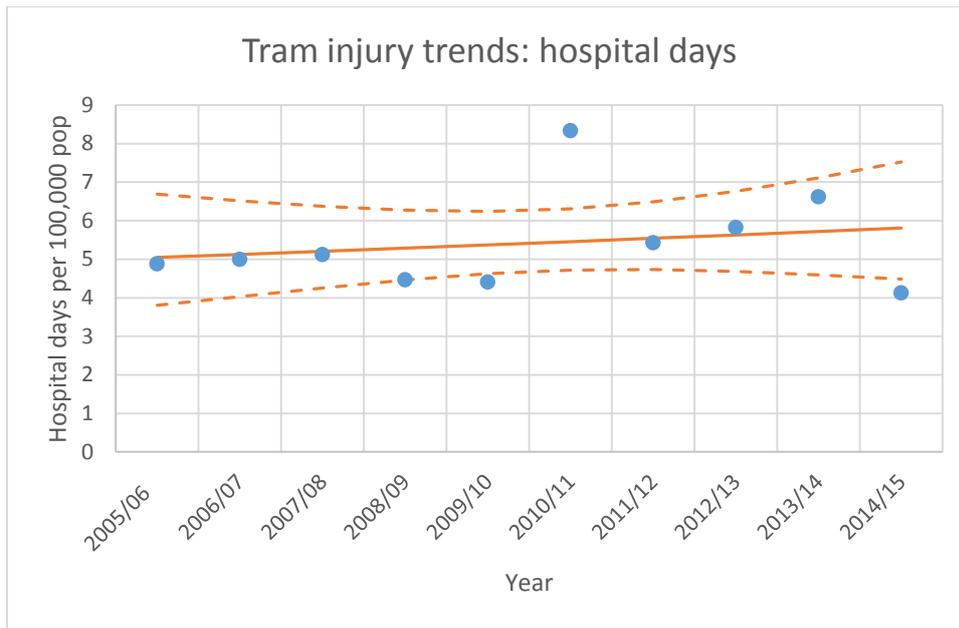


Table 7. Hospital bed days (grouped), 2005/06-2014/15

Bed Days	N	%
< 2 days	243	46.6
2-7 days	185	35.5
8+	93	17.9

The cost of tram-related injuries resulting in admission over the period 2011/12-2012/13 totalled \$894,240. Two-thirds (67.6%, n=352) of separations from hospital were to private residence/accommodation and 26.7% (n=139) of separations were to acute hospital or extended care.

Table 8. Type of separation from hospital, 2005/06-2014/15

Separation Type	N	%
Separation to private residence/accommodation	352	67.6
Separation and transfer to acute hospital/extended care	139	26.7
Statistical Separation	15	2.9
Separation and transfer to aged care residential facility	7	1.3
Left against medical advice	*	*
Separation and transfer to Transition Care bed based program	*	*
Death	*	*

Emergency Department Presentations Subsequently Admitted, 2005/06-2014/15

To better understand the nature of tram-related injuries and the role of the injured individual, VEMD was inspected using a text narrative search of accident descriptions. An iterative approach was used to improve the accuracy of the analysis but results are dependent on the accuracy and completeness of the descriptions entered. The VAED (hospital admissions) could not be used as these do not contain narrative text. Only ED cases that were subsequently admitted were included in this analysis, for better matching with the admissions data on which the rest of the report is based. A total of 796 ED presentations subsequently admitted to hospital were analysed.

Most commonly, the circumstances of tram-related injuries involved passengers injured whilst on board a tram or whilst boarding or alighting (32.4%, n=258), with the second most common scenario being a pedestrian or bystander struck by a tram (24.7%, n=197). Over a quarter of cases (28.8%, n=229) could not be accurately classified using the narrative data.

A broad inspection of the role of the injured person revealed 32.4% (n=258) to be passengers, and 27.1% (n=216) to be bystanders, whilst another 10.6% (n=84) were an occupant or rider of another vehicle. Of those injuries suffered by occupants or riders of other vehicles, the vehicle involved was a car in 66.7% of cases (n=56). With regard to all injuries, over a third (34.3%, n=273) were preceded, or caused, by a collision.

Table 9. Circumstances of accident resulting in ED presentation, 2005/06-2014/15

Nature of Accident	N	%
Person injured while on public transport (includes getting on or off)	258	32.4
Person (pedestrian) hit by tram	197	24.7
Cars, bikes, motorcycles in collision with public transport	84	10.6
Persons injured while running to catch a tram	19	2.4
Person injured while working on tram	*	*
Assault	*	*
Self-harm	*	*
Other and unspecified	229	28.8
Role of Injured Individual		
Passenger	258	32.4
Pedestrian or bystander	216	27.1
Occupant or rider of other vehicle	84	10.6
<i>Car</i>	56	66.7
<i>Bicycle</i>	22	26.2
<i>Other or unspecified</i>	6	7.1
Driver or other employee	*	*

Other	234	29.4
Impact Status		
Non-collision or unspecified	523	65.7
Collision	273	34.3

Discussion and Recommendations

Tram-related injuries are suffered more commonly by women (60.3%), individuals aged 60 years and over (74.1%), and residents of the metropolitan Melbourne area (88.7%). The finding that residents of the Melbourne metropolitan area are more likely to be injured in tram-related incidents is to be expected, given that tram services within Victorian run exclusively within the Melbourne metropolitan area. Perhaps it is more surprising that 11.3% of tram-related injuries are suffered by residents of other geographic regions but this could be due to a variety of factors such as unfamiliarity with tram operations (potential for sudden stopping) and lack of experience in sharing roadways with trams. Without accurate information about the gender split of tram patronage, it is difficult to say what is at the root of the gender disparity but the most likely explanation is that a greater number of women travel by tram rather than suggesting women are at greater risk of being injured on or around trams.

Age as a risk factor is not unexpected for two reasons. The first reason relates to rates of public transport use; older persons utilise public transport at greater rates than middle aged or younger persons who are likely to use a private vehicle. The second reason ties into an aspect mentioned by Mitra et al (2010) and also reinforced by the findings of this report: falls account for a significant proportion of tram-related injuries. Trams reducing speed suddenly or taking corners at considerable speed can cause passengers to be thrown, and older passengers may have more difficulty maintaining balance under such circumstances. Older passengers may also have more difficulty boarding and alighting from trams, especially older classes of tram with a number of steps to climb. In general, an older person who suffers a fall is more likely to be injured as a result of a fall, due to factors such as bone density, osteoporosis, and general increasing frailty with increasing age. Further supporting this is the finding that fractures accounted for almost half (49.7%) of all tram-related injuries and the lower extremities accounted for over a third (36.5%) of injuries, it is likely that older tram passengers suffering fractures as a result of falls account for a reasonable proportion of tram-related injury admissions and could be the focus of an intervention plan.

With regard to hospital admission trends, rates of tram-related injuries have increased significantly, rising an average of 6.1% per year over the ten-year period. It is already known that the number of tram journeys have increased over time (TSV, 2017) but this finding indicates that the increase in injuries is larger than the increase in patronage over the same time period. One potential explanation for this is that an increased reliance on Melbourne's tram network has resulted in issues with overcrowding on trams, making them less safe for passengers with regard to boarding and alighting. Given that a large proportion (39.3%, n=205) of tram related injuries are suffered by those trying to board or alight trams, this may warrant attention. Trend analysis of hospital bed days per population revealed that this remained relatively stable over the study period. This could indicate a decrease in severity (as indicated by length of stay) per admitted injury.

To further explore the circumstances surrounding tram-related injuries, the text narratives contained within the VEMD were analysed. The distributions observed among ED presentations

subsequently admitted were different to those in the VAED admissions data. A smaller proportion were injured whilst on board, or whilst boarding or alighting (57.1% v 88.1%) and pedestrians struck by trams account for almost a quarter (24.7%) of incidents (pedestrians hit by trams were not captured in the VAED analysis because of ICD-10-AM coding limitations). However, the findings can be difficult to interpret as 28.8% of cases were coded as 'other' or 'unspecified'. Nevertheless, the issue of pedestrians being hit by trams warrants attention; despite already being the target of safety campaigns in the past.

A slightly different method was used to determine the role of the injured individual (i.e., pedestrian, bystander etc.). This also yielded incomplete results with 29.4% of cases lacking sufficient information to be designated. However, reinforcing tram drivers' concerns about drivers' lack of safety around trams mentioned in the introduction of this report, is the fact that when the injury is suffered by the occupant of another vehicle, the vehicle involved most often is a car (or similar, e.g. van, ute etc.). This does suggest that an intervention to raise awareness regarding driver safety on shared roadways would be beneficial. The problem was also addressed by the recent infrastructure upgrades which reduce the proportion of shared roadways in Victoria. However, as there were 273 ED presentations for tram-related injury as a result of collisions, there is still work to be done with respect to tram safety around pedestrians and motor vehicles.

In accordance with the main findings of this report, the Victorian Injury Surveillance Unit recommends the following:

- Further safety initiatives be implemented to ensure the safety of tram passengers with a focus on older persons and falls prevention
- Increased tram services, especially during peak times to reduce tram crowding and reduce any potential impact of crowding on the occurrence of injury
- Continued work on educating drivers and pedestrians regarding safe behaviour around trams and on shared roadways

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Appendix A: Additional Tables

Table 10. Admissions breakdown by year and sex

Year	Male	Female	Total
2005/06	17	26	43
2006/07	14	18	32
2007/08	13	27	40
2008/09	18	33	51
2009/10	15	31	46
2010/11	21	30	51
2011/12	18	28	46
2012/13	27	42	69
2013/14	33	44	77
2014/15	31	35	66
Total	207	314	521

Table 11. Admissions breakdown by year and circumstances of injury

Year	Occupant injured in collision with motor vehicle	Occupant injured in collision with other object	Person injured while boarding or alighting	Occupant of streetcar injured in fall on or from tram	Occupant injured due to other or unspecified transport accident	Person injured by placing themselves in front of tram	Person injured after falling lying or being pushed in front of tram with undetermined intent
2005/06	*	*	17	23	*	*	*
2006/07	*	*	13	18	*	*	*
2007/08	*	*	17	19	*	*	*
2008/09	*	*	16	26	*	*	*
2009/10	*	*	19	22	*	*	*
2010/11	*	*	15	27	*	*	5
2011/12	*	*	26	15	*	*	*
2012/13	*	*	25	35	7	*	*
2013/14	*	*	31	39	*	*	*
2014/15	*	*	26	30	8	*	*
Total	10	*	205	254	33	*	9

Table 12. Admissions breakdown by year and specific body location

Year	Head	Neck	Thorax	Abdomen, lower back, lumbar spine & pelvis	Shoulder & upper arm	Elbow & forearm	Wrist & hand	Hip & thigh	Knee & lower leg	Ankle & foot	Burn- lower limb	Body region not relevant
2005/06	7	*	*	*	*	*	*	*	13	*	*	*
2006/07	8	*	*	*	*	*	*	11	5	*	*	*
2007/08	7	5	*	10	*	*	*	*	*	*	*	*
2008/09	5	*	5	9	7	*	*	10	9	*	*	*
2009/10	6	*	9	*	7	*	*	6	8	*	*	*
2010/11	10	*	7	6	6	*	*	5	8	*	*	*
2011/12	10	*	*	*	*	*	*	10	13	*	*	*
2012/13	12	*	8	5	11	*	*	12	13	*	*	*
2013/14	24	*	8	6	8	*	*	5	15	*	*	*
2014/15	17	*	*	6	*	5	*	16	8	*	*	*
Total	106	21	52	54	53	28	17	83	94	11	*	*

Table 13. Admissions breakdown by year and body region

Year	Head, face and neck	Trunk	Upper extremity	Lower extremity	Body region not relevant
2005/06	8	8	9	18	*
2006/07	10	*	*	17	*
2007/08	12	14	6	7	*
2008/09	7	14	10	20	*
2009/10	6	13	13	14	*
2010/11	12	13	12	14	*
2011/12	12	*	*	23	*
2012/13	15	13	14	27	*
2013/14	26	14	15	22	*
2014/15	19	10	10	27	*
Total	127	106	98	189	*

Table 14. Admissions breakdown by nature of injury and year

Nature of Injury	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	Total
Superficial Injury	7	3	3	5	6	2	3	3	7	6	45
Open Wound	5	2	0	3	5	4	7	10	7	7	50
Fracture	23	16	22	24	28	27	23	34	34	28	259
Dislocation, sprain & strain	3	1	4	4	0	3	3	3	4	6	31
Injury to blood vessels	0	0	1	0	0	0	0	0	0	0	1
Injury to muscle and tendon	0	0	0	4	0	1	0	1	1	1	8
Crushing injury	0	0	0	0	0	0	0	0	1	0	1
Traumatic amputation	0	0	0	0	0	1	0	0	0	0	1
Intracranial injury	0	4	3	2	0	6	2	2	10	6	35
Injury to internal organs	0	0	0	2	2	0	0	0	0	0	4
Burns	0	0	0	1	0	0	0	0	0	0	1
Other/unspecified	5	6	6	6	5	7	8	16	13	12	84
Other effects of external causes	0	0	1	0	0	0	0	0	0	0	1

Table 15. Admissions breakdown by year and grouped hospital bed days

Year	< 2 days	2-7 days	8-30 days	31+ days
2005/06	19	15	*	*
2006/07	11	12	*	*
2007/08	15	18	*	*
2008/09	19	22	*	*
2009/10	22	15	*	*
2010/11	20	19	*	*
2011/12	16	20	*	*
2012/13	33	23	*	*
2013/14	48	19	*	*
2014/15	40	22	*	*
Total	243	185	90	*

Table 16. ED presentations by year and circumstances of injury

Year	Person injured while on public transport (includes getting on or off)	Pedestrian hit by public transport	Cars, bikes, motorcycles in collision with public transport	Persons injured while running to catch a tram or bus	Person injured while working on public transport	Assault	Self-harm	Other and unspecified
2005/06	17	13	*	*	*	*	*	19
2006/07	33	17	6	*	*	*	*	19
2007/08	24	29	*	*	*	*	*	23
2008/09	18	20	7	*	*	*	*	15
2009/10	17	22	5	*	*	*	*	19
2010/11	21	17	8	*	*	*	*	20
2011/12	17	22	8	*	*	*	*	15
2012/13	30	13	6	*	*	*	*	32
2013/14	36	25	20	*	*	*	*	33
2014/15	45	19	15	*	*	*	*	34
Total	258	197	84	19	*	*	*	229

Table 17. ED presentations breakdown by year and classification of person injured

Year	Passenger	Pedestrian or bystander	Occupant or rider of other vehicle	Driver or other employee	Other
2005/06	17	15	*	*	19
2006/07	33	20	*	*	19
2007/08	24	32	*	*	25
2008/09	18	20	*	*	16
2009/10	17	22	*	*	19
2010/11	21	20	*	*	21
2011/12	17	24	*	*	15
2012/13	30	15	*	*	32
2013/14	36	27	20	*	34
2014/15	45	21	15	*	34
Total	258	216	84	*	234

Table 18. ED presentations breakdown by year and collision/non-collision

Year	Collision	Non-collision or unspecified
2005/06	20	36
2006/07	24	54
2007/08	31	56
2008/09	29	33
2009/10	16	47
2010/11	30	41
2011/12	24	40
2012/13	23	60
2013/14	41	76
2014/15	35	80
Total	273	523

Appendix B: Data sources & case selection

Deaths

Data have been extracted from the VISU-held Cause of Death (COD) dataset supplied by the Australian Coordinating Registry (ACR) and based on the Australian Bureau of Statistics (ABS) cause of death data.

Cases were selected according to the following criteria:

- Victorian cases (closed cases only)
- Deaths recorded with a reference year of 2007-2012
- Death was coded as due to external cause on completion of coronial process
- The type of activity being undertaken by the person when injured was coded as V82-V829, X811, Y022, and Y311 which pertain to tram-related injuries, self-harm, and assaults

Hospital admissions

Hospital admission data were extracted from the Victorian Admitted Episodes Dataset (VAED) for the years 2005/6 to 2014/5. The VAED records all hospital admissions in public and private hospitals in the state of Victoria.

Injury incident cases were selected if the admission was for a community injury (principle diagnosis code in range of S00-T75 or T79) and included a tram-related transport accident code (V82-V829) or any code referring to any tram-related assault, self-harm or potential self-harm (X811, Y022, and Y311 respectively). Those who were admitted via a statistical separation within the same hospital or transferred inward from another hospital were excluded to prevent over-counting of incident injuries.

When calculating estimates of direct hospital costs and number of hospital bed days, all cases with a principal diagnosis as an injury in the ICD-10-AM code range S00-T75.9, T79-T79.9, T89-T98.99 (these codes exclude medical injury) or one of two relevant rehabilitation codes - Z094 (follow-up examination after treatment of a fracture) or Z509 (care involving use of rehabilitation procedure, unspecified) with an injury code (any of the diagnosis codes in the range of S00-T98) were included, to provide a more accurate estimate of the burden of injury.

Note: Frequencies less than 5 and rates based on frequencies less than 10 are suppressed and appear with an “” in the tables provided.*

Emergency department (ED) presentations

ED presentations data were extracted from the Victorian Emergency Minimum Dataset (VEMD) for the years 2005/6 to 2014/15. The VEMD records all presentations to Victorian public hospitals with 24-hour emergency departments (currently 39 hospitals – 100% state-wide coverage of these hospitals applies from 2004). ED presentations were selected if the presentation was for a community injury (primary diagnosis code in the range of S00-T75 or T79) and the word ‘tram’ was found within the case description. Pre-arranged admissions (through the ED) and return visits were excluded to avoid over-counting of incident injury presentations.

Note: Frequencies less than 5 and rates based on frequencies less than 10 are suppressed and appear with an “” in the tables provided.*

Intent

Intentionally caused injuries (assault and self-harm) were included in this report as ICD-10-AM coding contains reference to intentionally caused tram-related injuries.

Appendix C: Analysis methods

Rates

Tram-related injury rates and bed day rates (per 100,000) were calculated using ABS population data for Victorians in the corresponding years of injury. Population data was sourced from Employment data were sourced from Australian Demographic Statistics, September 2016, copyright © Commonwealth of Australia 2017 (ABS, 2017). Crude rate and 95% confidence interval of the crude rates are shown, for ED presentation rates and hospital admission rates. Confidence intervals were calculated as:

$$\frac{100,000}{Population} \times (events \pm [1.96 \times \sqrt{events}])$$

Trend analysis

Trends in the rates of tram-related injuries and bed days (per 100,000) were modelled using Poisson models, as trends in the annual number of events, with the log of the Victorian population as offset. The results are shown in figures as the observed rates over time as well as the fitted rates with 95% confidence intervals. The results are presented in a table as the modelled annual % change in rate, calculated as:

$$percentage\ change = [e^{\alpha} - 1] \times 100\%$$

where α is the estimated value from the Poisson model. The analyses were conducted using the PROC GENMOD procedure in SAS V9.4.