ANNUAL REPORT

1 JULY 2017 TO 30 JUNE 2018

AUSTRALIA NEW ZEALAND TRAUMA REGISTRY

Management of the Severely Injured

ATR AUSTRALIA NEW ZEALAND TRAUMA REGISTRY

ANNUAL REPORT
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ISBN Print: 978-0-6482870-6-3 ISBN Online: 978-0-6482870-7-0

Suggested citation: Australian Trauma Quality Improvement (AusTQIP) Collaboration (2019). Australia New Zealand Trauma Registry, Management of the Severely Injured, 1 July 2017 to 30 June 2018. Alfred Health, Melbourne, Victoria.

Australia New Zealand Trauma Registry

FOREWORD

On behalf of the Australian Trauma Quality Improvement Program (AusTQIP) Steering Committee, the AusTQIP Collaboration of Australian major trauma centres, and the New Zealand Major Trauma National Clinical Network, it is a pleasure to present the *Australia New Zealand Trauma Registry Annual Report*, *Management of the Severely Injured in Australia and New Zealand, 2017-18*. This is the first time that national trauma data from both countries have been presented together.

During 2017-2018, with support from the Accident Compensation Corporation and the District Health Boards, New Zealand achieved full data collection and was in a position to submit data to the Australian Trauma Registry (ATR). As a result the ATR became the *Australia New Zealand Trauma Registry*, with the formal inclusion of data from seven (7) major trauma centres across New Zealand. To reflect the addition of the New Zealand sites and their trauma data, the ATR and AusTQIP logos have been redesigned to be inclusive of both nations. The AusTQIP Steering Committee elected to keep the acronym ATR to describe the Australia New Zealand Trauma Registry. As the AusTQIP collaboration is the collaboration of all major trauma centres in Australia, New Zealand has joined AusTQIP under a separate memorandum of understanding, hence its name remains the same.

The annual report content continues to grow and evolve. This year, for the first time, in addition to the inclusion of New Zealand data, risk-adjusted length of stay and mortality have been reported. Also reported are two extra data items representing two trauma process indicators, in line with the Royal Australasian College of Surgeons (RACS) trauma quality indicators: time to CT and Blood Alcohol Concentration. We have also added a special paediatric report, in addition to our usual road trauma and falls supplements.

We are entering an exciting period for the ATR and AusTQIP collaboration. As data improves and the uses expand, we are in a position to expand the process of benchmarking and implementing bi-national collaborative trauma quality improvement activities. In the next financial year, we look forward to the development of new research projects and trauma quality improvement activities. Our long term goal is to include geospatial, cost, pre-hospital provider, police and long term outcome data so that injury prevention strategies can be targeted and evidence-informed.

Please remember that all trauma data collected by the ATR is accessible to all ATR contributors, government, clinical researchers and the public. We encourage wider use of the data by all interested parties. For more information about data access please access the new, dedicated, ATR website – www.atr.org.au.

Lastly we are pleased to announce a publication, in 2018, that summarises the development of the Australian Trauma Registry from being flagged in 1993 by RACS and the Australasian Trauma Society to its current form - Fitzgerald MC, Curtis K, Cameron P, Ford JE, Howard TS, Crozier JA, Fitzgerald A, Gruen RL, Pollard C (2018) The Australian Trauma Registry, ANZ Journal of Surgery (In press).

Professor Mark Fitzgerald
Co-chair ATR Steering Committee

Professor Kate Curtis
Co-chair ATR Steering Committee

Professor Ian Civil
National Clinical Lead
New Zealand Major Trauma National Clinical Network

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2017-18 YEAR IN REVIEW
AUSTRALIA

PATIENT

8,454 severely injured

median **AGE 49**

73% **MALE**

35% occured on the **WEEKEND**

MECHANISM

94% **BLUNT** trauma

3.7% penetrating **trauma**

<1% BURNS

36% caused **by falls**

45% **caused by transport** related trauma

PLACE

51% injuries occurred on **streets & highways**

27% injuries occurred at home

ARRIVAL

69% direct from scene to definitive **HOSPITAL**

Median time from scene **to definitive care** **1hr 27mins**

HOSPITAL

Median time **spent in ED** **4hrs 12mins**

median **length** of stay **7days**

36% **admitted to ICU**

median ICU length of stay **3.7 DAYS**

OUTCOMES

842 in-hospital **deaths** **1 in 10**

41% of deaths **aged 75+**

16.2% **died** in ED

62% discharge home

24% to rehabilitation

2017-18 YEAR IN REVIEW
NEW ZEALAND

PATIENT

1,319 severely injured

median **AGE 45**

71% **MALE**

37% occured on the **WEEKEND**

MECHANISM

96% **BLUNT** trauma

2.9% penetrating **trauma**

1.3%BURNS

29% caused by falls

54% caused by transport related trauma

PLACE

50% injuries occurred on **streets & highways**

23% injuries occurred at home

ARRIVAL

76% direct from scene to definitive **HOSPITAL**

Median time from scene to definitive care **1hr 45mins**

HOSPITAL

Median time **spent in ED** **4hrs 24mins**

median **length** of stay **7days**

37% **admitted to ICU**

median ICU length of stay **2.6 DAYS**

OUTCOMES

124 in-hospital **deaths** **9.4%**

35% of deaths **aged 75+**

7.3% **died** in ED

57% discharge home

21% to rehabilitation

EXECUTIVE SUMMARY

The importance of credible, reliable data from trauma registries has been shown to drive improvements to trauma systems. For the first time, in this report, we have data from major trauma services across Australia and New Zealand, allowing meaningful comparisons of processes and outcomes for injured patients across both countries. In addition, we have included risk-adjusted outcomes, ensuring data that is beyond the control of the clinician or health service is compared.

This annual report covers dates of injury between 1 July 2017 to 30 June 2018 for severely injured patients (injury severity score greater than 12 or in-hospital death following injury) from 24 Australian and seven New Zealand designated trauma centres.

In 2017-18 the ATR received data for 9,773 patients (8,454 in Australia, 1,319 in New Zealand). Overall, men continued to be over-represented, accounting for 73 percent of severe injuries.

Bi-nationally, ninety-five percent of severe injury was caused by blunt mechanisms, with 3.5 percent due to penetrating trauma, and less than one percent due to burns.

Forty-eight percent of severe injuries were transport-related and 35 percent falls-related, accounting for 83 percent of all severe injuries.

A major change is occurring in the epidemiology of severe injuries with older patients injured from low falls increasingly the predominant group experiencing severe injury and death (1,2). Low falls accounted for 21.3% of all severe injuries. The median (IQR) age for low falls was 74 (57-84) years with 15.6 per cent mortality and 85.6 percent of deaths aged 65 years and above. Over 70% of low falls occurred in the home with this number increasing for older people aged 75 years or older (82%). Excluding deaths, 52.4% were discharged home and 26.1% were discharged to a rehabilitation facility.

Seventy percent of severely injured patients were transferred from the scene directly to definitive care. Of these, 74.5 percent were transported directly from the scene to definitive care by road ambulance, 17.2 percent by helicopter and 3.9 percent arrived via private vehicle/walk-in.

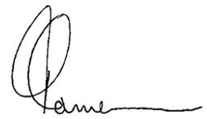
The median (IQR) time from scene to arrival at definitive care was 1.48 (1.07-2.25) hours and the median (IQR) time spent in the emergency department was 4.22 (2.42-7.07) hours. The median time to first head computed tomography (CT-Head) for patients with a total GCS less than 13 was 0.73 (0.43-1.23) hours from time of arrival.

The median (IQR) length of stay in hospital was 7.0 (3.7-14.0) days and the median (IQR) intensive care unit length of stay was 3.0 (2.0-8.0) days. Overall in-hospital mortality was 9.9 percent with 15.1% of deaths occurring in the emergency department.

Length of stay and mortality were risk adjusted for age, mechanism, arrival Glasgow Coma Scale, shock index and injury severity. No significant difference were noted across sites or age groups for length of stay, however some sites fell outside the 95% confidence intervals for mortality. Small numbers made it difficult to interpret.

At the conclusion of the acute care episode most severely injured people were discharged home (62 percent), or to a rehabilitation facility (24 percent).

This report provides a bi-national view of severe injury resulting in hospitalisation. It is hoped that as data quality and completeness continues to improve, together with benchmarking, that further improvements in preventable death and morbidity post severe injury will occur.



Professor Peter Cameron
University Representative
Monash University

BI-NATIONAL MAP

AUSTRALIA

NEW ZEALAND

CONTRIBUTING HOSPITALS

By Jurisdictions

AUSTRALIAN CAPITAL TERRITORY (A.C.T.)

Canberra Hospital (from 1 July 2014 to present)

QUEENSLAND (QLD)

Gold Coast University Hospital (from 1 January 2015 to present)

Lady Cilento Children's Hospital
(from 1 December 2014 to present)

Mater Children's Hospital (merged)

Royal Children's Hospital, Brisbane (merged)

Princess Alexandra Hospital (from 1 July 2014 to present)

Royal Brisbane and Women's Hospital

Townsville Hospital No data submitted

NEW SOUTH WALES (N.S.W.)

NSW data submitted by the Institute of Trauma and Injury Management (ITIM)

Children's Hospital, Westmead

John Hunter Children's Hospital

John Hunter Hospital

Liverpool Hospital

Royal North Shore Hospital

Royal Prince Alfred Hospital

St George Hospital

St Vincent's Hospital

Sydney Children's Hospital

Westmead Hospital

NORTHERN TERRITORY (N.T.)

Royal Darwin Hospital

SOUTH AUSTRALIA (S.A.)

S.A. data submitted by the S.A. Department of Health

Flinders' Medical Centre

Royal Adelaide Hospital

Women's and Children's Hospital, SA

TASMANIA (TAS)

Royal Hobart Hospital

No data submitted since the inaugural report (2010-2012)

VICTORIA (VIC)

Victorian data submitted by the Victorian State Trauma Registry (VSTR)

Alfred Hospital

Royal Melbourne Hospital

Royal Children's Hospital

WESTERN AUSTRALIA (W.A.)

Princess Margaret Hospital

Royal Perth Hospital

NEW ZEALAND (N.Z.)

New Zealand data submitted by the New Zealand Major Trauma Clinical Network (NZMTCN)

Auckland City Hospital

Starship Hospital

Middlemore Hospital

Waikato Hospital

Wellington Hospital

Christchurch Hospital

Dunedin Hospital

ABOUT THE DATA

ATR Goals

The ATR is a valuable source of data about major trauma patients across Australia and New Zealand. Its purpose is to help improve the quality of care of trauma patients, and to assist in monitoring trauma systems. The ATR provides the data for monitoring the quality of trauma care provided in the pre-hospital and in-hospital setting. A bi-national registry provides an opportunity to streamline efforts and work towards reducing inconsistencies in care across services and jurisdictions and allows for meaningful comparisons.

This annual report will provide for the first time risk-adjusted outcome data.

Minimum Dataset

ATR data is defined by the Bi-National Trauma Minimum Dataset. Data elements from existing hospital and state-based registries were mapped to the dataset according to standard definitions. If data elements were not already collected by existing data sources, they were not otherwise obtained by the ATR.

The current version of the minimum dataset (Version 1.51) can be downloaded from the ATR website (www.atr.org.au).

INCLUSION/EXCLUSION CRITERIA

The ATR collects data on severely injured patients presenting to one of 33 major trauma centres across Australia and New Zealand.

Inclusion Criteria

Patients admitted to these centres who subsequently die after injury, or who sustain major trauma (defined as an Injury Severity Score greater than 12)[3] are included in ATR data.

Exclusion Criteria

Patients with delayed admissions greater than seven days after injury, poisoning or drug ingestion that do not cause injury, foreign bodies that do not cause injury, injuries secondary to medical procedures, isolated neck of femur fracture, pathology directly resulting in isolated injury, older adults (≥65 years of age) who die with superficial injury only (contusions, abrasions, or lacerations) and/or have co-existing disease that precipitates injury or is precipitant to death (e.g. stroke, renal failure, heart failure, malignancy).

WHAT'S NEW

ATR Website

A new and improved website has been developed for the ATR - www.atr.org.au

Risk Adjustment

This report includes risk adjusted length of stay and mortality for the first time. These variables were adjusted for age, mechanism, arrival GCS, shock index and injury severity. Transfers were removed from analysis (see appendix for detailed analysis). The dedicated working group will continue to further develop ATR risk adjustment.

Data Working Group

The data working group has reconvened with representatives from all States and Territories. The 67-variable dataset continues to be the minimum standard for all hospitals to strive for. Two new variables *Trauma Call* and *Tertiary Survey* will be introduced in the new version 1.60, which will be available on the ATR website (www.atr.org.au).

Publications

Fitzgerald MC, Curtis K, Cameron P, Ford JE, Howard TS, Crozier JA, Fitzgerald A, Gruen RL, Pollard C (2018) The Australian Trauma Registry, ANZ Journal of Surgery (In press) (https://atr.org.au/publications-1)

Australian Automobile Association (AAA) quarterly Benchmarking the Performance of the National Road Safety Strategy publication (https://atr.org.au/research)

Pilot Study

Pilot Study: In-hospital Burden of On-Road Trauma: National Incidence of Injury and Linkage to Scene Geolocations

This project will link emergency department data and ambulance service crash site geolocations for all minor and major on-road injuries that present to an emergency department. This pilot study will commence in Victoria, with the three major trauma services and Ambulance Victoria submitting data.

It is predicted this dataset will allow for the identification of more timely trends in on-road crashes, including location, providing an opportunity for proactive solutions to be implemented in order to reduce the burden of on-road trauma on the health care system.

In time, it is anticipated that the project will roll out nationally.

"Road trauma is a leading cause of death and injury in Australia"

DEMOGRAPHICS

Across the 2017-18 financial year (FY) 9,773 episodes of severely injured were collected by the ATR. Australia collected 8,454 episodes from 24 major trauma centres, with similar numbers collected to previous years. New Zealand provided 1,319 episodes of severely injured, from seven trauma centres. Incidence of severe injury varied greatly across hospitals (Figure 1). Hospital details page 14.

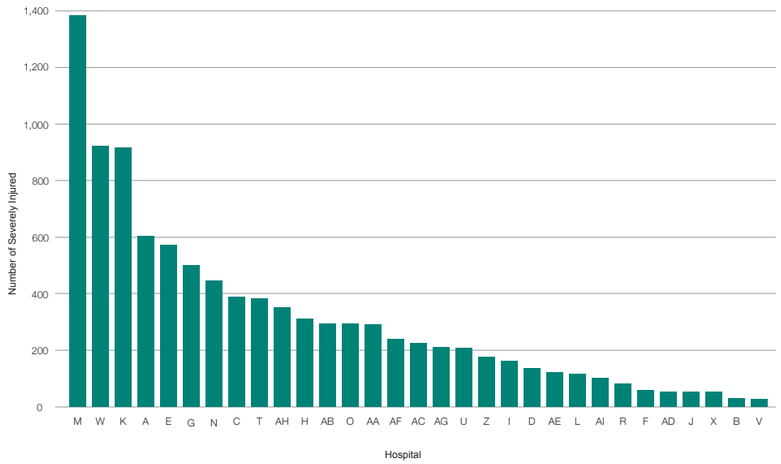


Figure 1. Severe Injury by hospital

AGE AND GENDER

Incidence by age and gender showed that most severe injuries continue to involve the male population (73%). When categorised into 5-year age groups and gender for further analysis interesting variations showed. There were two main age-group peaks for males : the 15-29 year olds and the 45-59 year olds. For females, there were three peaks in incidence, at 15-29 years, 50-64 years, and 75-89 years. Males experienced their highest incidence in the 15-29 year range and females in the 75+ range (Figure 2).

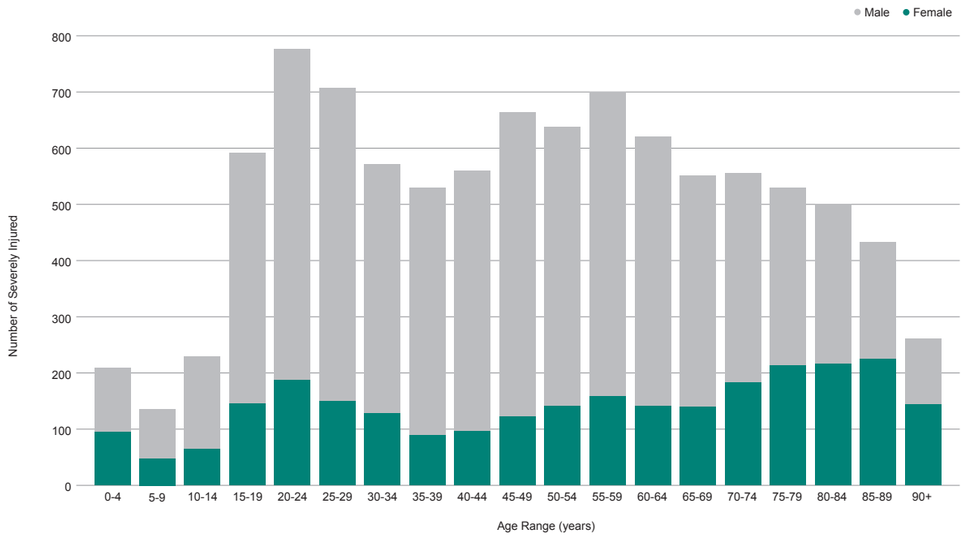


Figure 2. Severe Injury by Age Range

INJURY EVENT

DAY OF INJURY

Incidence of severe injuries by the day of the week revealed similar results to previous years. Saturday and Sunday remains the predominant days for injury, with 35 percent of injuries occuring over the weekend.

Day of injury by mechanism found interesting variations from the aggregate numbers. Whilst most falls and transport-related injuries had peak incidence over the weekend some groups such as pedal cyclists and motorcyclists had significantly more injuries occurring on the weekends. Conversely, pedestrians had peak injuries occurring on Thursdays and Fridays with lower numbers over the weekend (Figure 3).

Figure 3. Severely Injured by Weekday and Mechanism

PLACE OF INJURY

Eighty-eight per cent of severely injured patients had a known place of injury, with 50.5 per cent occurring on the street or highway and 26.3 per cent occurring at home. In the home was the most common place of injury aged 0-4 years old (63.2 per cent) and 75 years and older (60.2 per cent). The street and highway was the most prevalent injury place for all other age groups, peaking in the 16 to 25 years age group (70 per cent). The category ‘home’ for patients aged 75 years and above includes residential aged care due to the numbers who live in aged care facilities (11 per cent).

INTENT OF INJURY

Injury intent was specified for 77.7 per cent of all severe injuries. 85.1 per cent were unintentional, 8.5 per cent were assaults and 5.1 per cent intentional self-harm. Injury intent data was provided by all hospitals, up from ten hospitals in the previous financial year.

CAUSE OF INJURY

Falls-related and transport-related injuries accounted for 83.3 per cent of all severe injuries and continue to lead in-hospital admissions for severe injury (see figure 4). Thirty-five per cent of all severe injuries were caused by falls, low falls 21.3 per cent and high falls 14 per cent. Of this cohort, low falls accounted for 60.2 per cent of all falls. Forty-eight per cent of severe injuries were transport related. Of this, 43.6 per cent were motor vehicle, 26.9 per cent were motorcyclists, pedal cyclists were 13.3 per cent and pedestrians were 13.1 per cent.

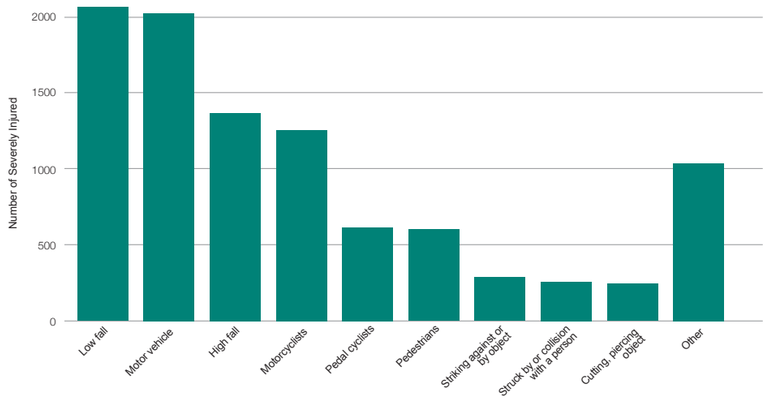


Figure 4. Severely Injured by Cause

Transport and falls-related injuries were the most common injury across all jurisdictions (figure 5). Low falls were the most common injury for two jurisdictions (B and G), and motor vehicle injuries were the most common for all other jurisdictions. Low falls were more common than high falls across seven of the eight jurisdictions.

Figure 5. Severely Injured by Cause, Jurisdictions

INJURY

SEVERITY OF INJURY

In the 2017-18 financial year, the proportion of severely injured categorised by Injury Severity Score (ISS) range was comparable with the previous three years. Most injuries admitted to hospital had an ISS between 16 and 24 (44.4%). When the cohort was broken down into gender, similar proportions by ISS Range occured.

ISS greater than 25 were most prevalent in the pedestrians and low falls populations whilst the less severe injuries occurred in the pedal cyclists and motorcyclists populations (figure 6).

ISS<12 DEATHS

The ATR also collects data on in-hospital deaths with an ISS less than 12. For the 2017-18 financial year there were 117 patients.

- 78 per cent were aged 65 years and older
- 64 per cent were caused by a low fall
- 9.4 per cent died in ED
- Those alive at ED discharge, 61.3 per cent went to the ward, 27.4 per cent to ICU.

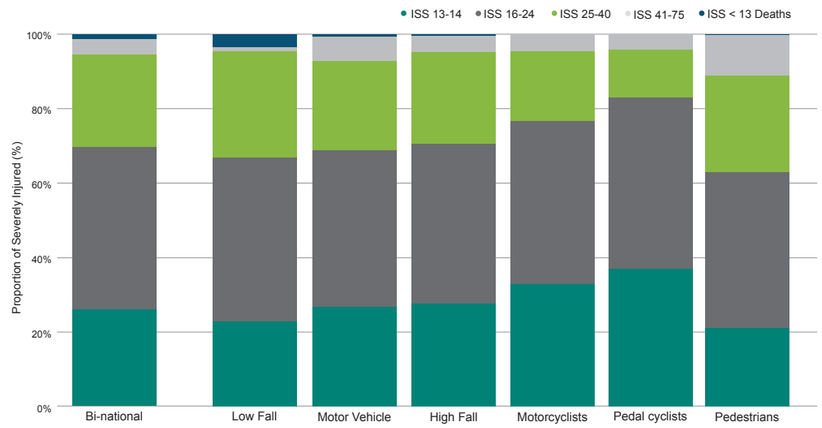


Figure 6. Proportion of Injury Severity by Mechanism

INJURIES SUSTAINED

Multiple injuries were the most prevalent across all jurisdictions for the severely injured, followed by ‘head and other associated injuries’ and ‘isolated head injuries’ (figure 7).

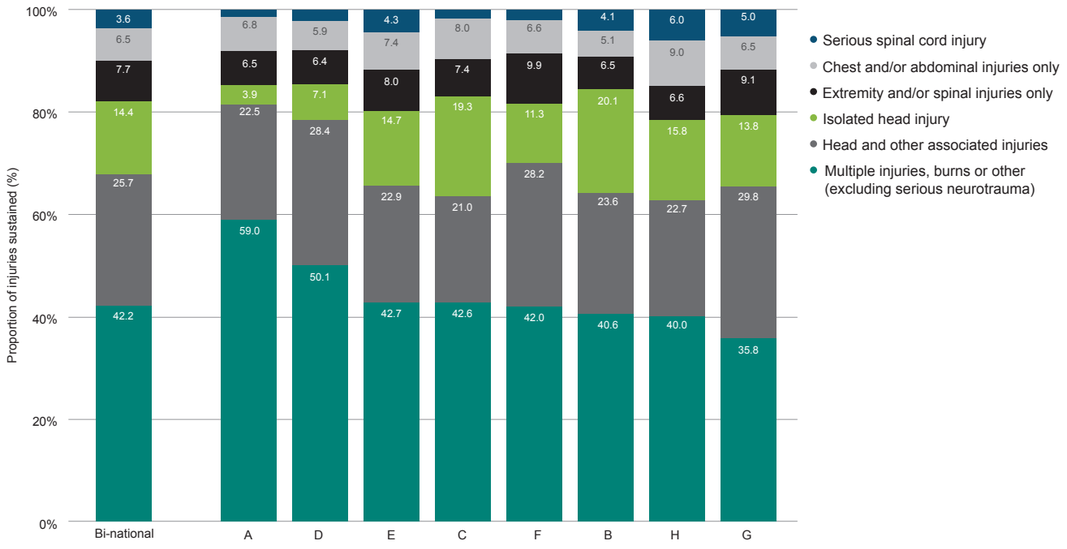


Figure 7. Injuries Sustained by Jurisdictions

Multiple injuries, burns or other = includes multiple body region injuries (excluding serious neurotrauma), burns and other injuries that do not fit into any of the other groups.

Head and other associated injuries = head injury with AIS > 2 in addition to another injury.

Isolated head injury = head injury with AIS > 2 and no other injury with AIS > 1

Extremity and/or spine injuries only = extremity injury with AIS > 1 and/or spine injury with AIS 2 or 3 and no other injury with AIS > 1

Chest and/or abdominal injuries only = chest and/or abdominal injury with AIS > 2 and no other injury with AIS > 1

Serious spinal cord injury = spinal cord injury with AIS > 3 with or without other injuries

TRANSPORT TO HOSPITAL

Over two-thirds (70%) of severely injured patients were transported direct from the scene to definitive care. Of those transported direct, 77.1 per cent arrived via road ambulance, 17.8 per cent via helicopter and 4.1 per cent via private vehicle/walk-in.

The number of patients who arrived to definitive care either directly from the scene or via a different health service, varied between jurisdictions. Direct transport from the scene to hospital ranged from 42.3% to 76.8% (Table 1).

Jurisdictions	Bi-national	A	B	C	D	E	F	G	H
Transfer	30.3%	28.6%	23.8%	24.9%	23.2%	31.0%	34.1%	57.7%	23.7%
Direct Transport	69.7%	71.4%	76.2%	75.1%	76.8%	69.0%	65.9%	42.3%	76.3%

Table 1. Proportion of transfers and direct transport, by Jurisdictions

TIME FROM SCENE TO EMERGENCY DEPARTMENT

Time to the ED was analysed for patients conveyed directly from scene to definitive care. The median time from scene to definitive care was one hour 29 minutes, similar to the previous financial year (figure 8).

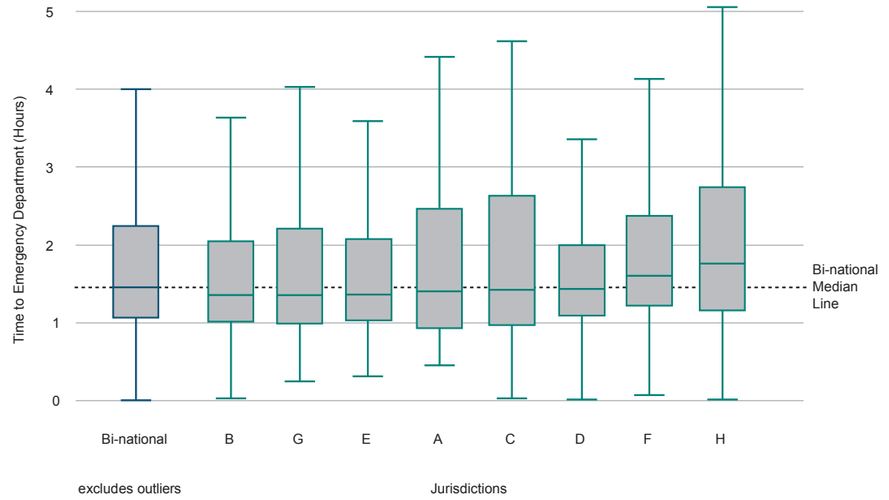
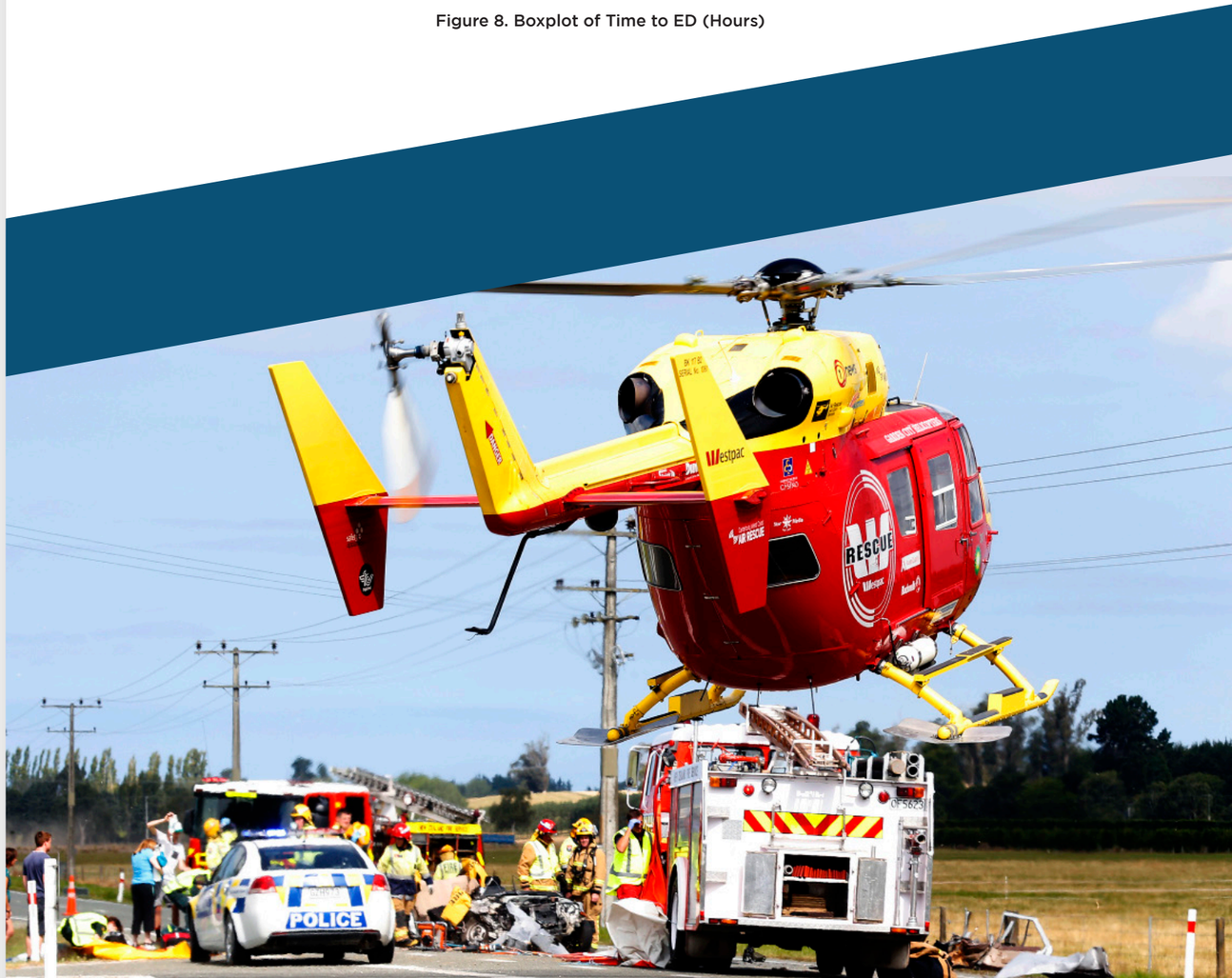


Figure 8. Boxplot of Time to ED (Hours)



TRAUMA CENTRE CARE

TIME TO HEAD COMPUTED TOMOGRAPHY (CT)

Time to first head CT for patients with a total Glasgow Coma Scale (GCS) less than 13, was analysed by jurisdictions (figure 9). 6,341 severely injured (65%) received a head CT. Unknown and incorrect times were removed from analysis, leaving 5,298 patients. Of those, 1,274 arrived to the emergency department with a known total GCS<13. The bi-national median time to head CT for patients arriving with a known total GCS<13 was 44 minutes from time of arrival.

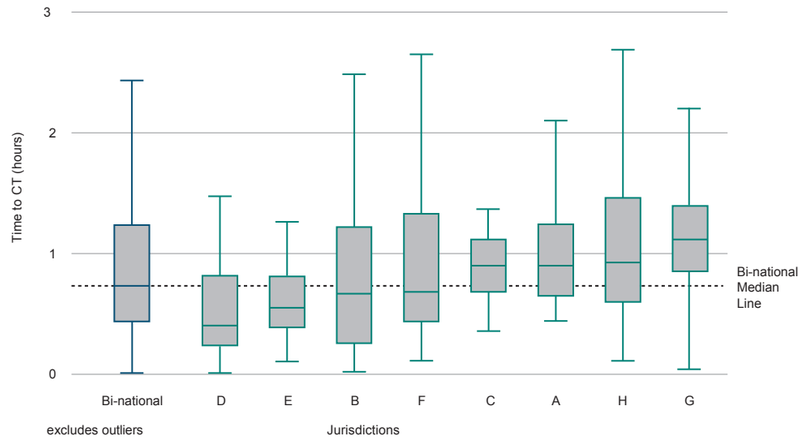


Figure 9. Boxplot of Time to CT (hours)

TIME IN EMERGENCY DEPARTMENT (ED)

The bi-national median time spent in the ED was four hours and 12 minutes. This time fluctuated when categorised by jurisdictions (figure 10). The Australian National Healthcare Agreement, 2018, states the importance of emergency department care remaining within 4-hours is a key performance indicator for improved outcomes.

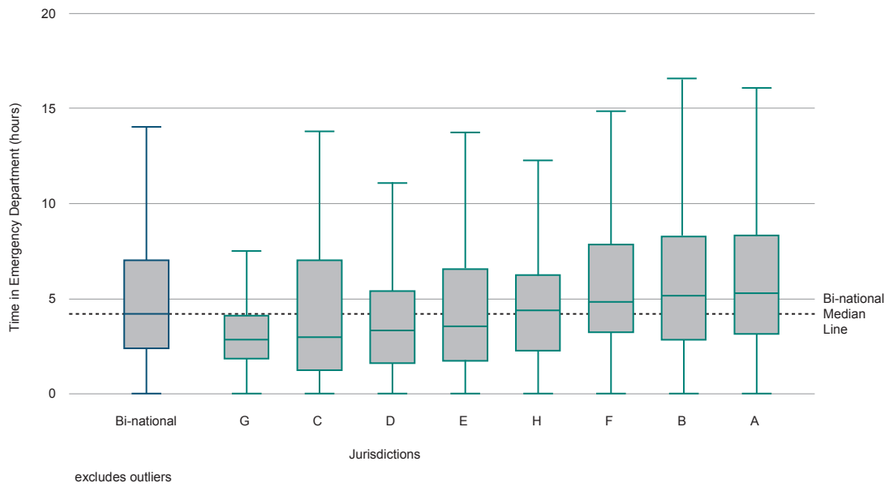


Figure 10. Boxplot of Time Spent in ED (hours)

RISK-ADJUSTED HOSPITAL LENGTH OF STAY (LOS)

The unadjusted bi-national median (IQR) hospital LOS was seven (3.7-14.0) days. When hospitals were risk adjusted for injury severity, age, mechanism, arrival Glasgow Coma Scale (GCS), and shock index there was no difference between hospitals for children (aged <16 years), adults (>=16 and <65 years) and older adults (>=65 years) (figures 11, 12, and 13).

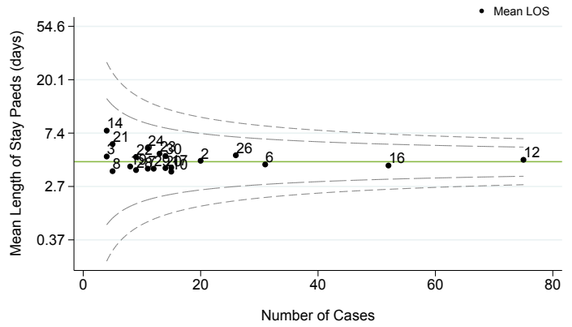


Figure 11. Risk-adjusted mean LOS, paediatrics (<16 years)

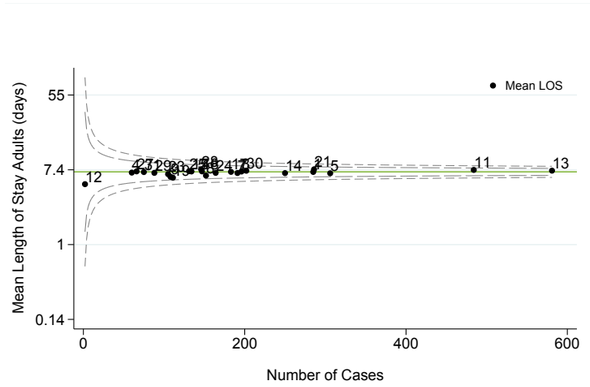


Figure 12. Risk-adjusted mean LOS, adults

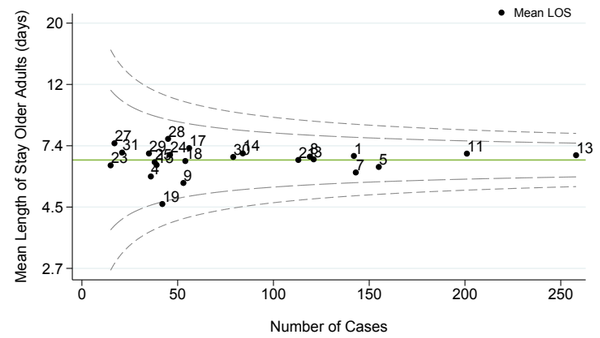


Figure 13. Risk-adjusted mean LOS, older adults (65+ years)

INTENSIVE CARE UNIT LENGTH OF STAY (ICULOS)

The bi-national median (IQR) hospital ICU LOS was 3.0 (2.0-8.0) days (figure 14).

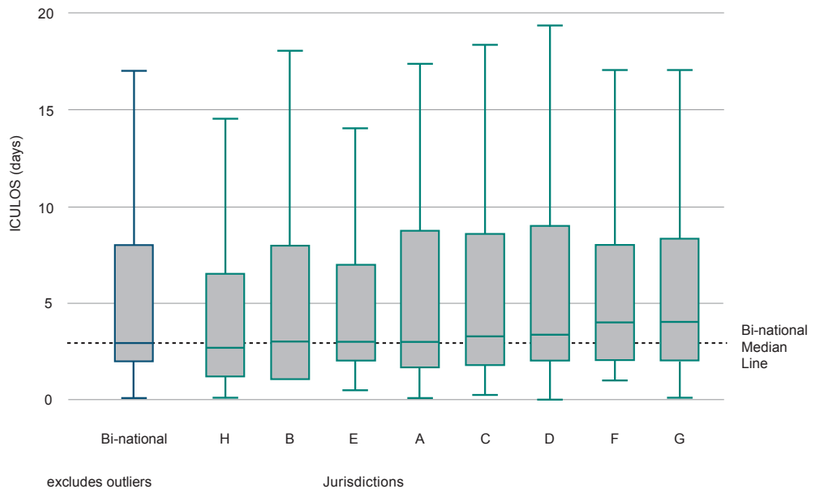


Figure 14. Boxplot of ICU LOS (in days) by Jurisdictions

OUTCOMES FROM INJURY

The primary outcome collected by the ATR is discharge destination (including deaths). Discharge destination was provided for over 98 per cent of patients.

MORTALITY

Nine hundred and sixty six severely injured people died in-hospital with a bi-national mortality rate of 9.9 per cent. Two-thirds (68.3%) of deaths were males. 15.1% died in ED. Pedestrians were most likely to die in the ED, followed by low and high falls. Mortality increased as ISS increased. Just over two-thirds of all deaths had an ISS>24 (67.5%). Categorising by age-groups (figure 15) and injury cause identified further mortality trends in the severely injured. The number one cause of death in the severely injured was low falls, accounting for one in three in-hospital deaths. This was followed by motor vehicle (15%), high falls (14%) and pedestrians (9%).

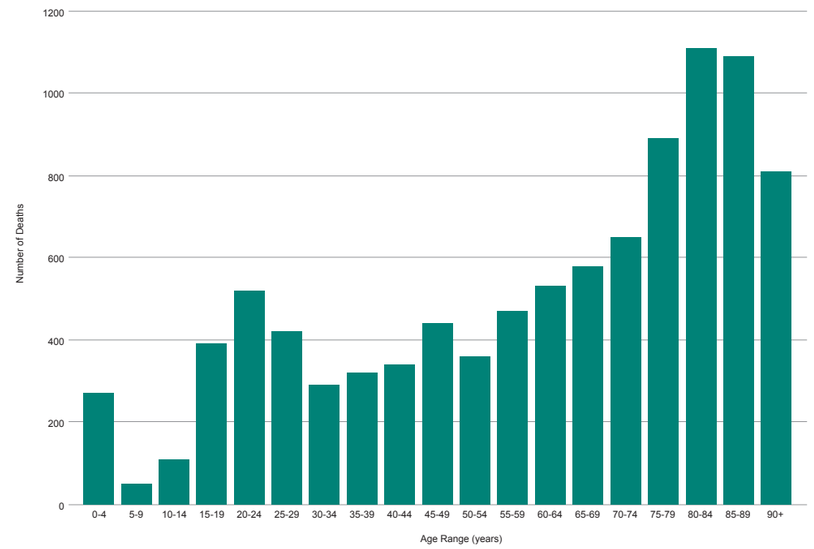
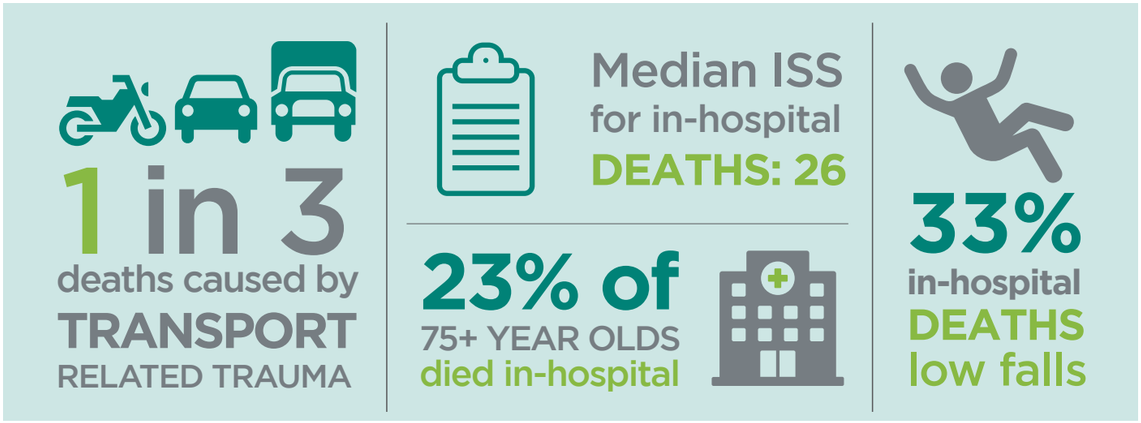


Figure 15. Mortality by Age Range



Risk Adjusted Mortality

Hospitals were risk adjusted for injury severity, age, mechanism, arrival Glasgow Coma Scale (GCS), and shock index. Patients were groups according to three age groups: children (aged <16 years), adults (>=16 and <65 years) and older adults (>=65 years) (figures 16, 17 and 18). Overall, most sites for each age group were within control limits. In the paediatrics population there were no significant differences between sites. In the adult population, sites 27 and 21 were outside the 95% confidence interval and site 13 had a reduction in risk adjusted mortality (Figure 17). In the older adult population all but site 18 were within control limits (Figure 18), however smaller numbers in this subgroup, make it difficult to make robust comparison of results.

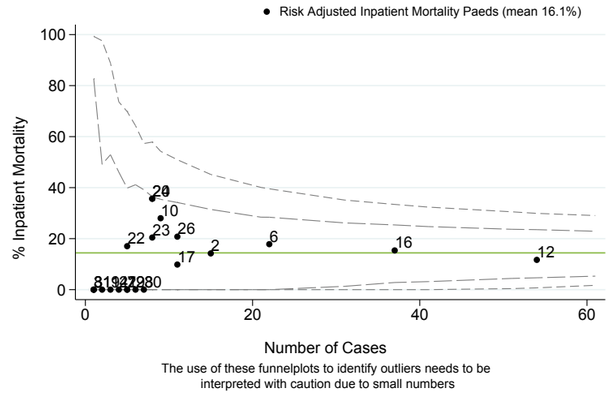


Figure 16. Risk-adjusted Mortality, paediatrics (<16 years)

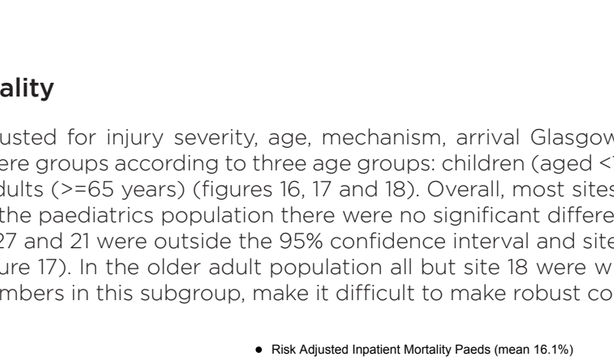


Figure 17. Risk-adjusted Mortality, adults

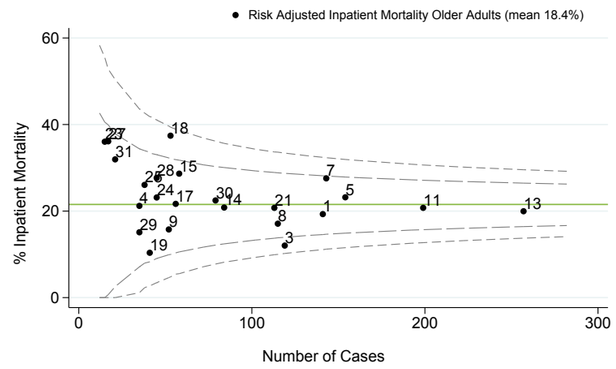


Figure 18. Risk-adjusted Mortality, older adults (65+ years)

DISCHARGE DESTINATION

A known discharge destination was collected for 99 per cent of patients. For patients discharged alive, the proportion of patients discharged home decreased as injury severity increased and patients discharge to inpatient rehabilitation increased with injury severity. A similar trend occurred with age. As age increased, the likelihood of being discharged home decreased and being discharge to inpatient rehabilitation increased (figure 19).

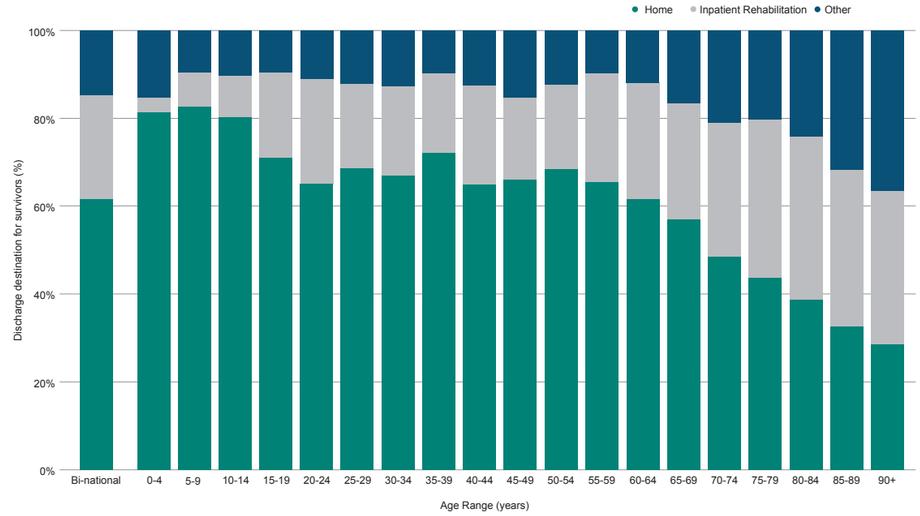


Figure 19. Discharge Destination (excluding deaths) by Age Group

APPENDIX A - GOVERNANCE COMMITTEES

ATR STEERING COMMITTEE MEMBERSHIP

Member	Committee Role
Professor Mark Fitzgerald	Co-chair/Alfred Health/NTRI representative
Professor Kate Curtis	Co-chair/University representative
Professor Peter Cameron	University representative
Dr Ian Civil	NZ National Trauma Clinical Lead
Ms Bronte Martin	National Critical Care & Trauma Response Centre (NCCTRC) Executive Sponsor
Mr Chris Clarke	South Australia representative
Professor Cliff Pollard	Queensland representative
Dr David Read	Northern Territory representative
Associate Professor Michael Dinh	New South Wales representative
Dr John Crozier	Royal Australasian College of Surgeons representative
Dr Grant Christey	RACS TQI Representative
Professor Michael Reade	Australian Defence Fore representative
Mr Nick Rushworth	Consumer representative
Dr Sandy Zalstein	Tasmania representative
Dr Sudhakar Rao	Western Australia representative
Associate Professor Anthony Joseph	Australasian Trauma Society representative
Professor Rodney Judson	Victoria representative
Dr Joseph Matthew	Australasian College of Emergency Medicine representative
Dr Rebekah Ogilvie	Australian Capital Territory representative
Dr Teresa Howard	NTRI Manager
Ms Emily McKie	Manager, Australia New Zealand Trauma Registry
Ms Kathleen McDermott	NCCTRC Representative
Proxies, Adjuncts and Observers	
Associate Professor Kirsten Vallmuur	Queensland representative
Ms Jane Ford	Australia New Zealand Trauma Registry
Ms Siobhan Isles	NZ Trauma Network
Mr Huat Lim	NCCTRC
Ms Maxine Burrell	Royal Perth Hospital

MANAGEMENT COMMITTEE MEMBERSHIP

Member	Committee Role
Professor Mark Fitzgerald	Co-chair/Alfred Health/NTRI representative
Professor Kate Curtis	Co-chair/University representative
Professor Cliff Pollard	State Trauma representative
Dr Teresa Howard	NTRI Manager
Professor James Harrison	Consultant expert, Australian Institute of Health & Welfare
Professor Belinda Gabbe	Monash University representative
Ms Sue McLellan	Monash University representative
Ms Mimi Morgan	Monash University representative
Professor Peter Cameron	Monash University representative
Ms Jane Ford	Australia New Zealand Trauma Registry representative
Ms Emily McKie	Australia New Zealand Trauma Registry representative

APPENDIX B - ADDITIONAL DATA

TABLES

ED Disharge Destination	ISS 13-14		ISS 16-24		ISS 25-40		ISS 41-75		Total	
	n	%	n	%	n	%	n	%	n	%
Ward	1,788	38.0%	2,250	47.8%	647	13.8%	20	0.4%	4,705	100%
ICU	264	11.8%	905	40.3%	893	39.8%	182	8.1%	2,244	100%
HDU	264	30.7%	441	51.2%	149	17.3%	7	0.8%	861	100%
OR	132	10.8%	427	34.8%	514	41.9%	154	12.6%	1,227	100%
Transfer to another hospital	14	24.6%	30	52.6%	13	22.8%	0	0.0%	57	100%
Death in ED	7	5.2%	17	12.7%	68	50.7%	42	31.3%	134	100%
Total	2,469	26.8%	4,070	44.1%	2,284	24.8%	405	4.4%	9,228	100%

Table 1. Injury Severity by ED Discharge Destination

Disharge Destination	ISS 13-14		ISS 16-24		ISS 25-40		ISS 41-75		Total	
	n	%	n	%	n	%	n	%	n	%
Home	1,885	35.2%	2,600	48.5%	822	15.3%	55	1.0%	5,362	100%
Inpatient Rehabilitation	342	16.7%	877	42.9%	681	33.3%	144	7.0%	2,044	100%
Other	272	21.3%	598	46.8%	372	29.1%	37	2.9%	1,279	100%
Death	37	4.4%	160	18.9%	472	55.7%	178	21.0%	847	100%
Total	2,536	26.6%	4,235	44.4%	2,347	24.6%	414	4.3%	9,532	100%

Table 2. Injury Severity by Discharge Destination

Cause of Injury (Mechanism)	ISS 13-14		ISS 16-24		ISS 25-40		ISS 41-75		Total	
	n	%	n	%	n	%	n	%	n	%
Motor Vehicle	547	27.1%	855	42.3%	482	23.8%	138	6.8%	2,022	100%
Fall - Low	469	23.6%	912	45.8%	593	29.8%	16	0.8%	1,990	100%
Fall - High	378	27.8%	585	43.0%	336	24.7%	63	4.6%	1,362	100%
Motorcyclists	411	32.8%	549	43.8%	235	18.8%	57	4.6%	1,252	100%
Pedal cyclists	229	37.0%	285	46.0%	80	12.9%	25	4.0%	619	100%
Pedestrians	128	21.1%	255	42.0%	158	26.0%	66	10.9%	607	100%
Striking against or by object	71	24.7%	141	49.1%	70	24.4%	5	1.7%	287	100%
Struck by or Collision with a person	58	22.5%	150	58.1%	49	19.0%	1	0.4%	258	100%
Cutting, Piercing Object	54	22.0%	117	47.6%	67	27.2%	8	3.3%	246	100%
Other Transport Related	37	25.9%	68	47.6%	31	21.7%	7	4.9%	143	100%
Other Threat to Breathing	4	4.3%	17	18.5%	71	77.2%	0	0.0%	92	100%
Fire, Flames, Smoke	12	14.3%	28	33.3%	30	35.7%	14	16.7%	84	100%
Firearm	8	17.0%	13	27.7%	22	46.8%	4	8.5%	47	100%
Submersion or Drowning	1	2.4%	9	22.0%	29	70.7%	2	4.9%	41	100%
Total	2,407	26.6%	3,984	44.0%	2,253	24.9%	406	4.5%	9,050	100%

Table 3. Injury Severity by Cause of Injury

APPENDIX C - ATR METHODOLOGY

Governance

The National Trauma Research Institute (NTRI), founded in 2003, is a collaboration between Alfred Health, Monash University and Gold Coast University Hospital and Health Service. The NTRI collaborates with organisations nationally and internationally to integrate Research, Education, Medical Technologies and Trauma Systems Development to improve clinical care and outcomes.

In 2012, the NTRI established the Australian Trauma Quality Improvement Program (AusTQIP) including the Australian Trauma Registry (ATR) bringing together Australia's 26 designated trauma centres to form a collaboration to provide important data on the most severely injured. In 2018, New Zealand joined the collaboration, introducing a further seven designated trauma centres to the registry, bringing the total number of sites to 33. This is the first report for the bi-national collaboration, now known as the Australia New Zealand Trauma Registry (ATR).

AusTQIP was formed with an overarching Steering Committee comprised of representation from all jurisdictions, and other participating stakeholders (Appendix A). Reporting to the Steering Committee is the AusTQIP Management Committee (Appendix A).

The ATR is supported by the Department of Infrastructure, Regional Development and Cities (DIRDC) and the Department of Health (DOH), who have provided funding for the period 16 May 2017 to 30 June 2019. The ATR is also supported by the New Zealand Major Trauma National Clinical Network and the NTRI, as well as by the large group of contributing sites.

Data Analysis

Risk adjusted outcomes are provided in this report. The primary outcomes were inpatient mortality and length of stay (LOS). For both outcomes, funnel plots were created as a visual representation of how individual sites fare compared to their peers and the overall average; it also identifies those who are performing better or worse than the average. The funnel plot contours represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits) from the mean, those above and below these lines are considered outliers, with a 5% and 0.2% chance of a false positive respectively.

Both crude and risk-adjusted funnel plots were calculated. For inpatient mortality, the binary logistic regression model was used and for LOS, the linear regression with a logarithmic transformation was used due to right skewness in the data. We then back transformed the risk-adjusted LOS. The following risk factors were included in the model as they were deemed to be clinically significant a-priori: age-group, cause of injury, arrival Glasgow Coma Scale (GCS) - motor, shock-index grouped in quartiles and ISS score. In addition we also evaluated the inclusion of gender and AIS head score, but found that only AIS score contributed significantly to inpatient mortality, but not LOS. We ran separate analysis for paediatric (age ≤15 years), adult (16≤age≤64) and older adults (age≥65). Data analysis was performed in Stata V14.0 (Stata Corp, College Station, Tx, USA) and level of significance set at 5%.

Data Definitions

Emergency Department length of stay (ED LOS) is calculated by the ATR based on the date and time of arrival at the definitive care hospital to the emergency department discharge date and time. ED LOS is presented as hours.

Intensive Care Unit length of stay (ICU LOS) is based on values provided by the designated trauma centres or as reported by the state-based trauma registries. ICU LOS is presented as days.

Hospital length of stay (LOS) is from date and time of arrival at definitive care hospital to the date and time of discharge from definitive care hospital as reported. Hospital LOS is based on values provided by the designated trauma centres or as reported by the state-based registries. Hospital length of stay is presented as days.

External cause of injury International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification[4] (ICD-10-AM) codes were used to define causes/mechanisms of injury, injury type and injury intent. Causes of injury were based on the Center for Disease Control's External Cause of Injury and Mortality Matrix (www.cdc.gov/nchs/data/ice/icd10_transcode.pdf).

Type of injury was based on ICD-10-AM codes as previously reported[5]. Codes were mapped to injury types in the BNTMDS.

Data Confidentiality

In 2016, Monash University, Department of Epidemiology and Preventive Medicine, became the custodian of the ATR data and responsible for all reporting.

All jurisdictional data is de-identified in order to maintain hospital confidentiality as per the collaboration agreement.

Each hospital and jurisdiction has been allocated a unique identifier which is consistent throughout the report.

Data Quality

Data submitted to the ATR underwent various validity checks such as date and time formats and chronology, and correct classification as per the ICD-10-AM and Abbreviated Injury Scale 2005 (Updated 2008)[6] (AIS) codes prior to data processing. If data did not pass these validations, an error file was generated and a notification sent to sites submitting the data to address and correct the error, if possible.

Data contribution varies between hospitals as not all hospitals have all the BNTMDS data points available. However this continues to improve, along with data completeness as the hospitals update data systems and improved data quality processes are put in place.

Severity of Injury

Injury Severity Score (ISS) is an internationally-standardised approach to describing the overall severity of injury for each patient. The calculated value enables comparison between cohorts of injured patients, and can be used for inclusion into trauma registries. The higher the number the more severe the injury, ranging from one to 75.

Trauma patients are allocated an ISS after injury in order to determine their status as 'major trauma'. For this report major trauma is defined as an ISS > 12, which is derived from the Abbreviated Injury Scale (AIS) 2008. ISS is useful for predicting hospital length of stay, and associated morbidity and mortality.

ABBREVIATIONS

AIS	Abbreviated Injury Scale 2005 (update 2008)
ATR	Australia New Zealand Trauma Registry
AusTQIP	Australian Trauma Quality Improvement Program
BNTMDS	Bi-National Trauma Minimum Dataset of Australia and New Zealand
DOH	Department of Health
DIRDH	The Department of Infrastructure, Regional Development and Cities
ED	Emergency Department
EDLOS	Emergency Department Length of Stay
FY	Financial Year
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
ICU	Intensive Care Unit
ICU LOS	Intensive Care Unit Length of Stay
IQR	Interquartile Range
ISS	Injury Severity Score
LOS	Length of Stay
NTRI	National Trauma Research Institute
RACS	Royal Australasian College of Surgeons

ACKNOWLEDGEMENTS

The members of the Steering Committee and Management Committee.

The Registry and data managers who have collected and submitted data to the ATR and have been the first points of contact for ATR data management:

Mr Ben Gardiner; Ms Elissa Scriven; Ms Maxine Burrell; Ms Olivia Zheng; Mr Huat Hock Lim; Ms Lauren Harvey; Mr Hardeep Singh; Ms Amy Harney; Mr Cameron Palmer; Ms Helen Thomas; Ms Sue McLellan; Mr Joseph Sharpe; Ms Deb Wood.

The New Zealand Major Trauma National Clinical Network, particularly Dr Ian Civil, National Clinical Lead and Ms Siobhan Isles, NZ Trauma Network.

Grateful thanks also goes to the site investigators for their ongoing cooperation, and to all other contributors who have indicated their interest in the ATR.

This report has been prepared by Ms Emily McKie, Manager, ATR.

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IMAGE SOURCES

New Zealand Trauma Network pg 12, 14, 23

national trauma research institute

AusTQIP

Major Trauma National Clinical Network

MONASH University

The Australian Trauma Registry is supported by funding from:

Australian Government
Department of Health

Australian Government
Department of Infrastructure, Regional Development and Cities
Bureau of Infrastructure, Transport and Regional Economics