ANNUAL REPORT
1 JULY 2022 TO 30 JUNE 2023

AUSTRALIA
NEW ZEALAND
TRAUMA REGISTRY
Management of the
Severely Injured

ANZTRI AUSTRALIA NEW ZEALAND TRAUMA REGISTRY

ANNUAL REPORT
1 JULY 2022 TO 30 JUNE 2023

CONTENTS

Errata notice: An earlier version of this report, dated 2024, contained incomplete data for Townsville University Hospital, Queensland Children's Hospital and Waikato Hospital. This has been corrected in the current version of the report, published in 2025.

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The Australia New Zealand Trauma Registry (2025). Annual Report 2022/23. Alfred Health Melbourne, Victoria.

@ANZTrauma

FOREWORD

It is with great pleasure that we present the Australia New Zealand Trauma Registry (ANZTR) 2022/23 annual report.

A key enabler to the ANZTR has been the funding provided by three agencies, the Australian Federal Department of Health and Aged Care, The Bureau of Infrastructure and Transport Research Economics (BITRE), and the Te Whatu Ora – Health New Zealand. The 4-year funding contract with the Department of Health and Aged Care commenced July 2023 and key advancements within the ANZTR to date include:

- Launching the ANZTR clinician facing portal at contributing sites (an interactive, secure online platform to enhance 'feedback loop' reporting to clinicians) and working towards release of a public facing portal;
- Enhancing the governance of the ANZTR including development of a privacy management plan and commencing the establishment of a data governance group, as well as expanding the Board composition to have a broader representation across more jurisdictions;
- Finalising the move to the national mutual acceptance model for ethical oversight of the ANZTR;
- Assisting sites to transition to the updated Bi-National Trauma Minimum Data Set (V2.0); and
- Examining options for expanding the ANZTR's value through data linkages with other national health data sources.

We are delighted to present our new design for the first time. Designed by artist Sam Walker-Wilson, this image represents the patient journey. Sam describes this artwork so eloquently in her own words, which we share as follows:

This image represents the journey of a patient who has experienced trauma. The hand and footprints are black signifying the darkness of trauma and the impact it has. The red medicine flowers are of great cultural significance representing healing and the care provided by all healthcare professionals. And the meeting places are the site of trauma or at hospital where family, first responders or health professionals have gathered.

At its core, the ANZTR is an important tool to drive quality improvement in trauma care in Australia and New Zealand. In this report we have chosen to focus a special section on major trauma in older people, given the large and increasing proportion of major trauma associated with older people.

This annual report is a collaborative effort by everyone involved in the collection of data and the care of the trauma patient. We acknowledge the efforts of all who have contributed to this report and in particular the Department of Health, BITRE, and Te Whatu Ora – Health NZ, who fund this work to support quality trauma care.

Thank you to Siobhan Isles (Co-Chair of the Board), Dr Don Campbell, and Professor Ian Civil for years of commitment and contributions to the ANZTR. Welcome aboard to our new ANZTR Board members, Dr Max Raos and Dr James Moore (New Zealand), Professor Dieter Weber (Western Australia), Professor Zsolt Balogh (New South Wales), Associate Professor Adam Mahoney (Tasmania) and Professor Kirsten Vallmuur (Queensland, acting Co-Chair of the Board).

Finally, a huge thanks to all the dedicated nurses, doctors, paramedics, administrators, allied health workers, rehabilitators and researchers that contribute to the recovery, rehabilitation and reintegration of the severely injured.

Professor Mark Fitzgerald
Co-Chair ANZTR Board

Professor Kirsten Vallmuur
Co-Chair ANZTR Board

ANZTR Board Members

Professor Mark Fitzgerald

Professor Kirsten Vallmuur

Professor Zsolt Balogh

Prof Peter Cameron

Associate Professor Grant Christey

Associate Professor Daniel Ellis

Dr Yen Kim

Associate Professor Adam Mahoney

Dr James Moore

Dr Max Raos

Professor Dieter Weber

2022-23 YEAR IN REVIEW

AUSTRALIA

DEMOGRAPHICS

10,211 severely injured

median **AGE 53**

73% MALE

34% occurred on the **WEEKEND**

CAUSE OF INJURY

3.2% penetrating **trauma**

<1% BURNS

95.6% **BLUNT** trauma

44% TRANSPORT RELATED

39.2% **FALLS**

PLACE OF INJURY

44.8% streets & highways

29.9% home

PRE-HOSPITAL

71.8% direct from scene to definitive **HOSPITAL**

Median time from injury **to definitive care** **1hr 39mins**

HOSPITAL

Median time **spent in ED** **5hrs 12mins**

MEDIAN **length** of stay **7 days**

31.3% admitted **to ICU**

median **ICU** length of stay **4.0 DAYS**

OUTCOMES

9.7% in-hospital **deaths**

57.5% of deaths **aged 70+**

7.7% **of deaths** OCCURRED IN ED

61.4% discharged **home**

15.8% to rehabilitation

2022-23 YEAR IN REVIEW
NEW ZEALAND

DEMOGRAPHICS

1,897 severely injured

median **AGE 49**

70% MALE

36% occurred on the **WEEKEND**

CAUSE OF INJURY

3.3% penetrating **trauma**
1.4% BURNS

94.8% **BLUNT** trauma

47.2% TRANSPORT RELATED

33.3% **FALLS**

PLACE OF INJURY

45.8% streets & highways

24.8% home

PRE-HOSPITAL

74.6% direct from scene to definitive **HOSPITAL**

Median time from injury **to definitive care** **1hr 48mins**

HOSPITAL

Median time **spent in ED** **4hrs 48mins**

median **length** of stay **7.7 days**

34.2% **admitted** to ICU

median ICU length of stay **3.9 DAYS**

OUTCOMES

9.8% in-hospital **deaths**

44.7% of deaths **aged 70+**

6.0% **of deaths** OCCURRED IN ED

54.8% discharged **home**

20.6% to rehabilitation

EXECUTIVE SUMMARY

Quality improvement in the Australian and New Zealand trauma system

The ANZTR is a leading clinical quality registry which collects, analyses and reports information about processes of care and outcomes delivered by all major trauma services (MTS) across Australia and New Zealand.

The primary purpose of the ANZTR is to drive quality improvement across the contributing trauma systems, from time of injury through to discharge from definitive care.

By identifying areas of unwarranted variation trauma care processes and outcomes – which can then be used to inform strategies to improve patient care and to ensure the most favourable patient outcomes – the ANZTR acts as a fundamental driver in improving the quality and safety of care across Australia and New Zealand.

Major trauma in older persons

This year, the focus section of the annual report is major trauma in older persons.

Older persons represent an increasing proportion of the major trauma population in Australia and New Zealand, with older persons injured from low falls the predominant group experiencing major injury and death [1].

Similar trends have been described elsewhere: in the United States, trauma in older adults is increasing in both number of cases and as a proportion of total trauma centre volume[2], and in England and Wales, older persons now account for over 50% of the severely injured patients in the Trauma Audit and Research Network (TARN) database, with the falls being the commonest mechanism of injury in this patient group[3].

This report highlights that older persons contribute the largest number of deaths and adverse outcomes in hospital, are likely to have a longer length of stay, and are less likely to be discharged home. Benchmarking of outcomes for older patients is expected to improve in future with the inclusion of the frailty index in risk-adjusted modelling, which is now collected as a routine data point in the registry.

Older persons have more complex needs with pre-existent medical conditions, frailty, and they frequently lack social or family supports[1]. The changing demographics have significant implications for future planning of trauma systems. In the context of the projected increases in persons aged 65 years and older in both Australia and New Zealand, it is imperative that trauma systems prepare for this demographic shift which is expected to increase demand across the healthcare system[4,5,6].

Outcomes

The case fatality rate was 9.7% and has remained consistent with previous years. The risk-adjusted mortality rate indicates outliers above the 95% confidence interval in the age group 70 and over; there were no outliers in the paediatric or younger than 70 age groups. Further investigation is required to understand the different survival rates in the older age groups.

The discharge destination to inpatient rehabilitation ranges across jurisdictions, from 12.9% to 34.1%. The likelihood of being discharged to rehabilitation increased with increasing age, and with increasing injury severity. There are significant differences in recovery pathways and the optimal approach to rehabilitation is unclear.

Benchmarking - ANZTR Portal

This year, the ANZTR portal was rolled out across all contributing jurisdictions. The ANZTR portal is an interactive, secure online dashboard for existing sites.

The portal includes data about patient demographics, the injury event, key process indicators, and outcomes. Users can access data from their hospital, and visualise and manipulate these data to make meaningful comparisons with the national aggregate.

It is expected that access to data in a timely manner through the portal will assist with benchmarking.

Data quality

The ANZTR contains high quality data collected in a consistent and systematic way, and recent additions to the minimum dataset will support analysis by ethnicity and other parameters.

The collection of frailty index will enable further development of the risk-adjustment model, significantly improving the methodology for comparing outcomes for older persons.

At present, the registry is examining the level and determinants of data completeness across all variables, including the most recently added data fields. Having a better understanding of the completeness of ANZTR data and comparing data imputation methods will benefit future research and quality improvement initiatives.

The registry continues to work towards data linkage with admitted hospital episodes, prehospital records, and death registries. These linkages will enable comparison of outcomes for transferred patients, and will be essential to use population level data to identify variation in outcomes to improve trauma care.

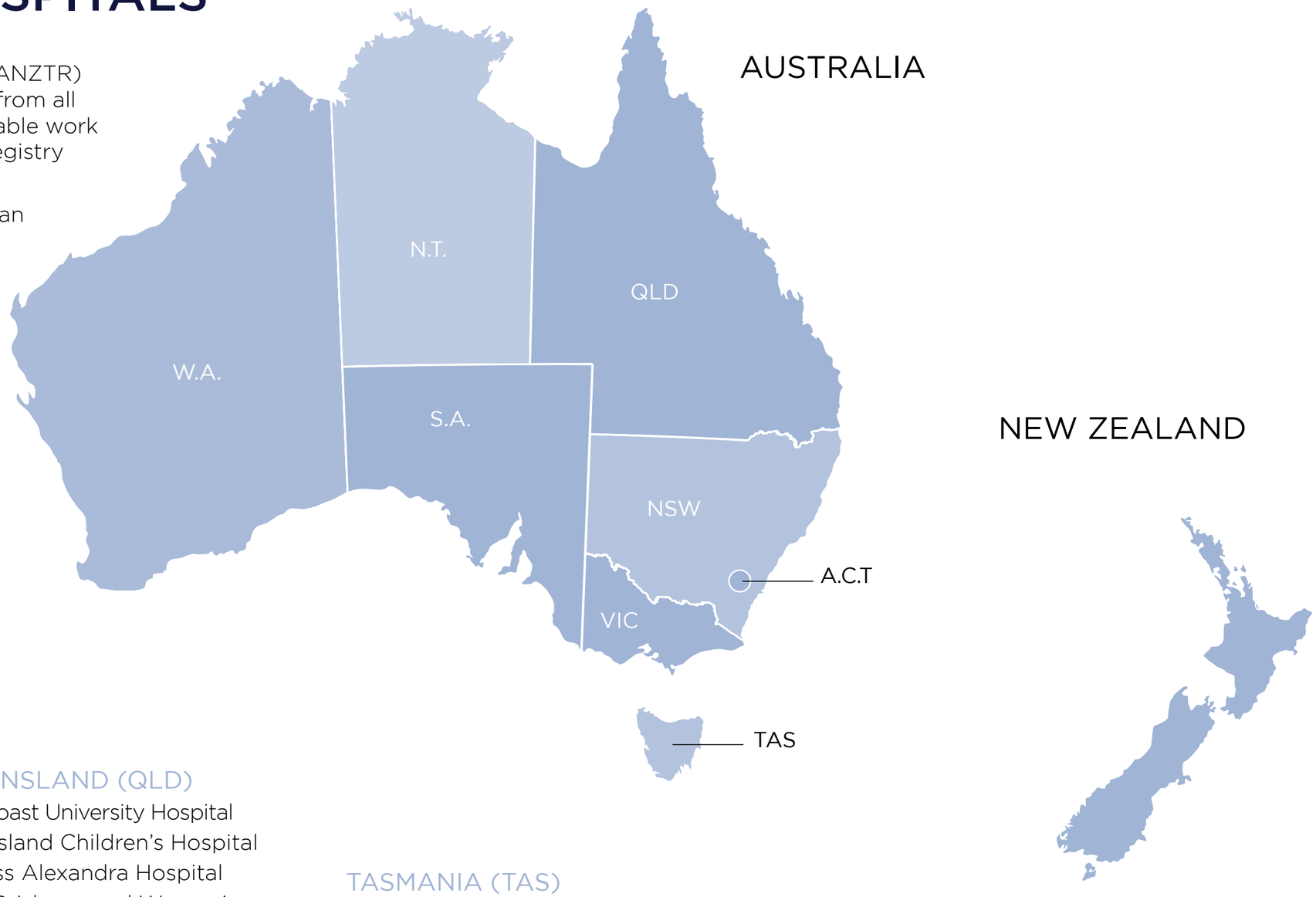
Professor Peter Cameron
University Representative
Monash University

Ancelin McKimmie
ANZTR Manager

CONTRIBUTING HOSPITALS

The Australia New Zealand Trauma Registry (ANZTR) would like to thank the Trauma Registry staff from all contributing registries and sites for the invaluable work they perform on a daily basis to ensure the Registry receives quality data in a timely fashion.

The ANZTR has eight years of quality Australian data from 1 July 2015 to 30 June 2023 and six years of quality New Zealand data from 1 July 2017 to 30 June 2023. Sites which have commenced data submissions after these start dates are mentioned below.



JURISDICTIONS

AUSTRALIAN CAPITAL TERRITORY (A.C.T.)

Canberra Hospital

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

QUEENSLAND (QLD)

Gold Coast University Hospital
Queensland Children's Hospital
Princess Alexandra Hospital
Royal Brisbane and Women's Hospital
Sunshine Coast University Hospital (from 1 October 2018)
Townsville University Hospital (from 1 January 2020)

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
Lyell McEwin (from 1 January 2018)

TASMANIA (TAS)

Royal Hobart Hospital (from 1 April 2020)

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.)

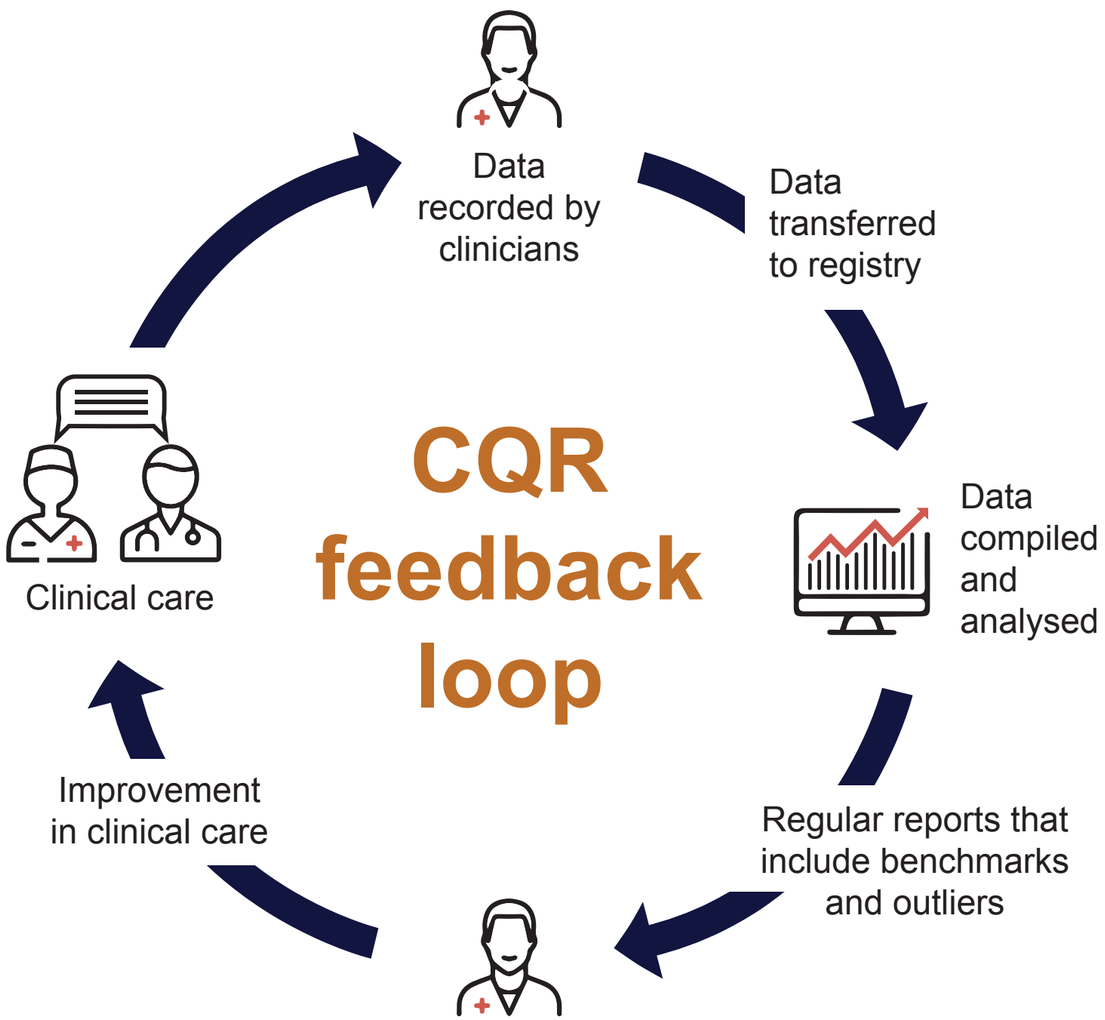
Perth Children's Hospital
Royal Perth Hospital

NEW ZEALAND (N.Z.)

New Zealand data submitted by the New Zealand National Trauma Network (NZMTCN)

Auckland City Hospital
Starship Hospital
Middlemore Hospital
Waikato Hospital
Wellington Regional Hospital
Christchurch Hospital
Dunedin Hospital

THE ANZTR AS A CLINICAL QUALITY REGISTRY



Operating since 2012, the ANZTR has established itself as a leading clinical quality registry (CQR). The Australian Commission on Safety and Quality in Health Care has promoted the importance of CQRs as drivers of quality improvement for over a decade, allocating trauma to the second highest priority due the high burden of disease, increasing costs and unsatisfactory outcomes associated with poor quality trauma care.

In 2016, funding for the Australian Trauma Registry was the number one recommendation from the Road Safety Senate Committee. Funding was subsequently obtained from the Department of Health and the Bureau of Infrastructure and Transport Research Economics to support the registry's core responsibilities and reporting. In 2018, New Zealand joined the collaboration to become the Australia New Zealand Trauma Registry, and the registry began providing risk adjusted outcomes.

The ANZTR is now a leading CQR, collecting prehospital and in-hospital data on the most severely injured patients, defined as an Injury Severity Score (ISS) greater than 12 or death following injury[7]. The ANZTR continues to recruit sites with the purpose of capturing population-based data for the severely injured.

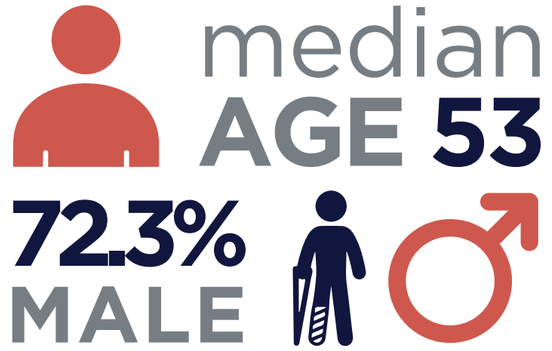
DEMOGRAPHICS

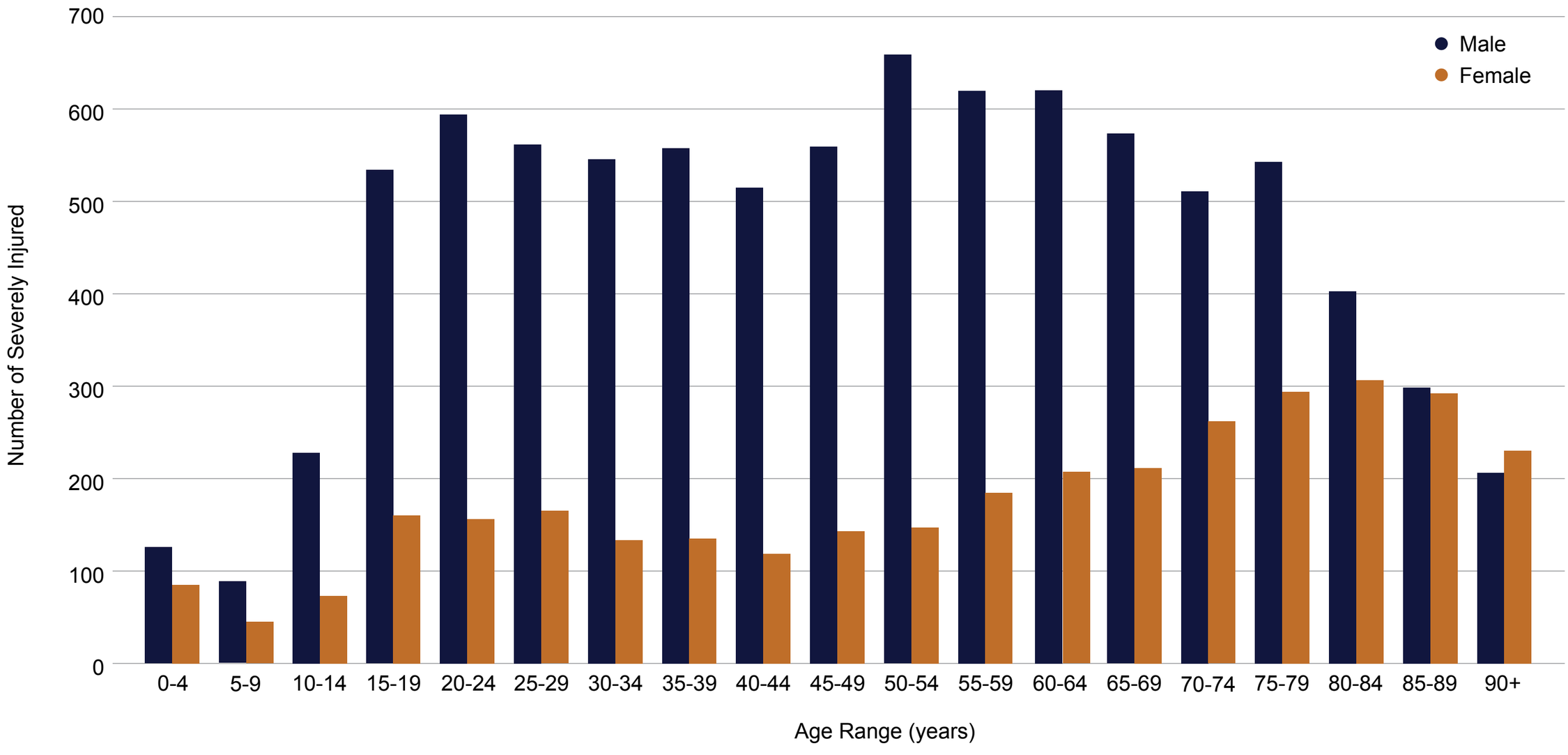
AGE AND GENDER

Incidence by age and gender showed that most severe injuries continue to involve males (72.3%). The distribution of severely injured patients according to age and gender are shown in the figure below.

The median age was 53 years (IQR 31-72 years).

There were two main age-group peaks for males: the 20-29 year olds and the 50-64 year olds. For females, incidence peaked in the 15-29 year age groups and then again in the 70-89 year age groups.





Age Group	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+
n	210	134	300	693	752	728	679	693	635	704	805	807	828	787	774	837	709	590	436

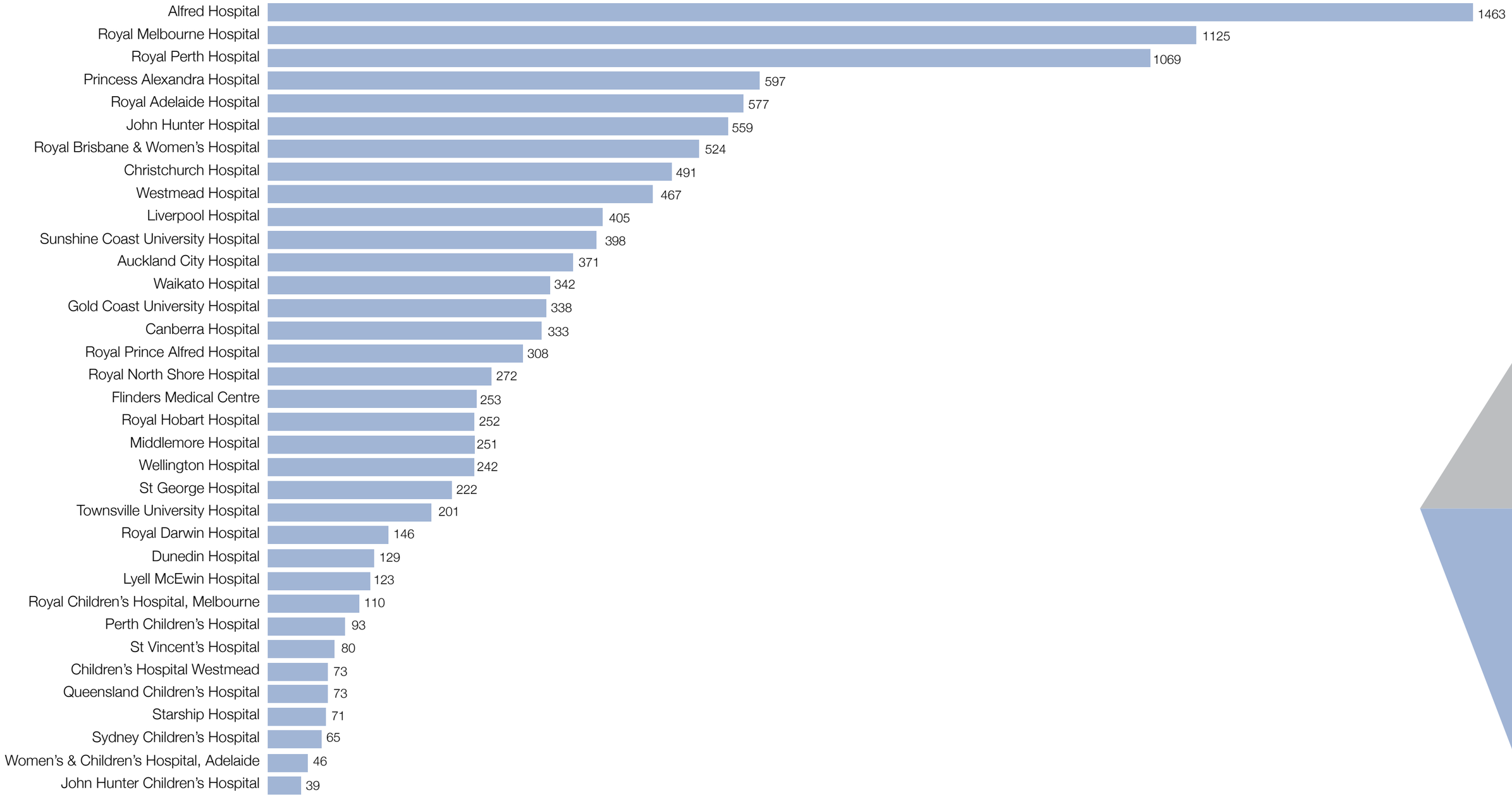
*n=7 missing age; n=3 missing gender; n=1 missing age and gender

DEMOGRAPHICS

Across the 2022-23 financial year, 12,108 episodes of severely injured were collected by the ANZTR.

10,211 episodes were collected from 28 major trauma centres in Australia and New Zealand provided 1,897 episodes from seven trauma centres.

Number of Severely Injured 2022-23, by Hospital



INJURY EVENT

INTENT OF INJURY

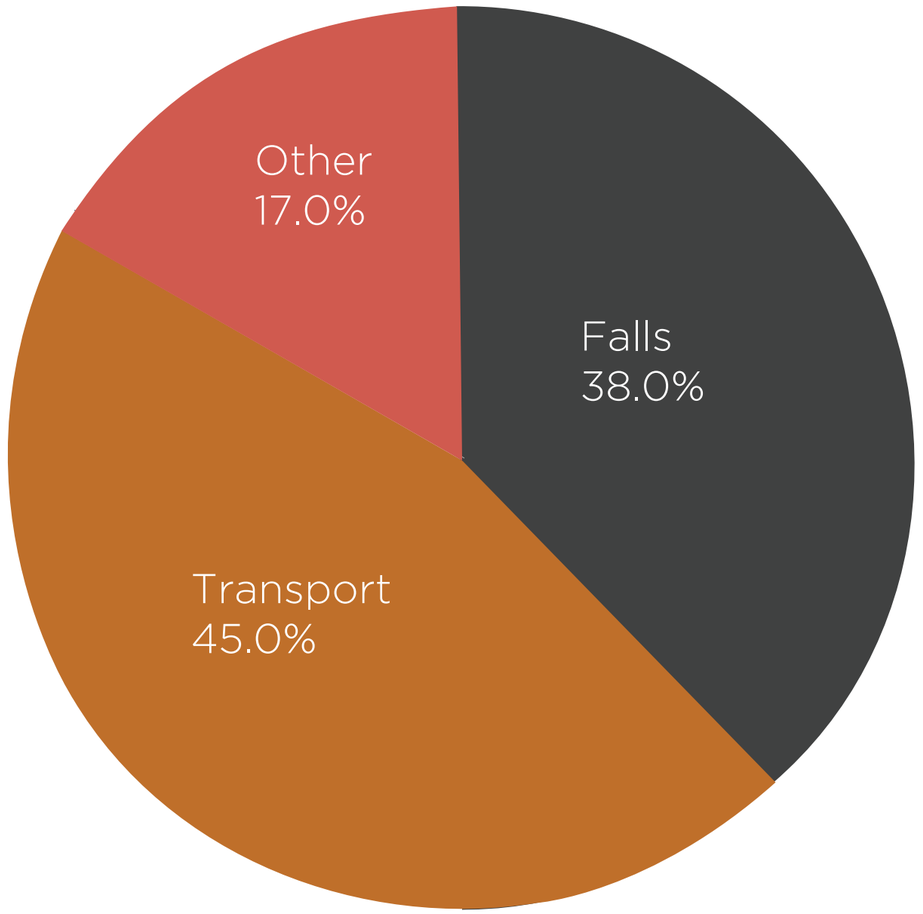
Injury intent was specified for 77.6% of all severe injuries, 91.0% of which were related to unintentional injuries. Injury intent data is not provided by New South Wales or the Northern Territory. It is anticipated that with the changeover to the updated Bi-National Trauma Minimum Data Set – which has been agreed upon by each jurisdiction – data collection for injury intent will continue to improve.

TYPE OF INJURY

Bi-nationally, the dominant type of injury for 95.5% of major trauma cases was blunt injury (e.g. motor vehicle collisions, pedestrian impacts, falls, and sports injuries). Penetrating injury (e.g. stab and gunshot wounds, glass-related injuries, and impalements) accounted for 3.2% of injuries, and burns 0.9%. This is consistent with previous years.

CAUSE OF INJURY

Forty-five percent (45%) of severe injuries were transport-related, and 38% of all severe injuries were caused by falls. Combined, transport-related and falls-related injuries accounted for 83% of all severe injuries, and remain the leading cause of hospital admissions for severe injury. The category “other” includes struck by or collision with a person (3.2%), other transport (2.7%), and cutting, piercing object (2.2%).



Cause of Injury

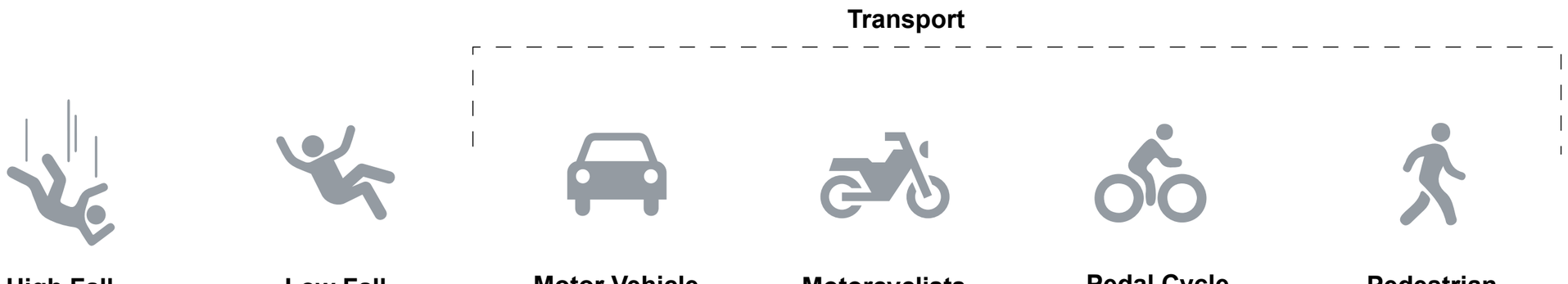
INJURY EVENT

DAY OF INJURY

Approximately one third (33.9%) of severe injuries occurred on the weekend, which is consistent with previous years. High falls remained consistent throughout the week with a peak on Saturdays; this was associated with an increase in injuries due to a fall on or from a ladder. Injuries relating to pedal cyclists and motorcyclists peaked on the weekend.

PLACE OF INJURY

Eighty-five percent of severely injured patients had a known place of injury. Of those with a known place of injury, 45.6% occurred on the road, street or highway, followed by the home (29.1%). The home was the most common place of injury for children aged ≤15 years (35.2%), and for adults aged ≥70 years (50.2%). The road, street or highway was the most common place of injury for all other age groups.

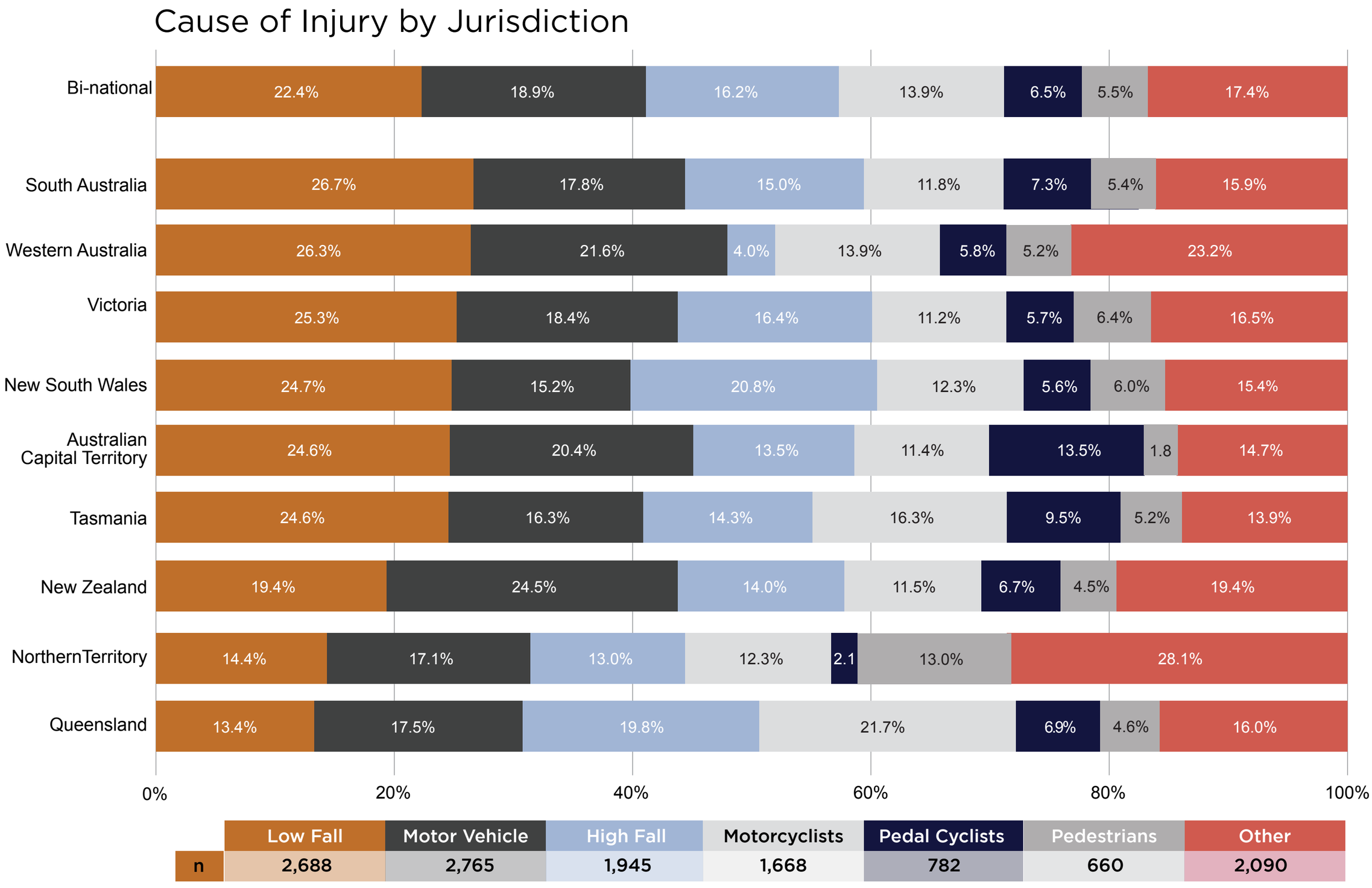


Monday	13.9% (n=268)	12.1% (n=323)	11.7% (n=264)	10.9% (n=180)	12.0% (n=94)	13.5% (n=89)
Tuesday	13.7% (n=264)	13.7% (n=366)	13.0% (n=295)	10.4% (n=172)	12.8% (n=100)	13.5% (n=89)
Wednesday	13.4% (n=257)	14.1% (n=376)	12.5% (n=283)	10.1% (n=168)	11.5% (n=90)	15.6% (n=103)
Thursday	13.4% (n=258)	14.2% (n=378)	14.4% (n=326)	10.6% (n=175)	11.1% (n=87)	16.5% (n=109)
Friday	14.5% (n=279)	15.2% (n=405)	16.7% (n=379)	14.2% (n=235)	14.3% (n=112)	13.5% (n=89)
Saturday	17.1% (n=329)	16.2% (n=432)	15.3% (n=346)	21.9% (n=362)	18.5% (n=145)	14.6% (n=96)
Sunday	13.9% (n=268)	14.2% (n=377)	16.3% (n=370)	21.9% (n=362)	19.5% (n=152)	12.7% (n=84)
Total	100% (n=1,923)	100% (n=2,657)	100% (n=2,263)	100% (n=1,654)	100% (n=780)	100% (n=659)

INJURY EVENT

CAUSE OF INJURY BY JURISDICTIONS

Transport and falls-related injuries continue to be the most common severe injuries across all jurisdictions. In 2022-23, low falls were the most common cause in six of the nine jurisdictions and 'other specified injuries' were the most common for two jurisdictions.



INJURY

SEVERITY OF INJURY

The Injury Severity Score (ISS) is an internationally standardised approach to describing the overall severity of injury for each patient which is derived from the Abbreviated Injury Scale (AIS) 2008. Trauma patients are allocated an ISS after injury in order to determine their status as 'major trauma'. ISS is useful for predicting hospital length of stay and associated morbidity and mortality.

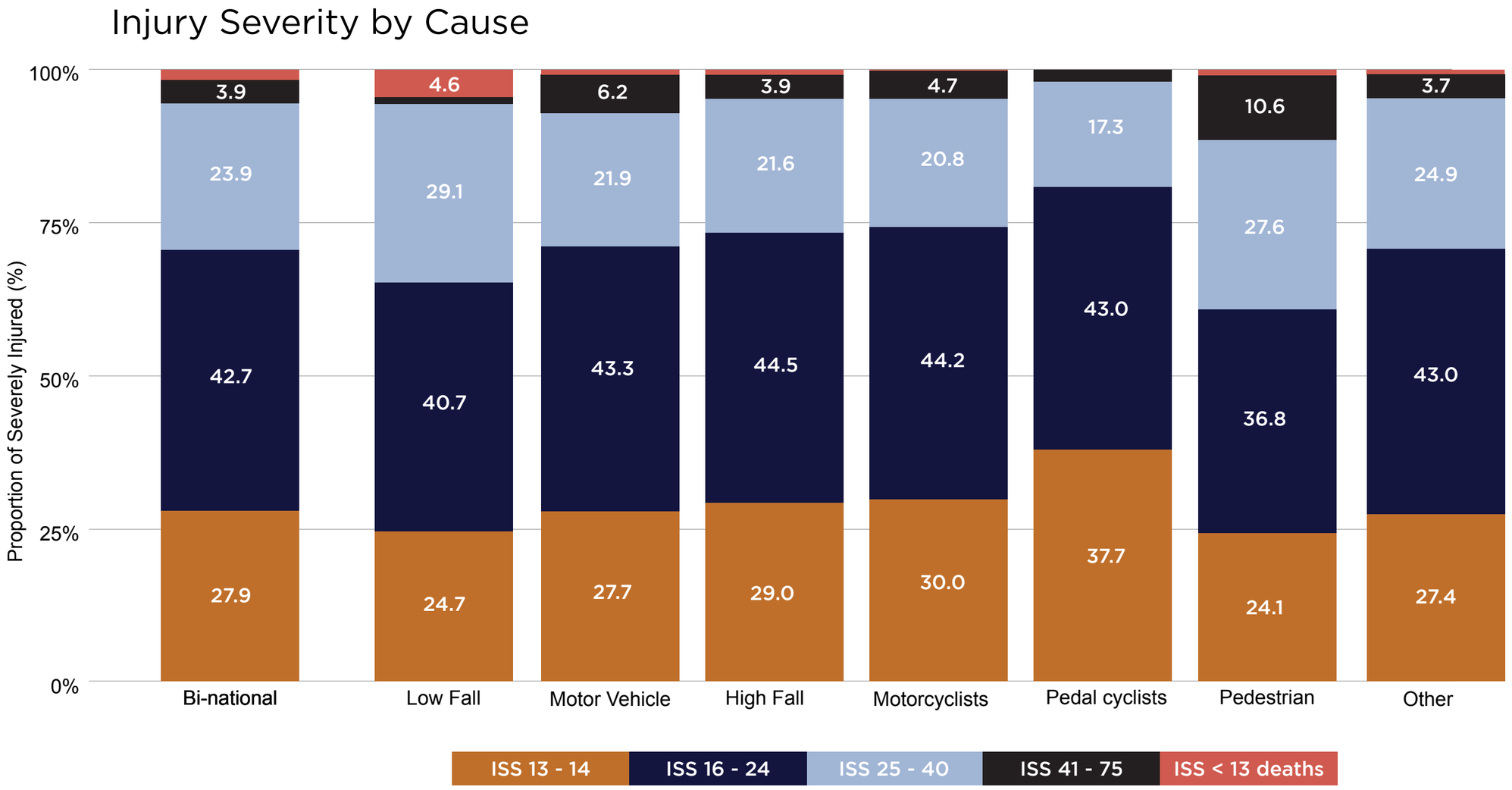
In the 2022-23 financial year, the proportion of severely injured categorised by ISS range was comparable with the previous four years. Most injuries admitted to hospital had an ISS between 16 - 24 (43%). When the cohort was broken down into gender, similar proportions by ISS range occurred.

An ISS >25 was most prevalent in the low fall, high fall, and motor vehicle populations, whilst less severe injuries occurred in pedal cyclists.

DEATHS WITH ISS<13

The ANZTR also collects data on in-hospital deaths with an ISS less than 13. For the 2022-23 financial year there were 194 patients:

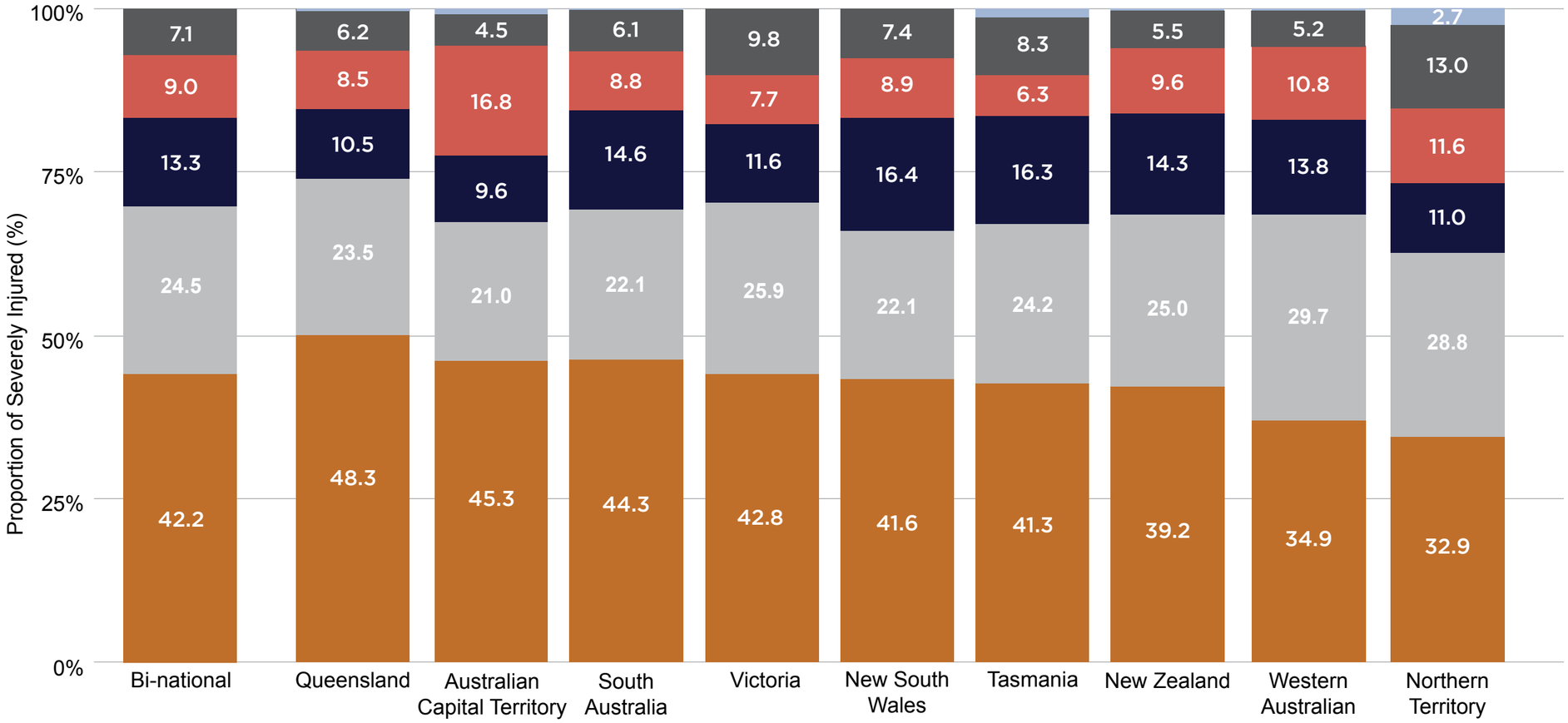
- 78% were aged 70+ years
- 63% were caused by a low fall
- 7% died in the emergency department



INJURIES SUSTAINED

Multiple injuries (excluding serious neurotrauma) were the most prevalent across all jurisdictions for the severely injured, followed by 'head and other associated injuries', and 'isolated head injuries'. This is consistent with the previous annual report. One patient was without AIS coding to ascertain injury severity.

Injury Severity by Cause



Jurisdiction	Severly Injured (n)	Jurisdiction	Severly Injured (n)
Bi National	12,108	Western Australia	1,162
Victoria	2,968	South Australia	999
New South Wales	2,490	Australian Capital Territory	333
Queensland	2,131	Tasmania	252
New Zealand	1,897	Northern Territory	146

Gender	Male	Female
n*	8,751	3,354

*3 without gender specified

"Multiple injuries, burns and 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 had 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 in other body regions.

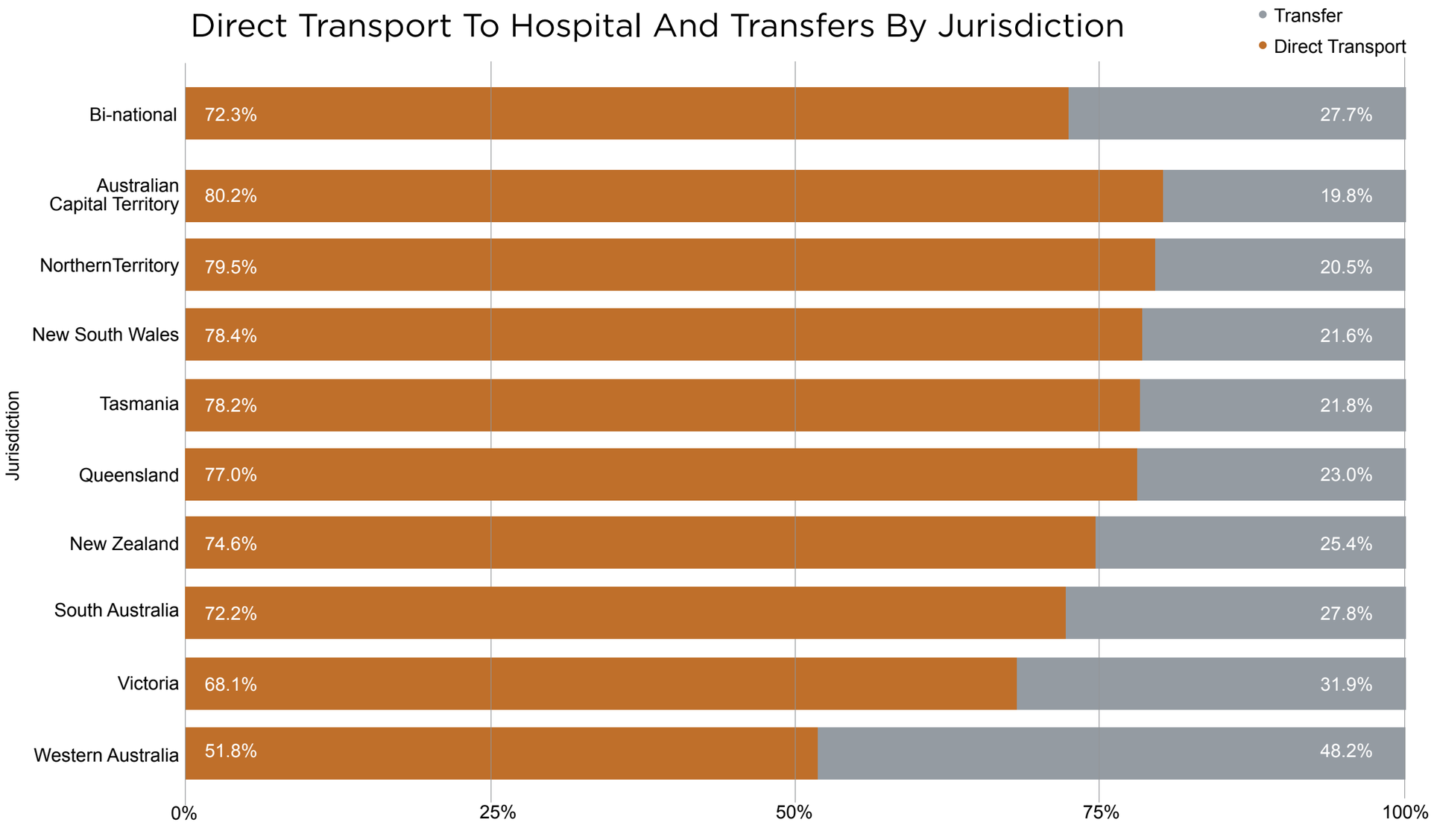
Serious spinal cord injury = spinal cord injury with AIS > 3 with or without other injuries.

TRANSPORT TO HOSPITAL

Over two thirds (72.3%) of severely injured patients were transported from the scene to definitive care. Of those transported directly, 76.6% arrived via road ambulance, 15.9% via helicopter and 4.6% via private vehicle/walk in.

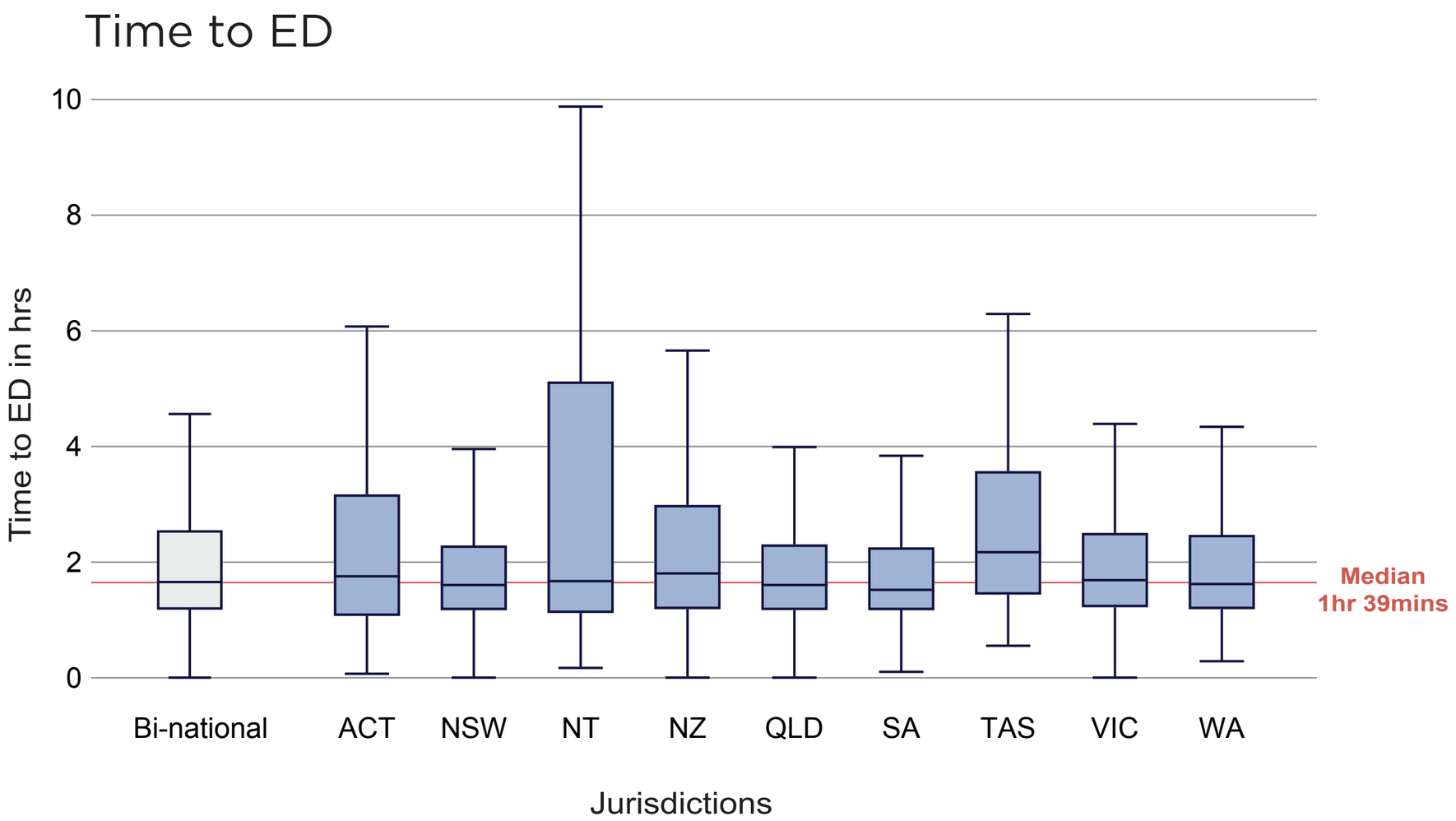
For the severely injured that arrived at a major trauma service via one or more hospitals, 60.7% were transported from the scene by road ambulance, 19.0% via private vehicle/walk-in and 4.4% via helicopter.

The majority of those who were transferred (98.2%) attended only one other hospital prior to arrival at a major trauma service. The number of patients who arrived at 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 51.8% to 80.2% across sites.



TIME FROM INJURY TO EMERGENCY DEPARTMENT

Time to Emergency Department was analysed for patients conveyed directly from injury to definitive care. The median time from injury to definitive care was **1 hour 39 minutes**, similar to the previous financial year. The box and whisker plots presented in this report represent the median, interquartile range and range - where the edges of the box represent the lower and upper quartiles, the line in the middle of the box is the median, and the whiskers represent the range.



*Excludes outliers & transfers

* Extreme outliers are values smaller than the lower quartile minus 1.5 times the interquartile range (IQR) or values larger than the upper quartile plus 1.5 times the IQR

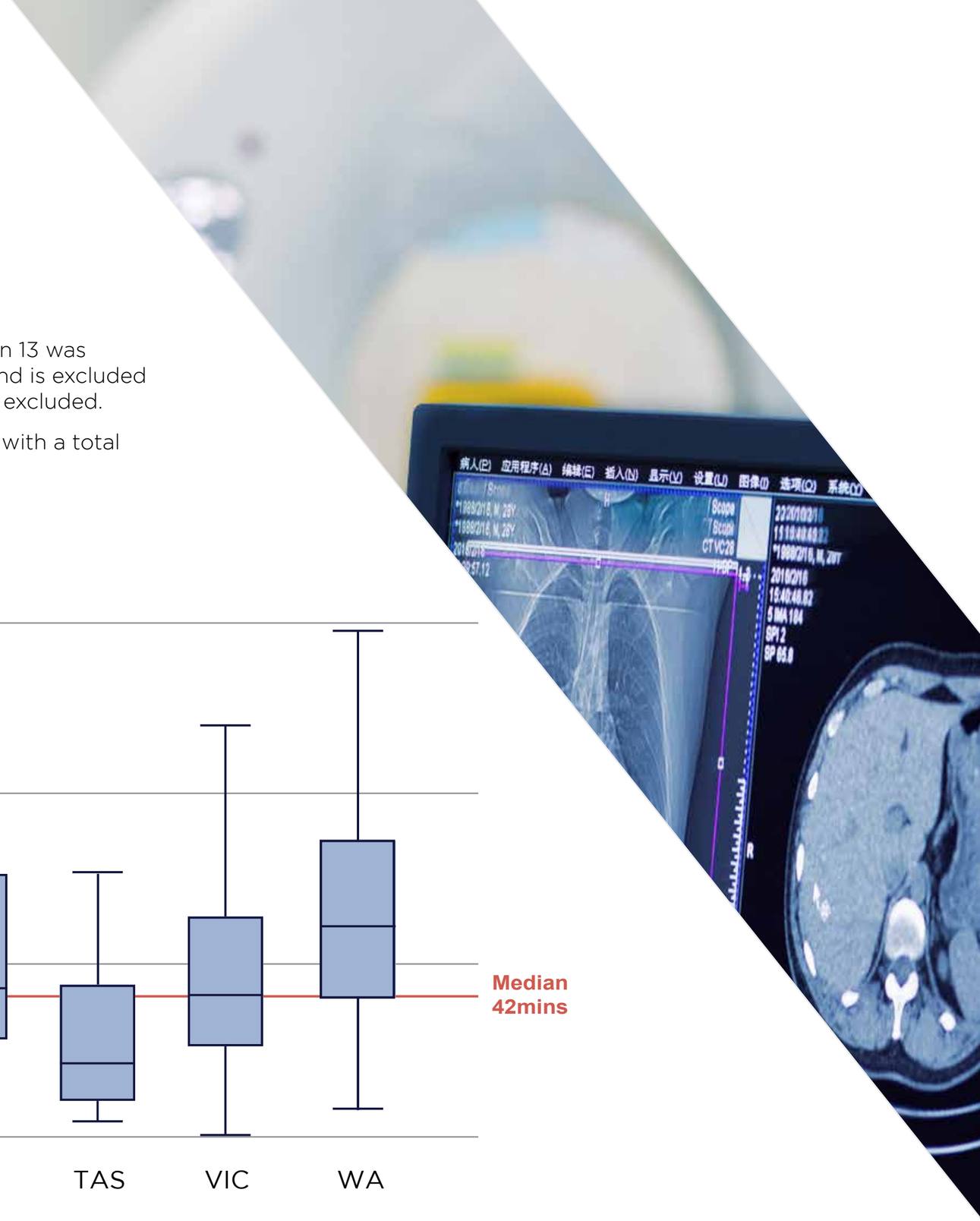
* For NT, this is inclusive of ‘Directly from Scene’ & ‘Clinic Transfers’ to Royal Darwin Hospital

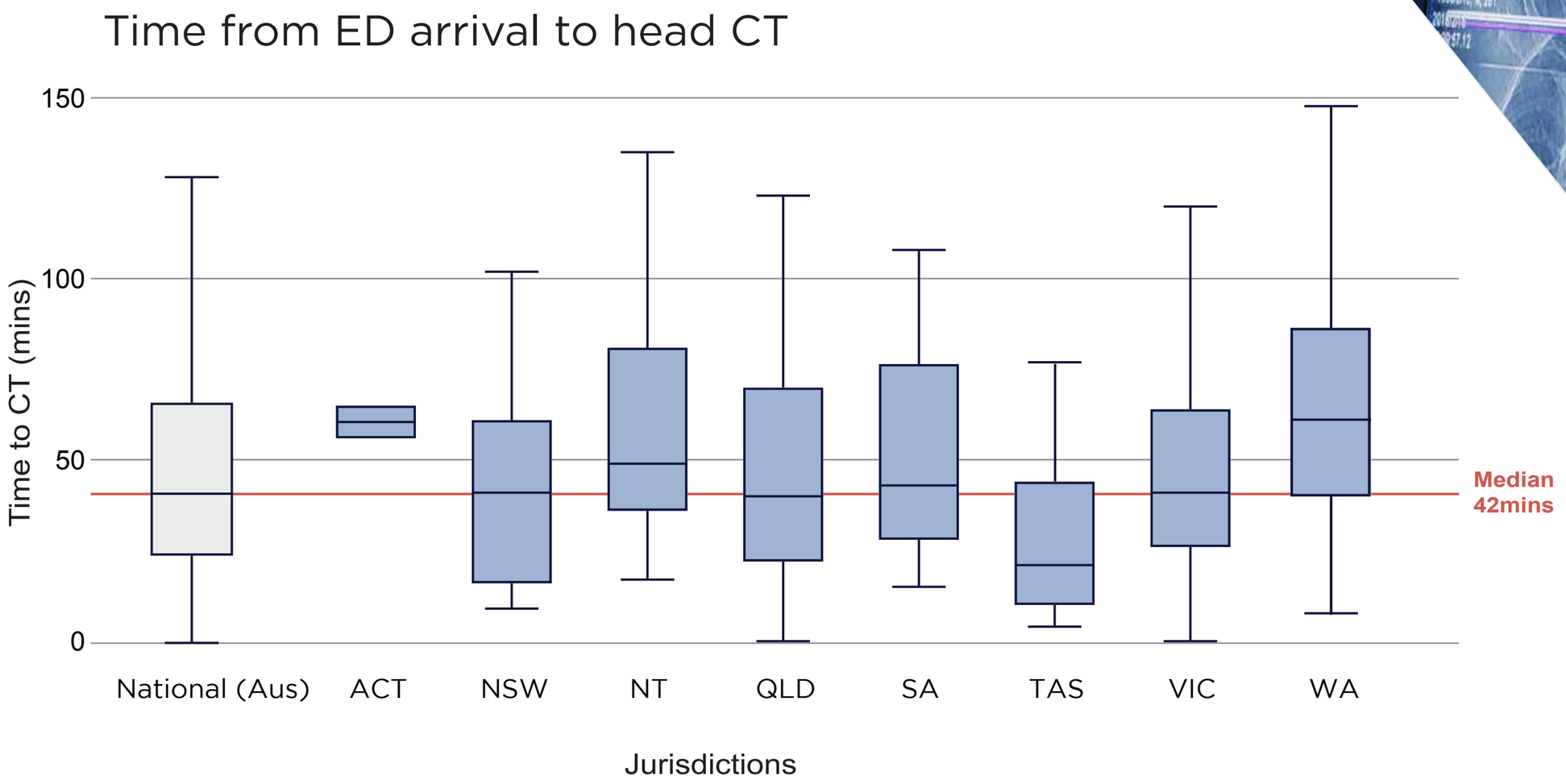
TRAUMA CENTRE CARE

TIME FROM ED ARRIVAL TO HEAD COMPUTED TOMOGRAPHY (CT)

The time to first head CT for patients with a total Glasgow Coma Scale (GCS) less than 13 was analysed by jurisdiction for Australian sites. NZ does not submit data for type of CT and is excluded from the box plot below. Prolonged CT scans related to repeat/transfer patients were excluded.

The median time from arrival at the definitive hospital to time of head CT for patients with a total GCS less than 13 was **42 minutes** (IQR 26 to 67 minutes).





* Extreme outliers are values smaller than the lower quartile minus 1.5 times the interquartile range (IQR) or values larger than the upper quartile plus 1.5 times the IQR.

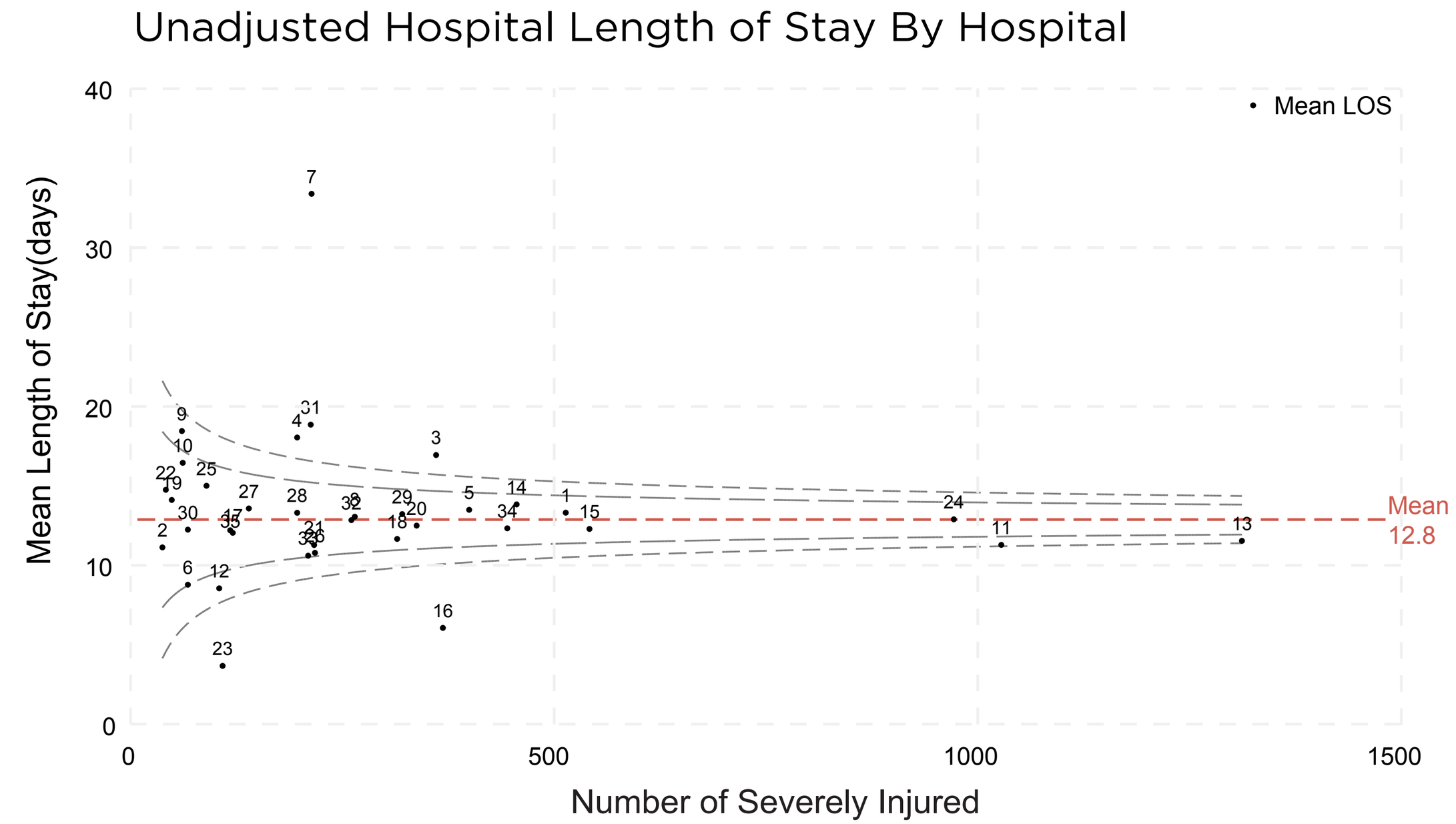
HOSPITAL LENGTH OF STAY BY HOSPITAL (LOS)

Hospital Length of Stay was compared between hospitals, before and after risk adjustment. The following risk factors were included in the model as they were found to be significant predictors: age, cause of injury, arrival Glasgow Coma Scale (GCS), highest and second highest AIS scores. Only survivors were included in the LOS analysis. After risk adjustment there was only a difference in length of stay. Please refer to Appendix A for detailed data analysis. Each numbered dot represents one hospital in the funnel plots on the following pages. The funnel plots, where the aim is to identify outliers, show contours which represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits) from the mean. Those outside these lines are considered outliers, with a 5% and 0.2% chance of a false positive respectively.

ID#	Hospital Name	Jurisdiction
1	John Hunter Hospital	NSW
2	John Hunter Children's Hospital	NSW
3	Liverpool Hospital	NSW
4	St George Hospital	NSW
5	Westmead Hospital	NSW
6	Children's Hospital, Westmead	NSW
7	Royal North Shore Hospital	NSW
8	Royal Prince Alfred Hospital	NSW
9	St Vincent's Hospital	NSW
10	Sydney Children's Hospital	NSW
11	Royal Melbourne Hospital	VIC
12	Royal Children's Hospital	VIC
13	Alfred Hospital	VIC
14	Royal Brisbane and Women's Hospital	QLD
15	Princess Alexandra Hospital	QLD
16	Townsville University Hospital	QLD
17	Sunshine Coast University Hospital	QLD
18	Gold Coast University Hospital	QLD
19	Queensland Children's Hospital	QLD
20	Royal Adelaide Hospital	SA
21	Flinders Medical Centre	SA
22	Women's and Children's Hospital	SA
23	Lyell McEwin Hospital	SA
24	Royal Perth Hospital	WA
25	Perth Children's Hospital	WA
26	Royal Hobart Hospital	TAS
27	Royal Darwin Hospital	NT
28	Canberra Hospital	ACT
29	Auckland City Hospital	NZ
30	Starship Hospital	NZ
31	Middlemore Hospital	NZ
32	Waikato Hospital	NZ
33	Wellington Hospital	NZ
34	Christchurch Hospital	NZ
35	Dunedin Hospital	NZ

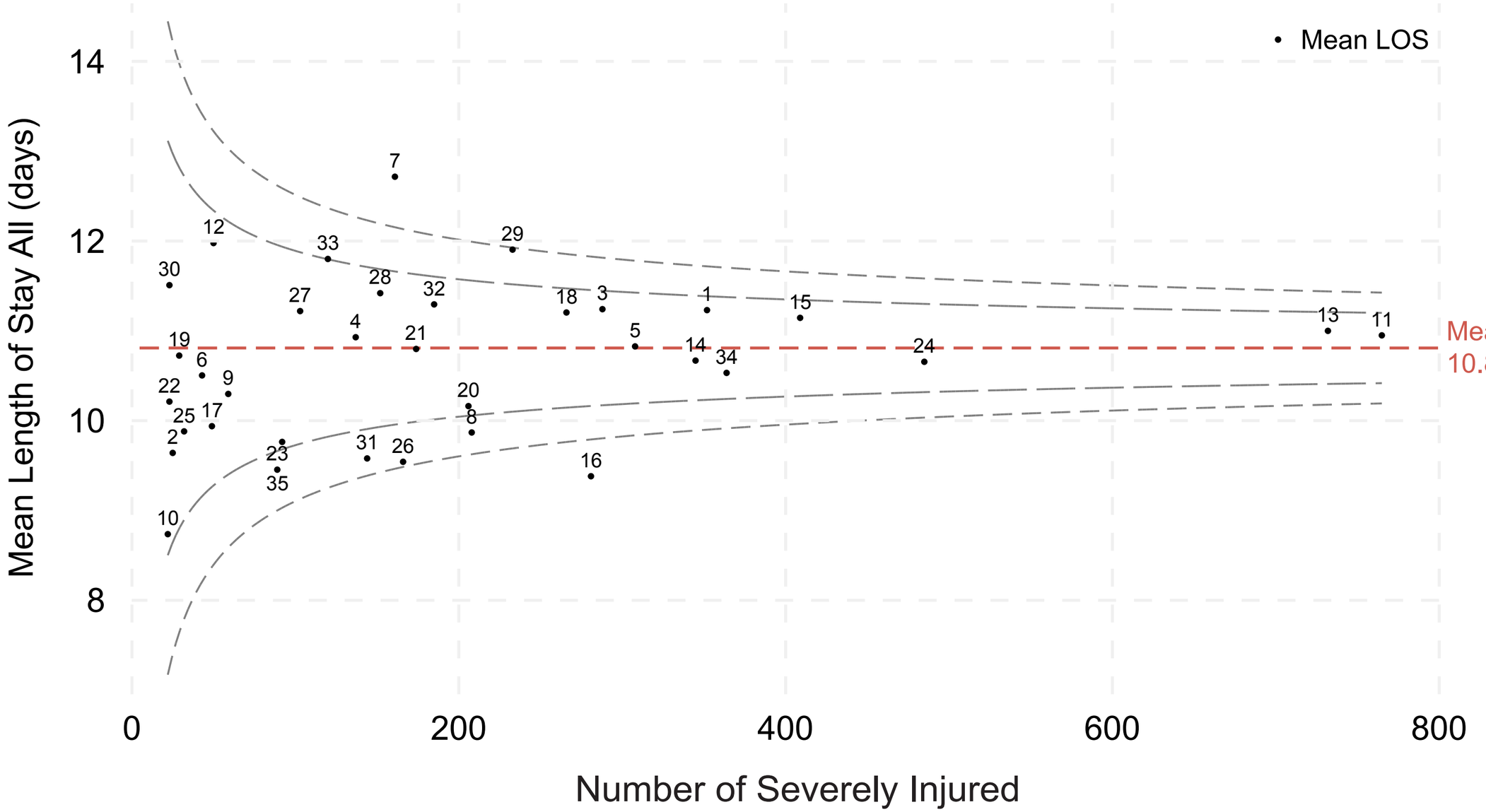
RISK-ADJUSTED HOSPITAL LENGTH OF STAY BY HOSPITAL (LOS)

The unadjusted bi-national median (IQR) hospital LOS was 7.7 (3.9 -14.9) days. When hospitals were risk adjusted there was a maximum 1-2 days difference between hospitals apart from hospital 7, which is unlikely to be clinically significant. Reasons for variations in hospital length of stay will be reviewed. Each numbered dot represents one hospital in the funnel plots below. The funnel plots, where the aim is to identify outliers, show contours which represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits) from the mean. Those outside these lines are considered outliers, with a 5% and 0.2% chance of a false positive respectively.



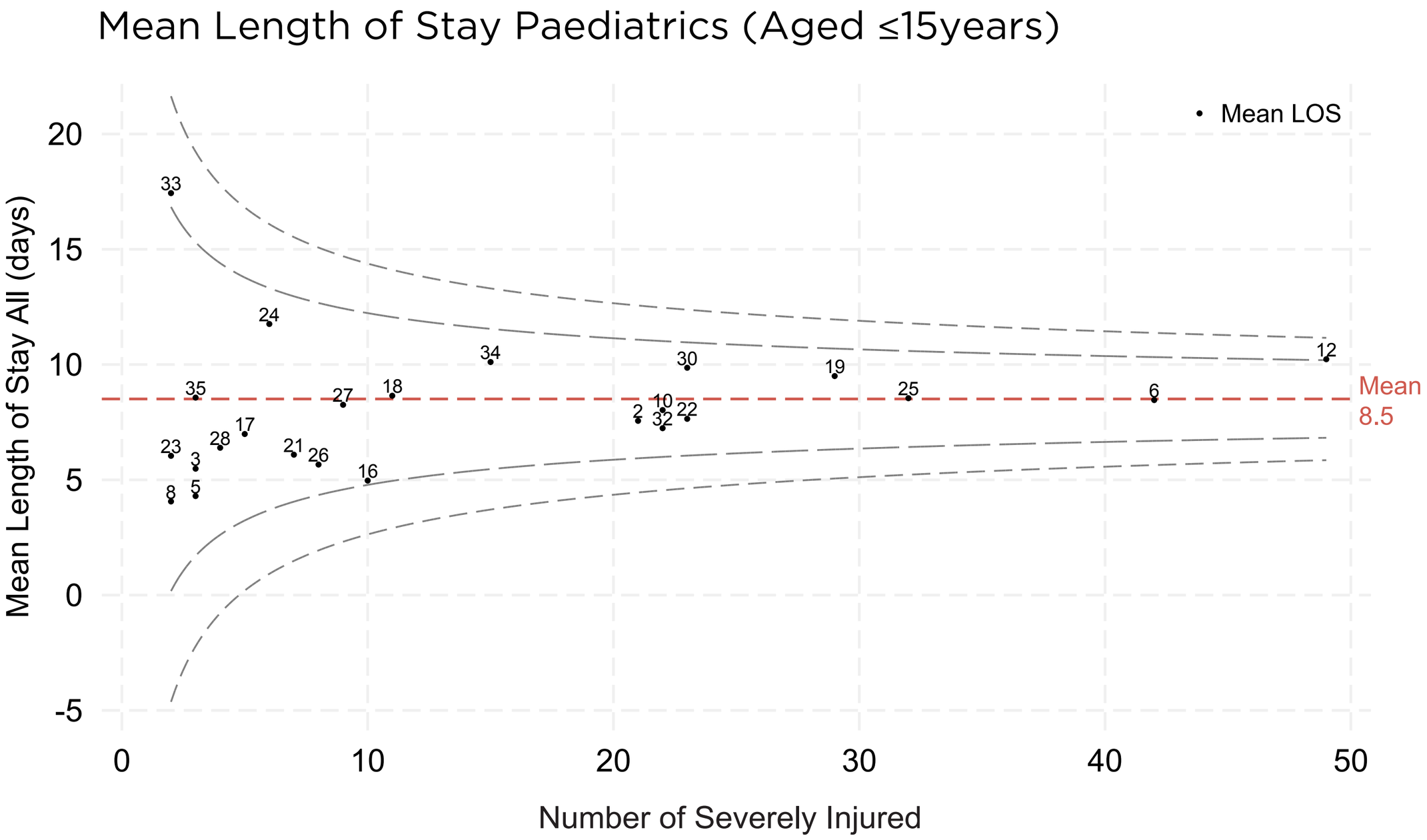
Includes transfers & only among survivors

Risk-Adjusted Hospital Length of Stay By Hospital



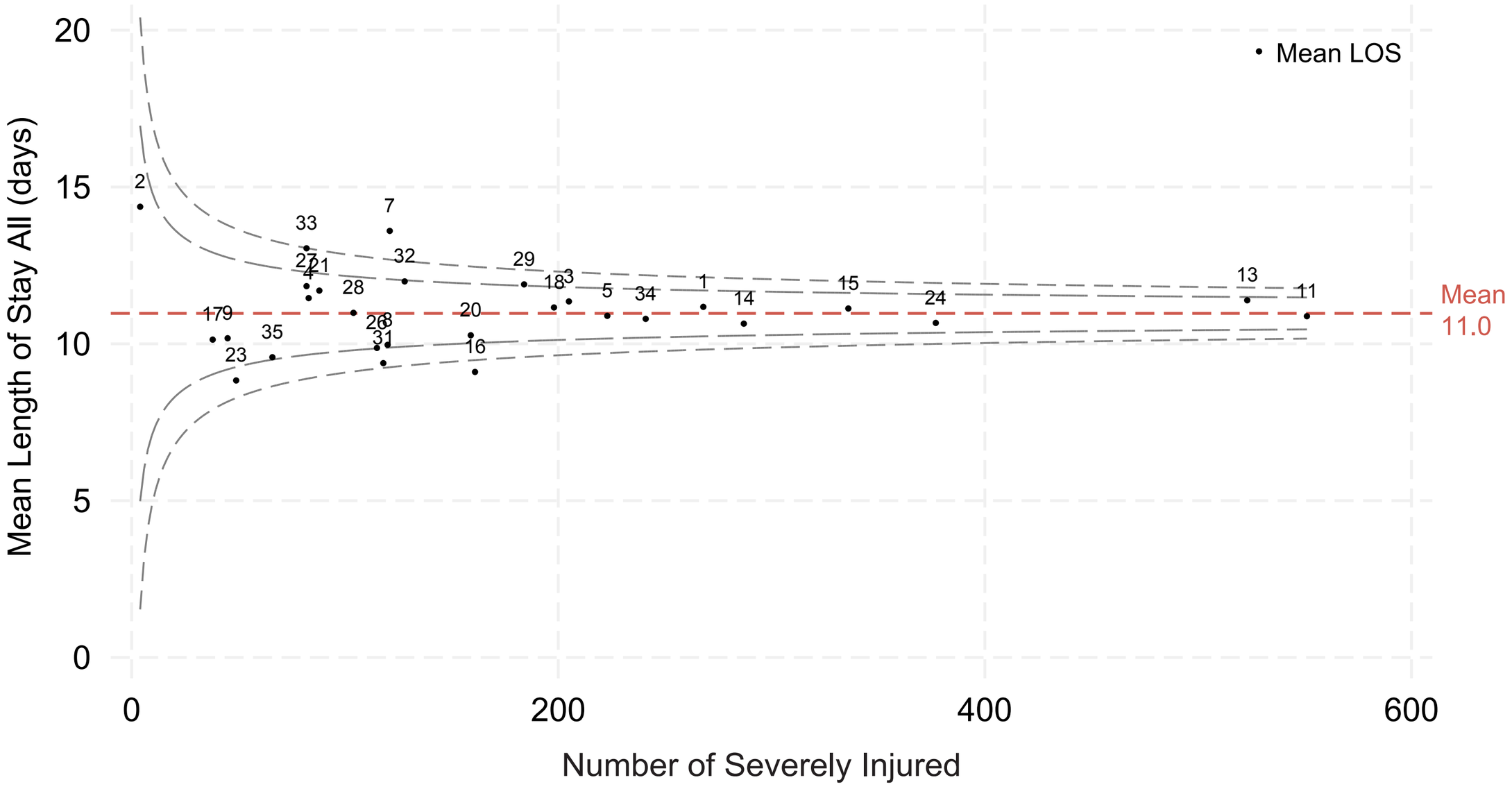
Among all age groups. Excludes transfers & includes only blunt injuries and among survivors

RISK-ADJUSTED HOSPITAL LENGTH OF STAY (LOS) BY AGE GROUPS



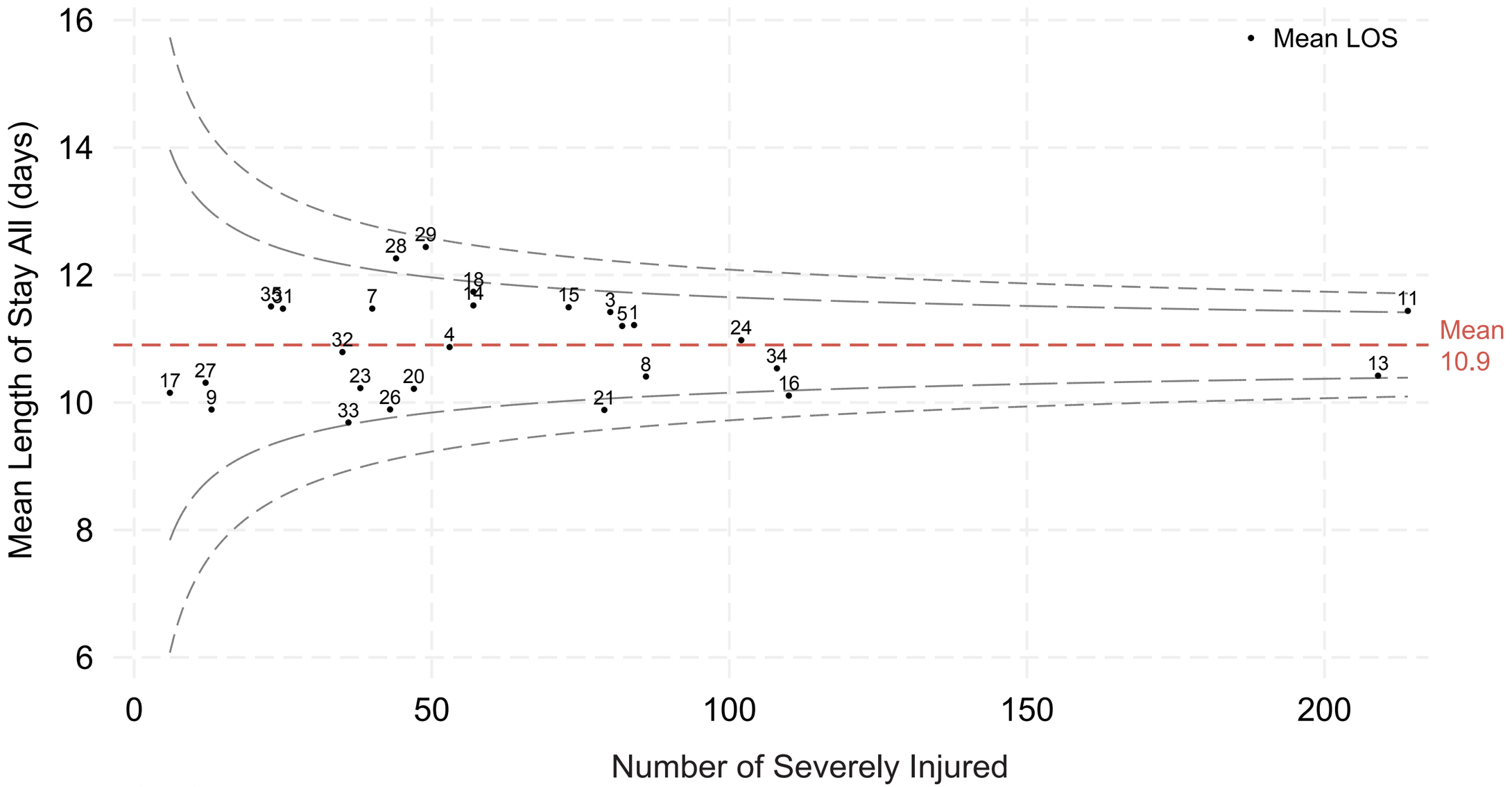
Excludes transfers & includes only blunt injuries and among survivors

Mean Length of Stay Adults (Aged ≥16 and ≤69 years)



Excludes transfers & includes only blunt injuries and among survivors

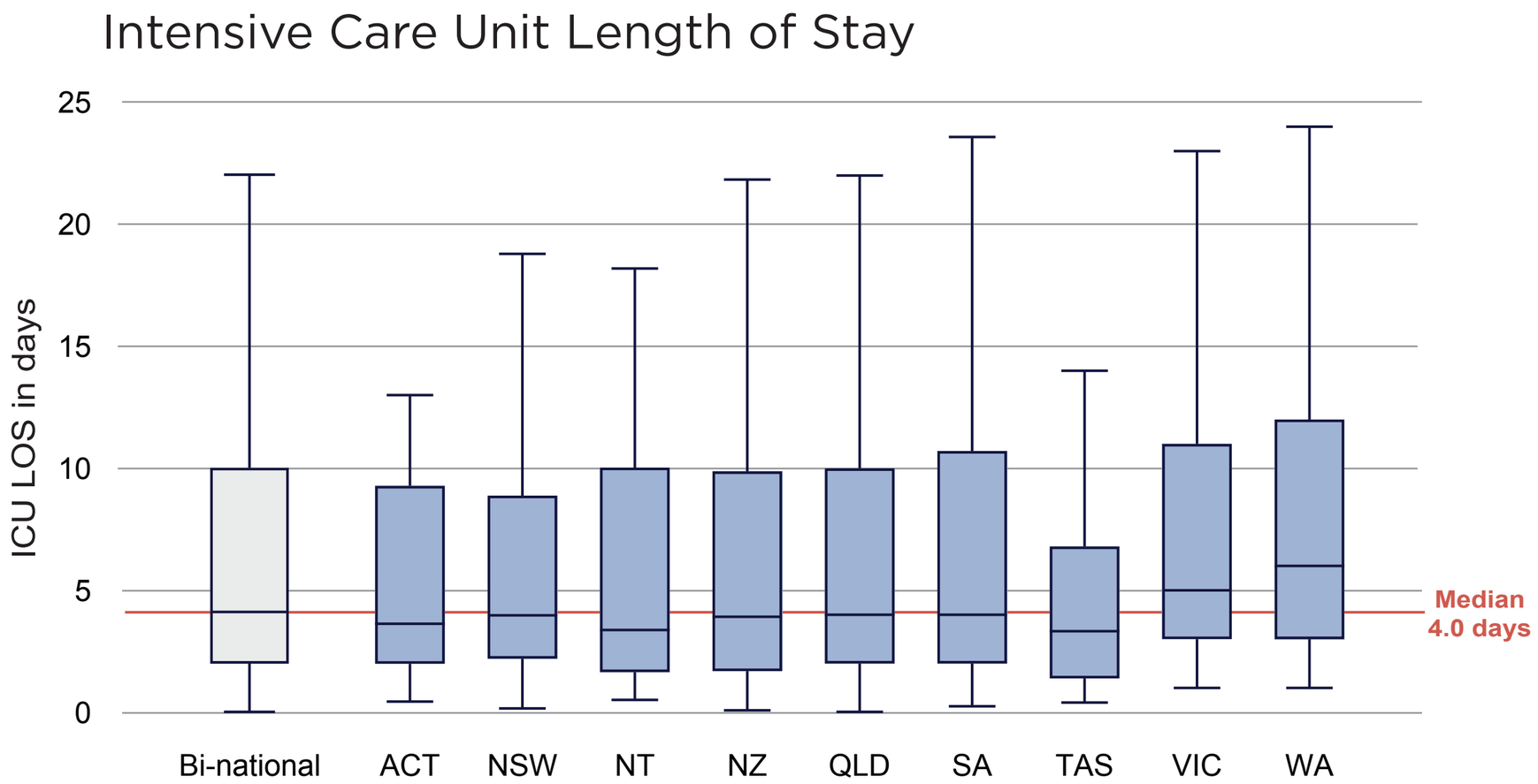
Mean Length of Stay Older Adults (Aged ≥70 years)



Excludes transfers & includes only blunt injuries and among survivors

INTENSIVE CARE UNIT (ICU) LENGTH OF STAY (LOS)

The bi-national median IQR for hospital ICU LOS was **4.0 (2.0 – 10.0) days**.

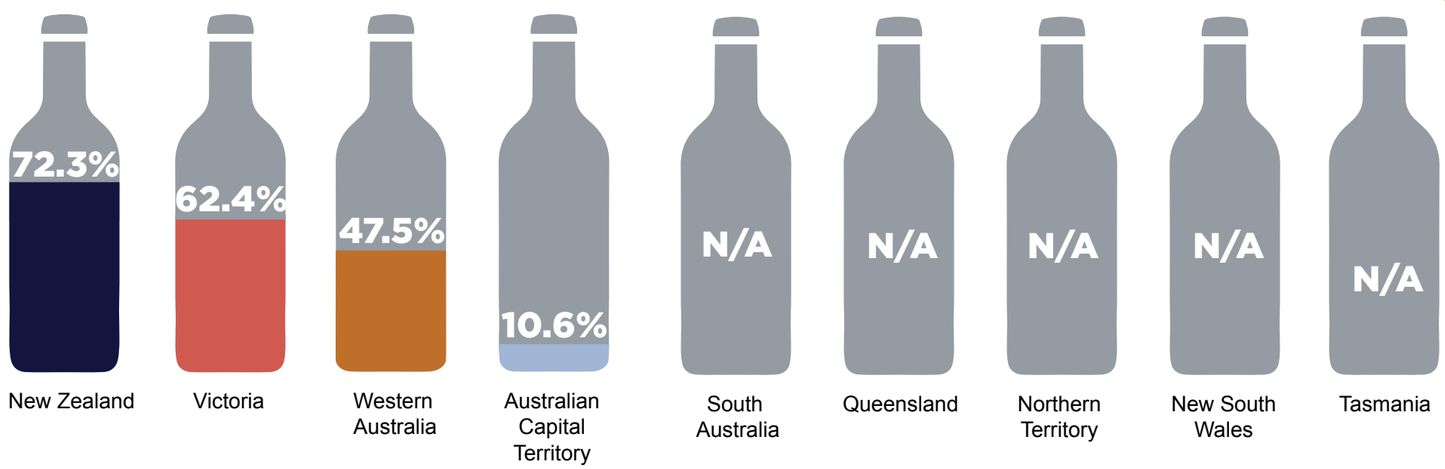


*Excludes outliers & transfers

*Extreme outliers are values smaller than the lower quartile minus 1.5 times the interquartile range (IQR) or values larger than the upper quartile plus 1.5 times the IQR

BLOOD ALCOHOL CONCENTRATION COLLECTION RATE

Blood alcohol collection is one of the eight RACS process indicators and is recommended in patients with severe injuries, defined as an ISS>12. The ANZTR does not currently receive blood alcohol concentration from all jurisdictions, and continues to work with registries and sites to improve data capture. The below figure demonstrates the proportion of severely injured cases where a blood alcohol test was performed and recorded for transport related injuries aged 15 years and older.



OUTCOMES FROM INJURY

The primary outcome collected by the ANZTR is discharge destination (including deaths). Discharge destination was provided for 100% of patients.

MORTALITY

One thousand one hundred and sixty severely injured people died in-hospital with a bi-national mortality rate of 9.7%. Categorising by age-group identified further mortality trends in the severely injured.

Mortality Over Time

Year	Severe Injuries (n)	Deaths (n)	Deaths (%)
17/18	9,840	927	9.4
18/19	10,135	1,007	9.1
19/20	10,050	1,053	9.6
20/21	11,254	1,050	9.3
21/22	10,836	1,051	9.7
22/23	12,108	1,178	9.7

9.7% MORTALITY

UNCHANGED FROM 2021-2022

7.4% OF DEATHS OCCURRED IN ED

from 9.7% in 2021/22

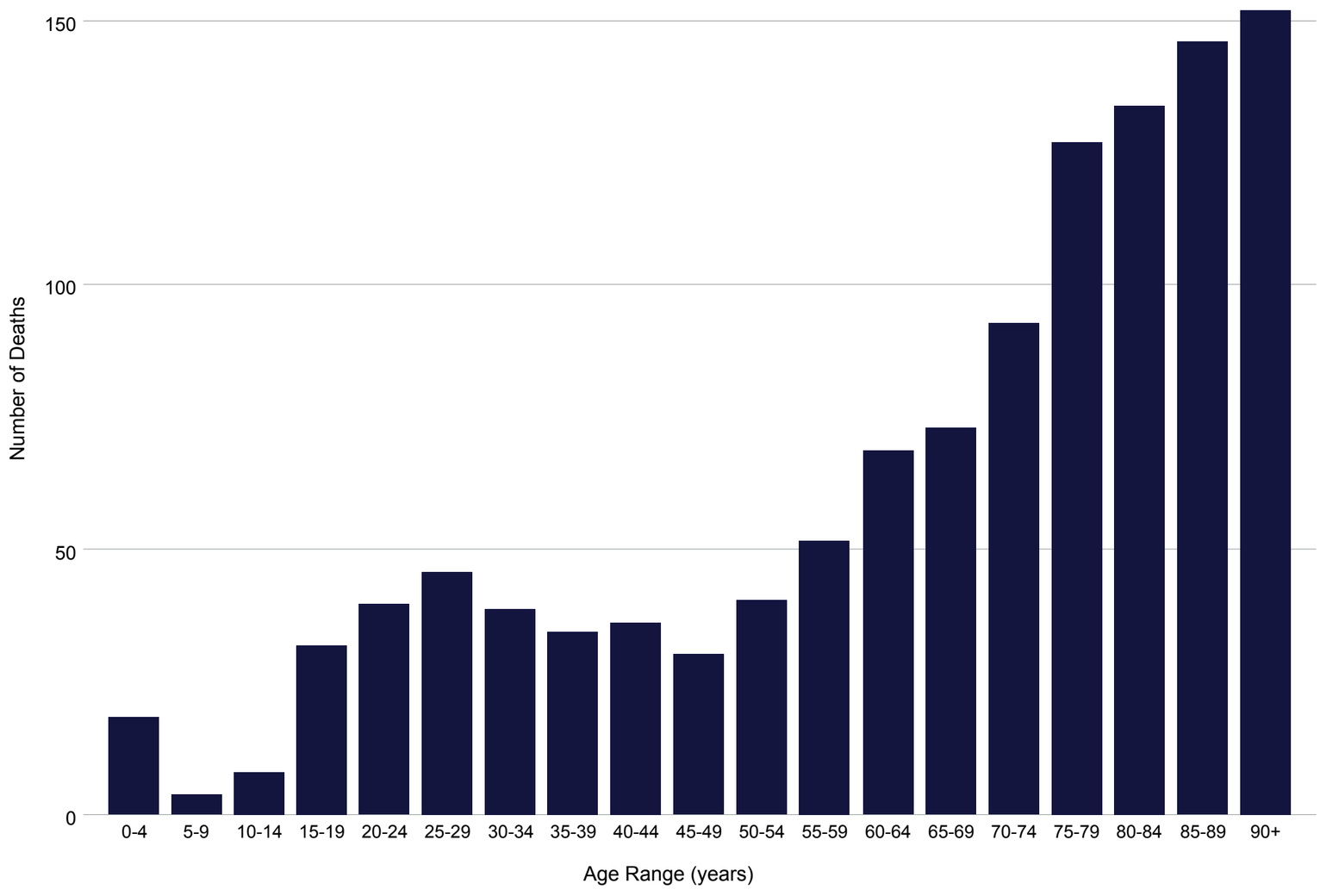
47.4% OF DEATHS AGED 75+

70.1% MALE

58.2% ISS>24

2.9% OF DEATHS AGED ≤15 YEARS

Mortality by Age Range (years)

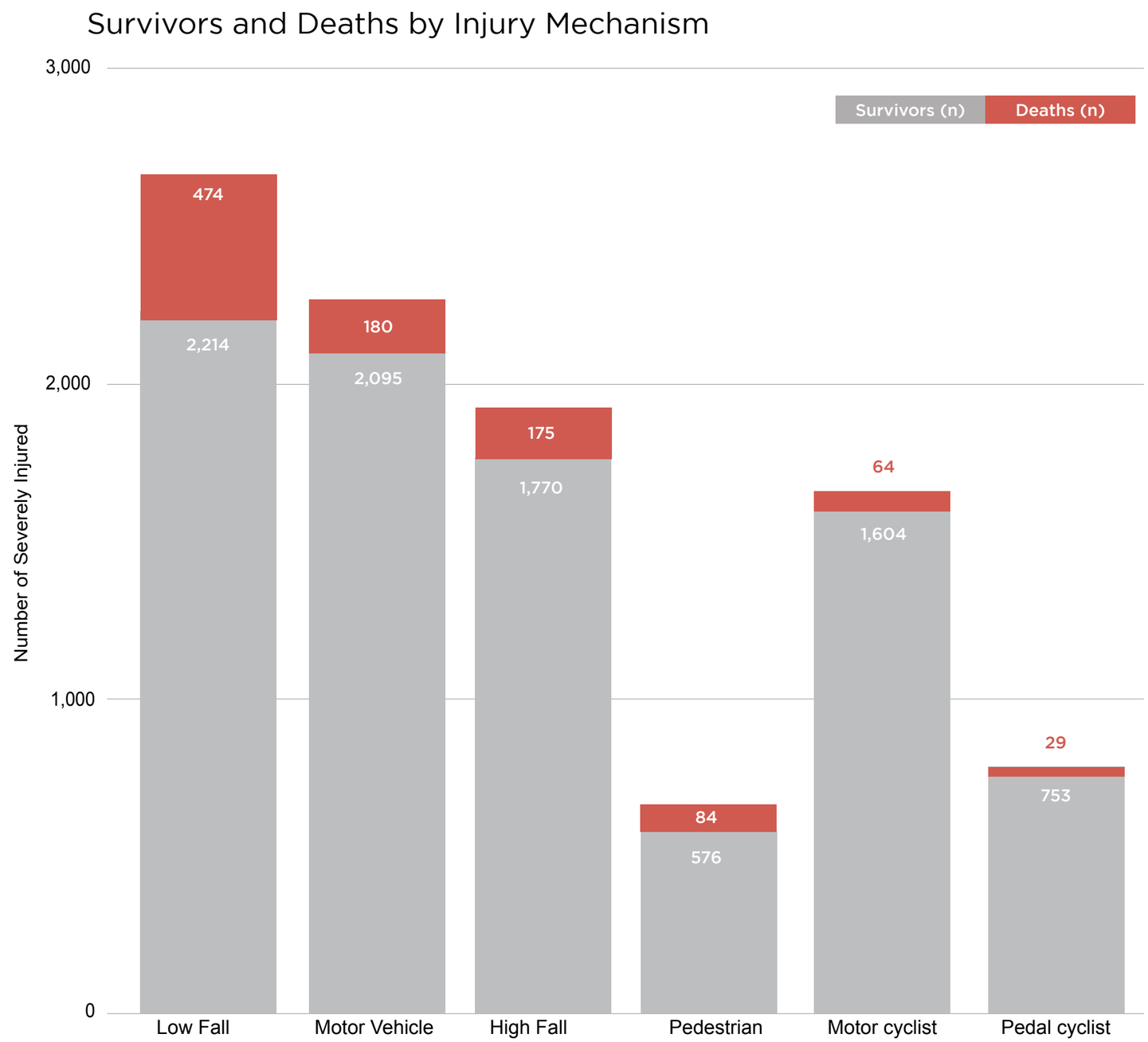


MORTALITY BY MECHANISM OF INJURY

As a proportion of total deaths, low falls accounted for the highest number of deaths (40.2%) followed by transport-related deaths (30.3%). Pedal cyclists and motorcyclists had the lowest mortality rate (3.7% and 3.8% respectively).

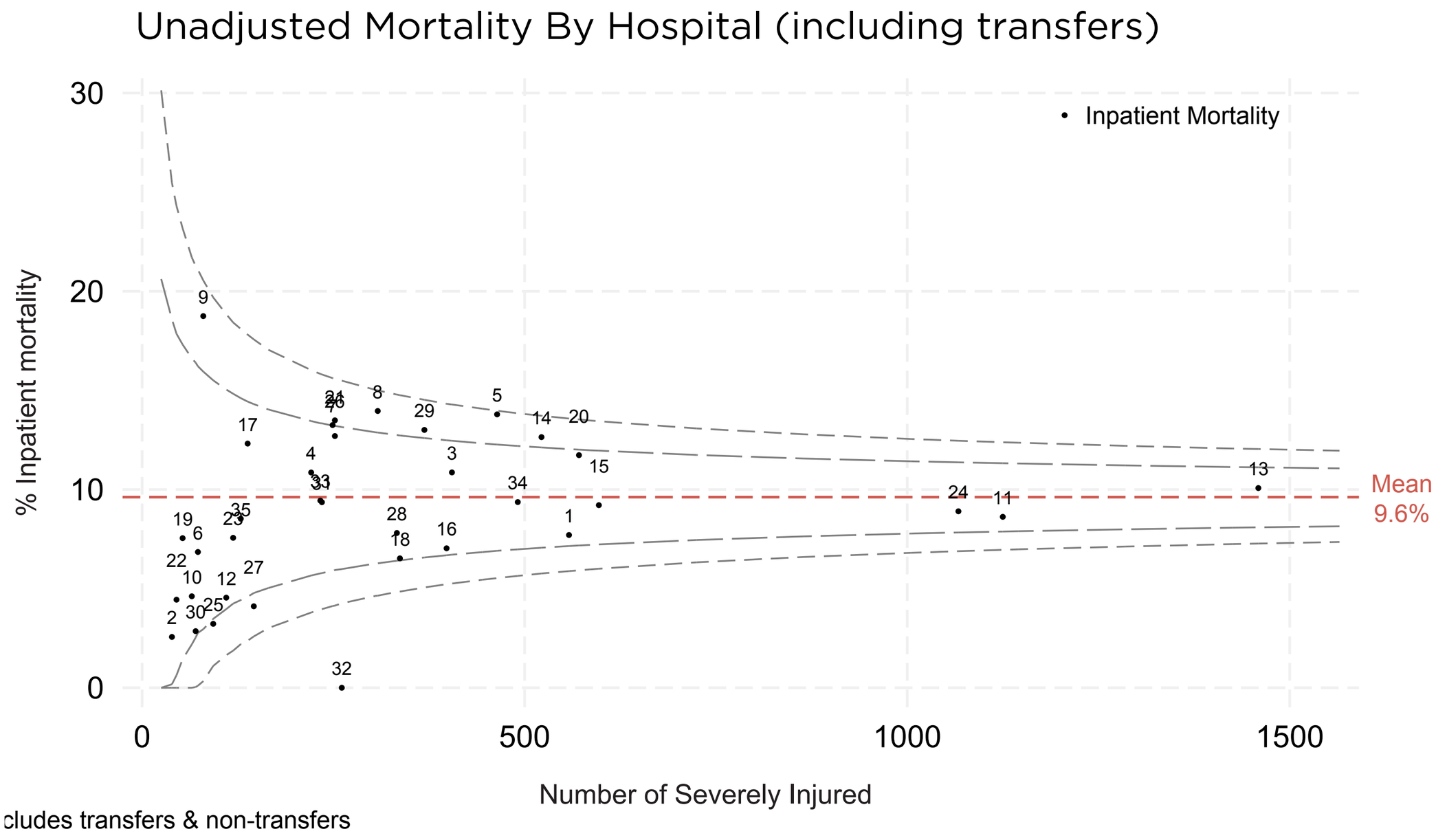
40.2% DEATHS LOW FALLS

30.3% TRANSPORT DEATHS RELATED

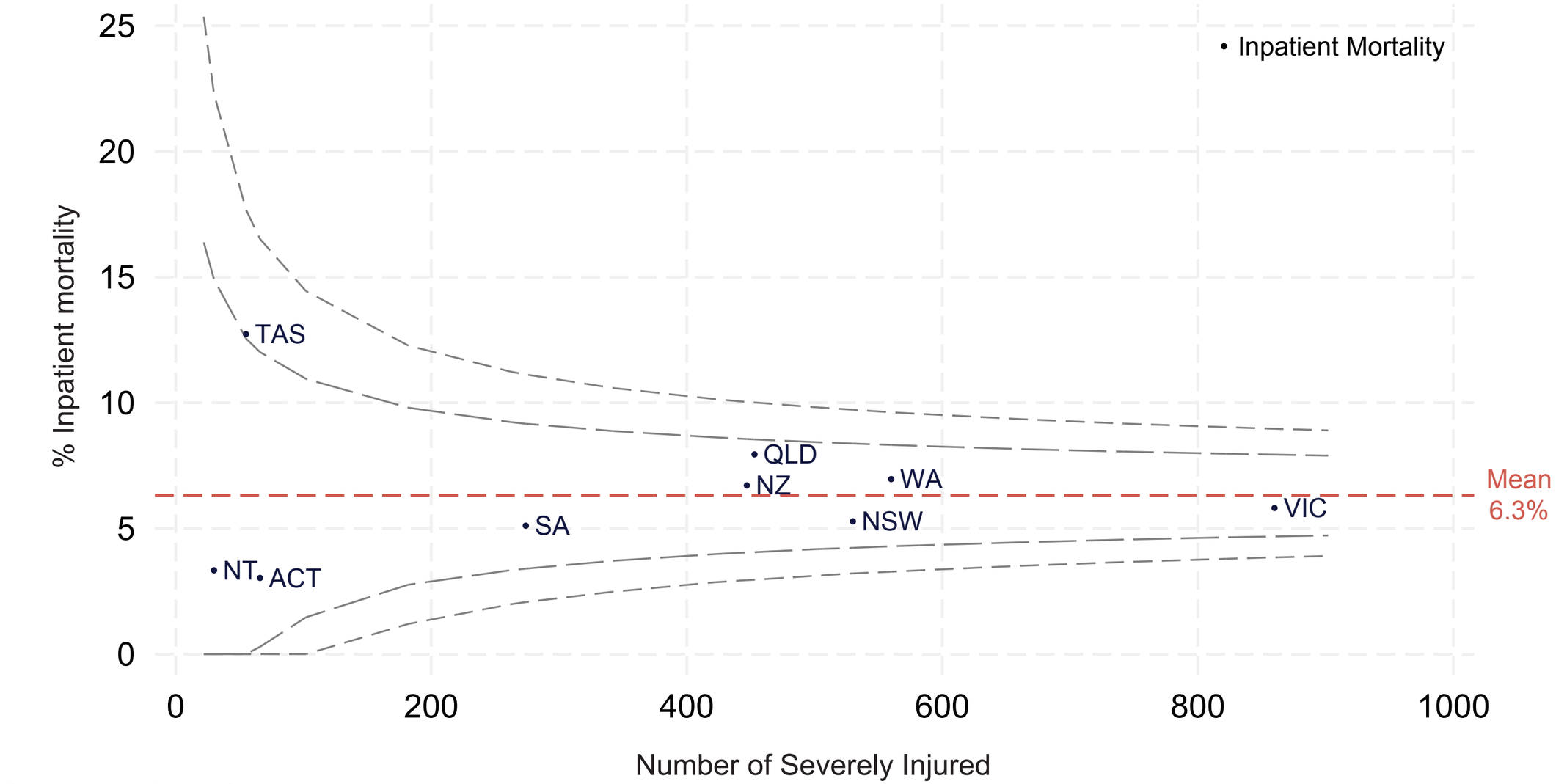


UNADJUSTED MORTALITY

Unadjusted plots do not take into account the variations in casemix which occur between hospitals, such as patient proximity to hospital, number of transfers and prior treatment, and severity of injuries. The below plot represents unadjusted mortality by hospital, including all transfers. It allows the reader to identify the total number of severely injured patients admitted for severe injuries. Unadjusted mortality for patients who were transferred to one or more hospitals are represented on page 30, by jurisdiction.

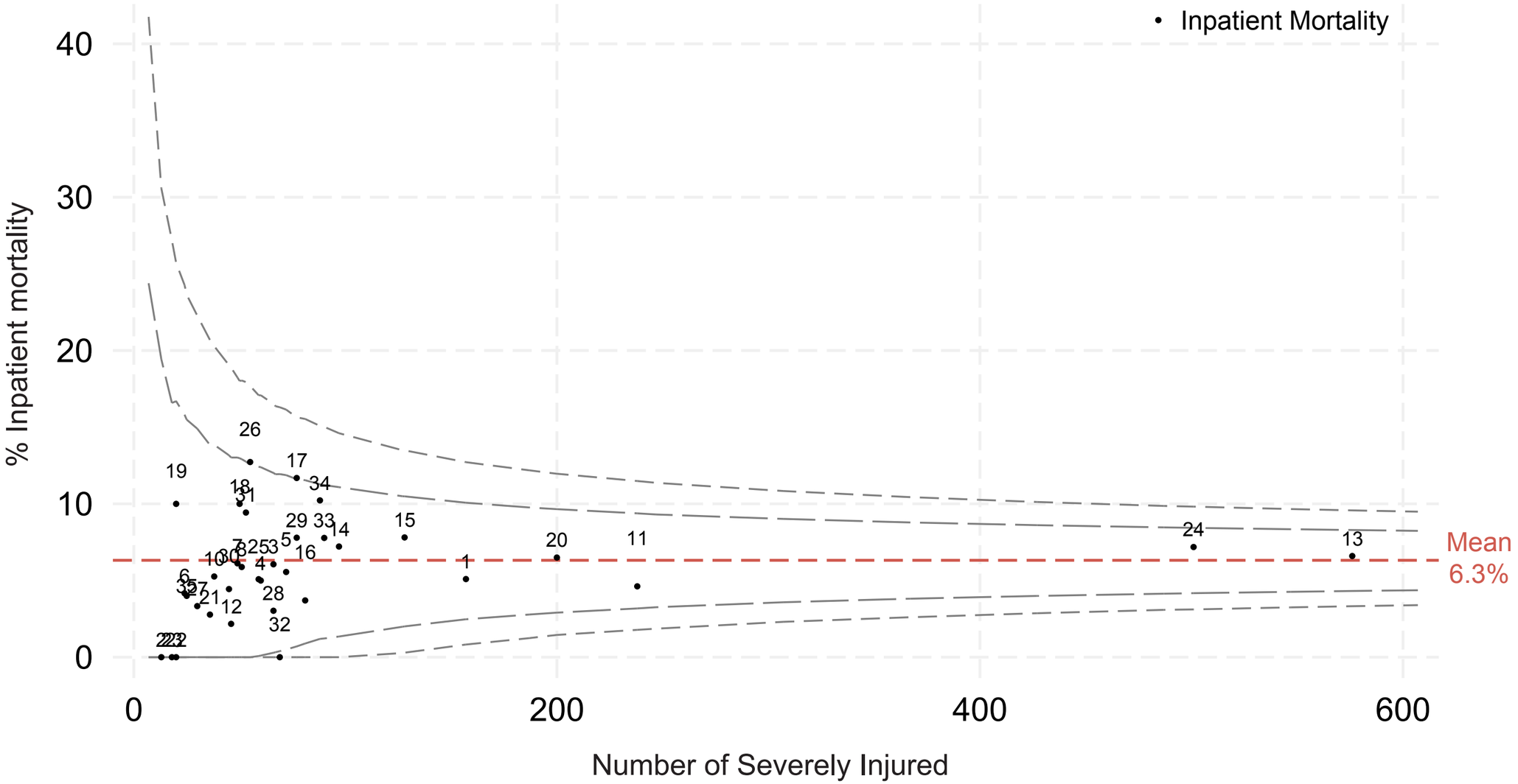


Unadjusted Mortality By Jurisdiction (among transfers)



Among transfer patients

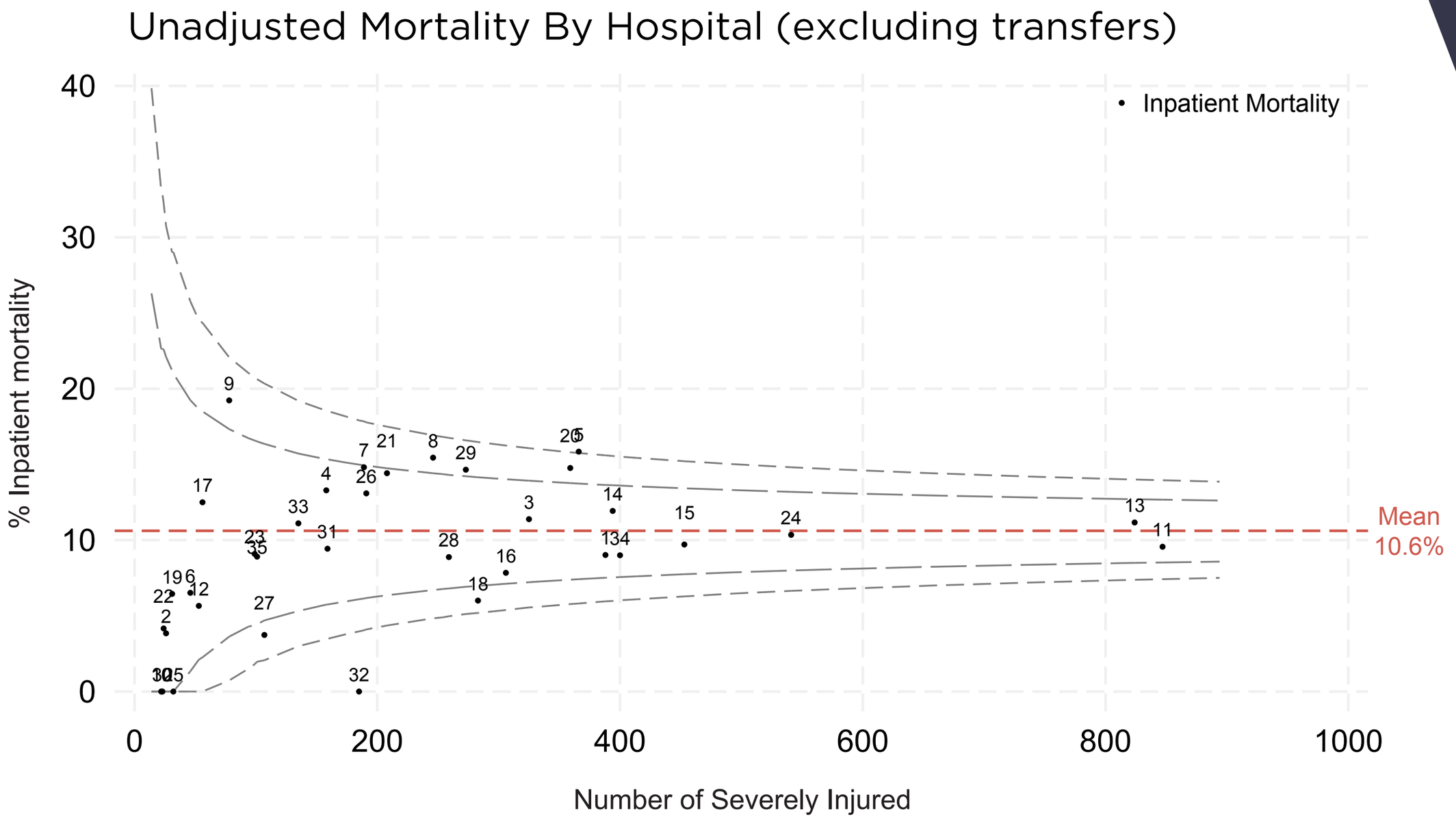
Unadjusted Mortality By Hospital (among transfers)



Among transfer patients

MORTALITY BY HOSPITAL (EXCLUDING TRANSFERS)

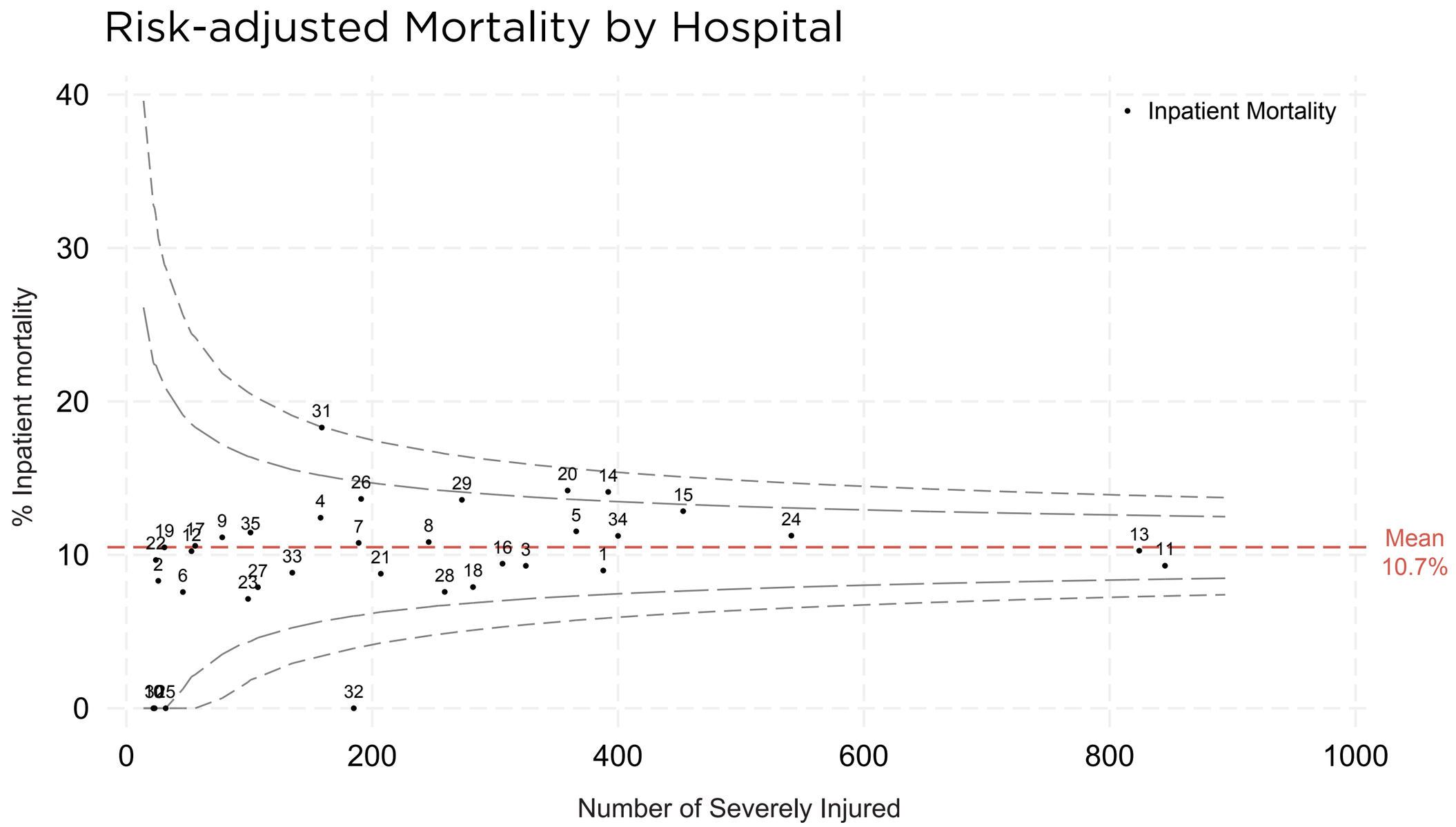
Mortality was compared between hospitals, before and after risk adjustment. The following risk factors were included in the model as they were found to be significant predictors: age, cause of injury, arrival Glasgow Coma Scale (GCS), highest and second highest AIS scores. No significant differences were noted after risk adjustment. Please refer to Appendix A for detailed data analysis. Each numbered dot represents one hospital in the funnel plots below. The funnel plots, where the aim is to identify outliers, show contours which represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits) from the mean. Those outside these lines are considered outliers, with a 5% and 0.2% chance of a false positive respectively. Total numbers for risk adjustment have been reduced because the transferred group of patients has been excluded. This resulted in a 30% reduction in numbers. A further reduction in numbers was the exclusion of non-blunt cases such as burns and penetrating as they are a heterogenous group (5%).



Excludes transfers & includes only blunt injuries

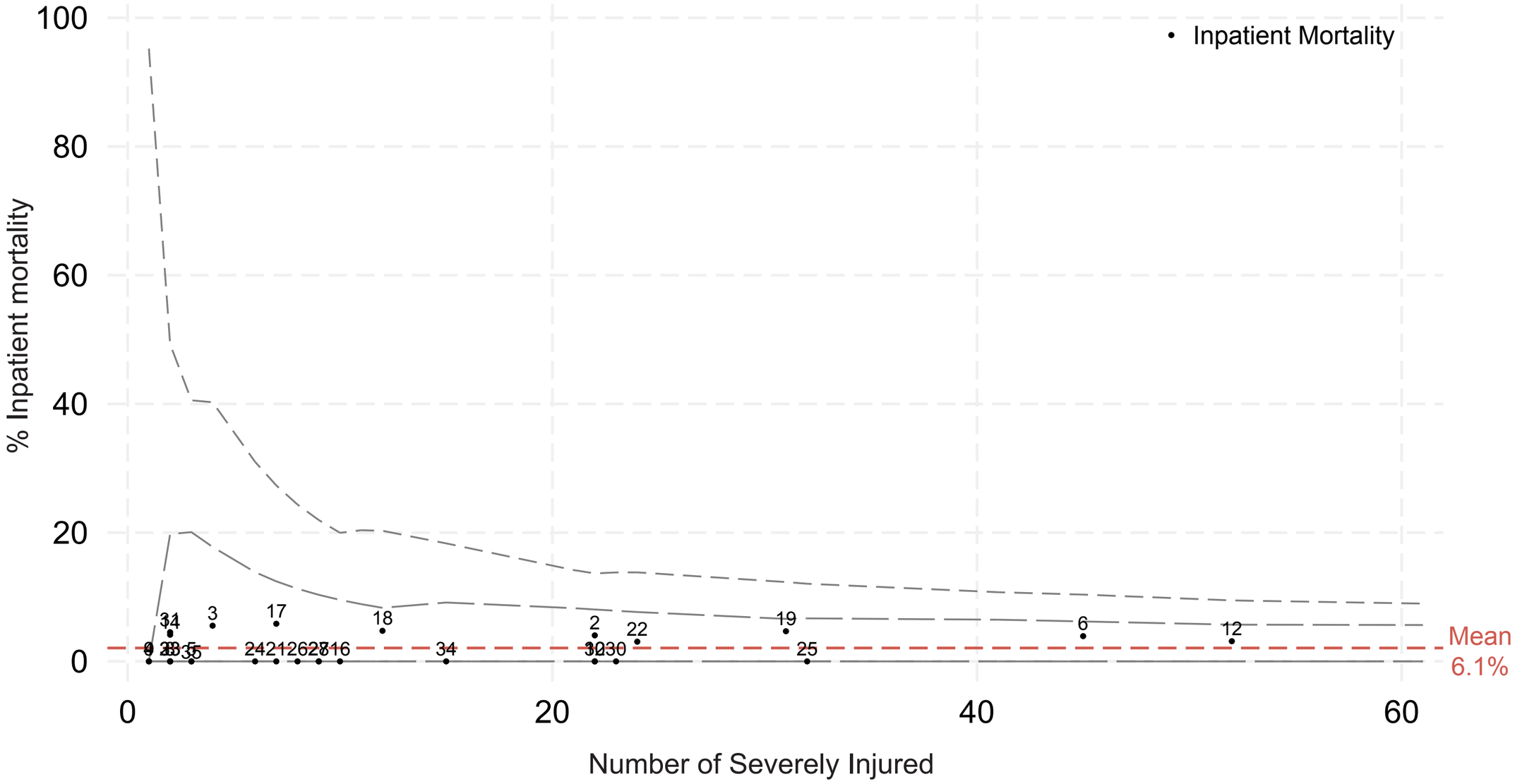
RISK ADJUSTED MORTALITY BY HOSPITAL AND AGE GROUP (EXCLUDING TRANSFERS)

Mortality was compared between hospitals using funnel plots and risk adjusted. Patients were categorised into three age groups: children (aged ≤15 years), adults (≥16 and ≤ 69 years) and older adults (≥70 years). All hospitals were within the 99% control limits for risk adjusted mortality.



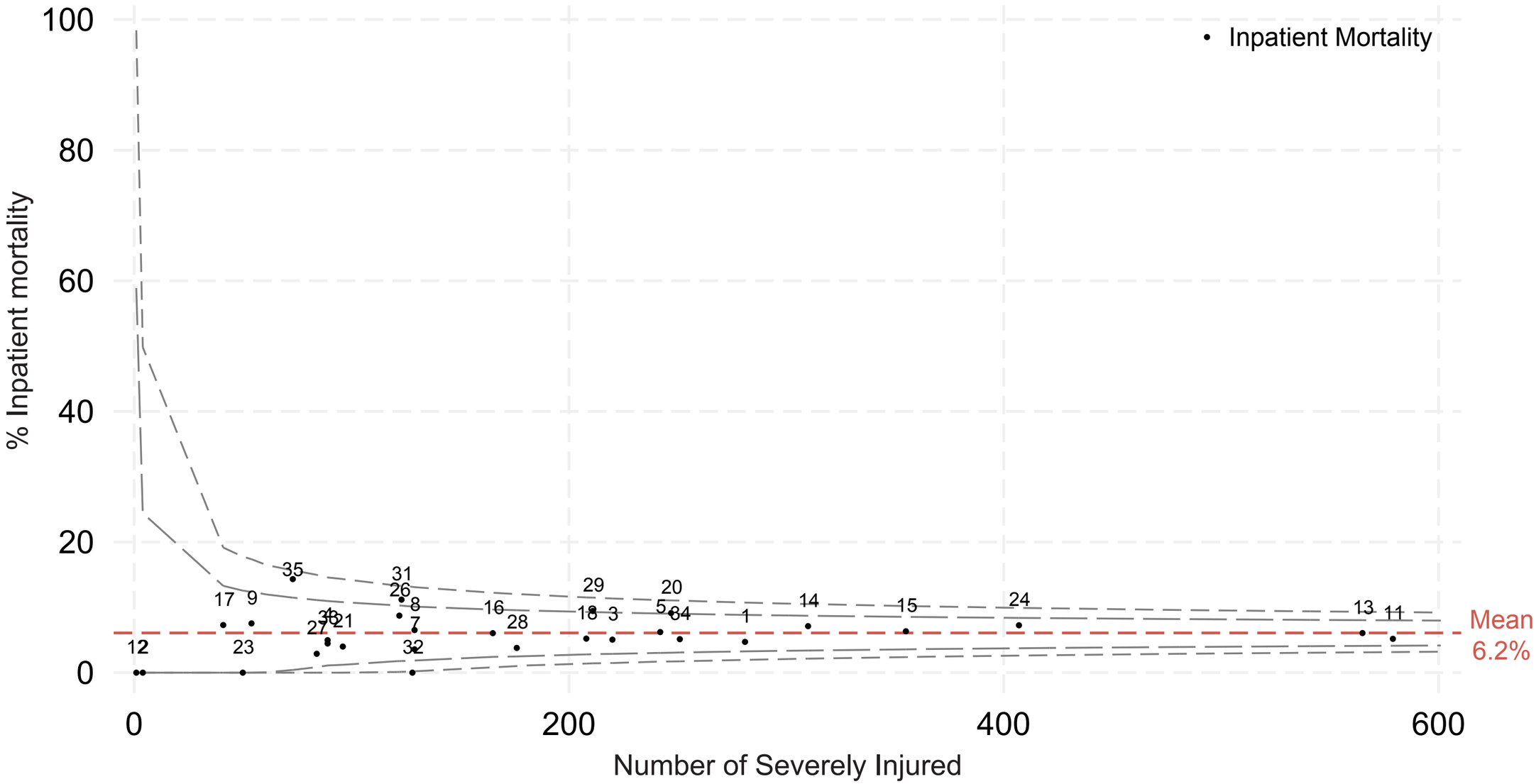
Excludes transfers & includes only blunt injuries

Risk Adjusted Mortality Paediatrics (Aged ≤15years)



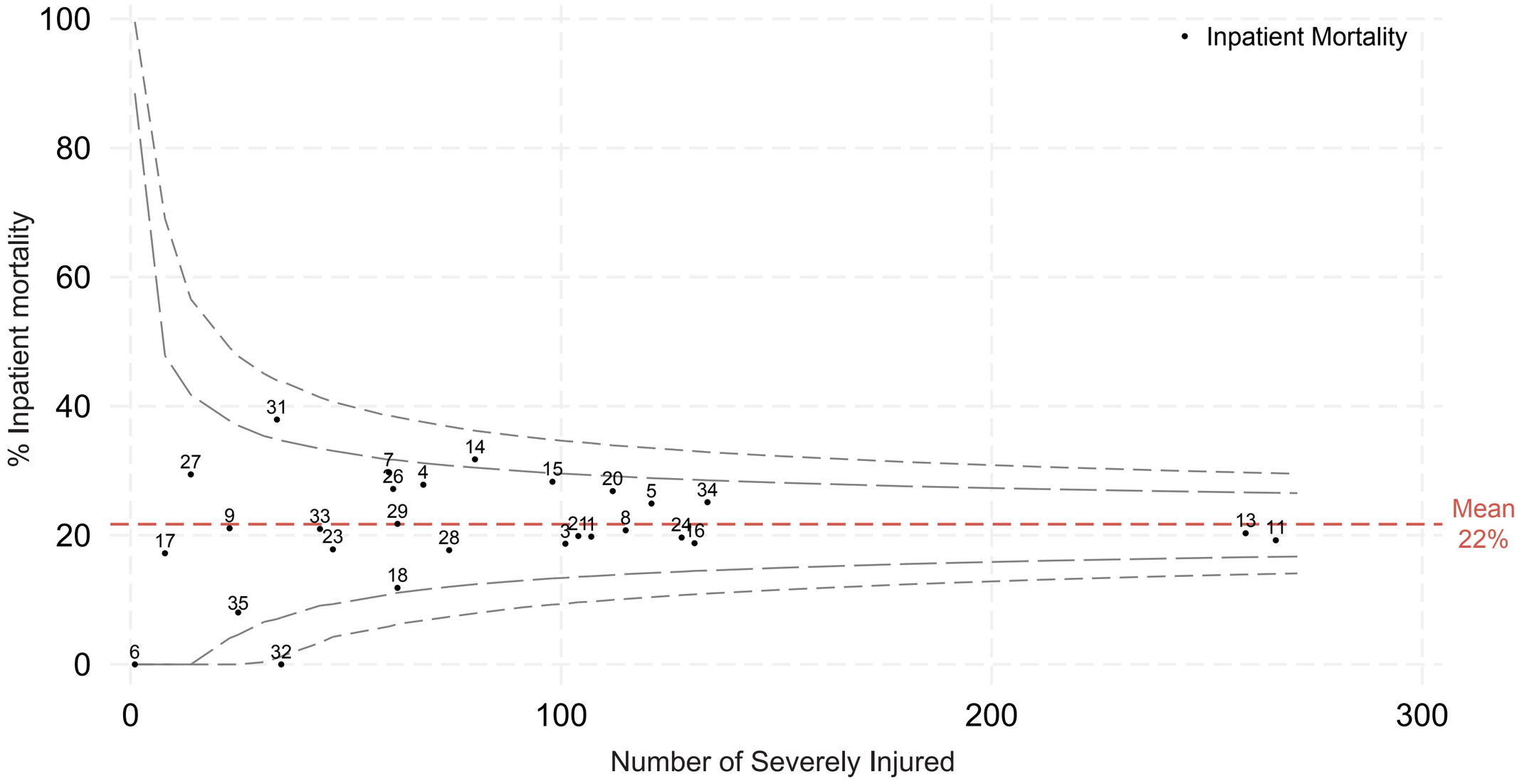
Excludes transfers & includes only blunt injuries

Risk Adjusted Mortality Adults (Aged ≥16 and ≤69years)



Excludes transfers & includes only blunt injuries

Risk Adjusted Mortality Older Adults (Aged ≥70years)

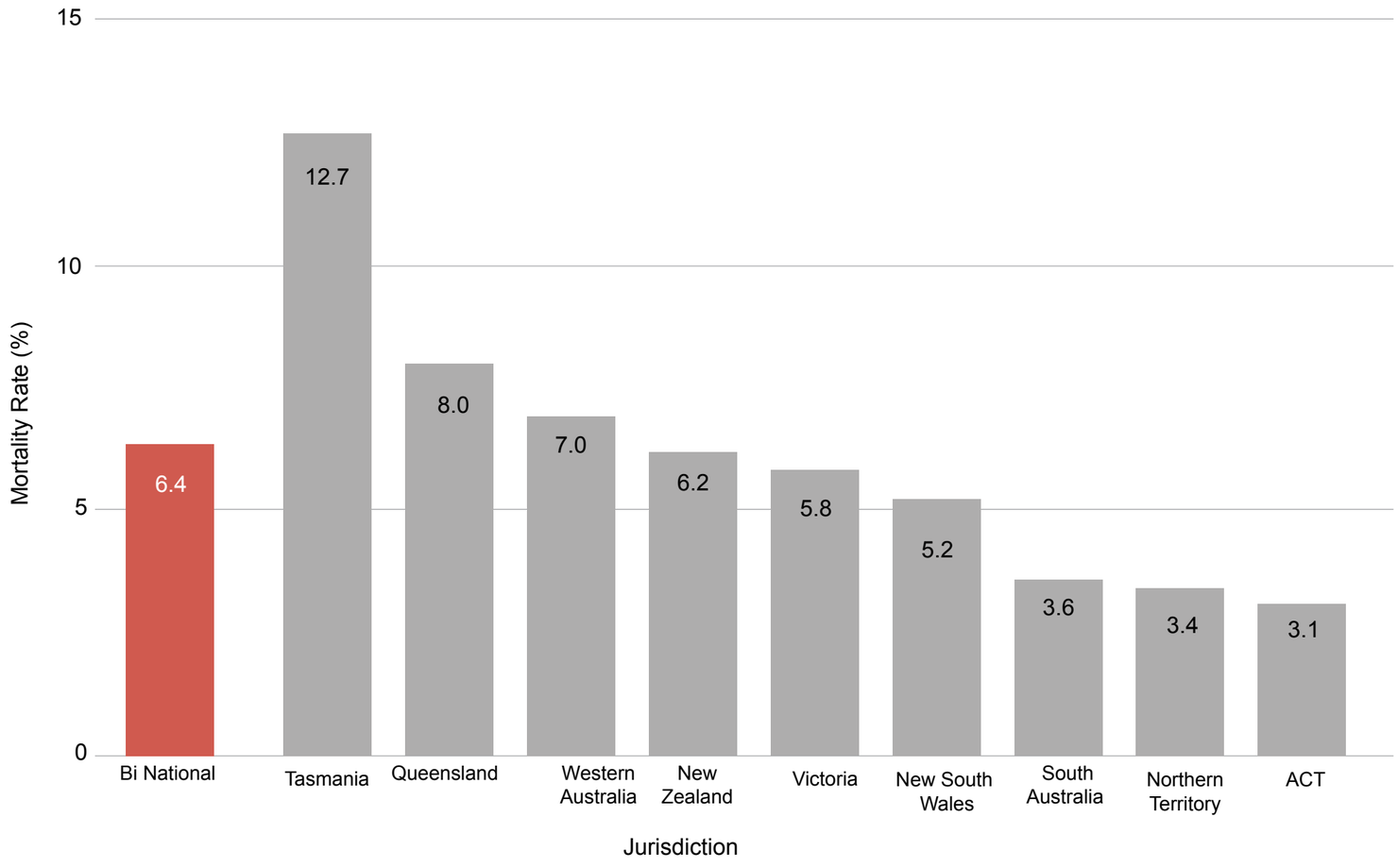


Excludes transfers & includes only blunt injuries

TRANSFER OUTCOMES

Transfers make up 27.7 per cent of all major trauma patients and they are an important group of patients to consider when assessing trauma outcomes. Approximately 6.4 per cent of major trauma patients die after transfer to a major trauma service, which is consistent with the previous year. Approximately 28.8% of transfers were treated in the ICU.

This is an extremely heterogenous group which makes interfacility comparison of outcomes difficult. To reliably compare outcomes for this group, we will need to link with geospatial information on location of injury and with identification of prehospital and regional hospital deaths, prior to transfer. The ANZTR is developing processes to allow for risk adjusted comparisons over coming years.



Jurisdiction	Total Transfers (n)	Deaths (n)	Mortality (%)
ACT	*	*	3.1
Northern Territory	*	*	3.4
South Australia	278	10	3.6
New South Wales	536	28	5.2
Victoria	861	50	5.8
New Zealand	481	30	6.2
Western Australia	560	39	7.0
Queensland	489	39	8.0
Tasmania	55	7	12.7
Bi-national	3,356	214	6.4

*total deaths n<5

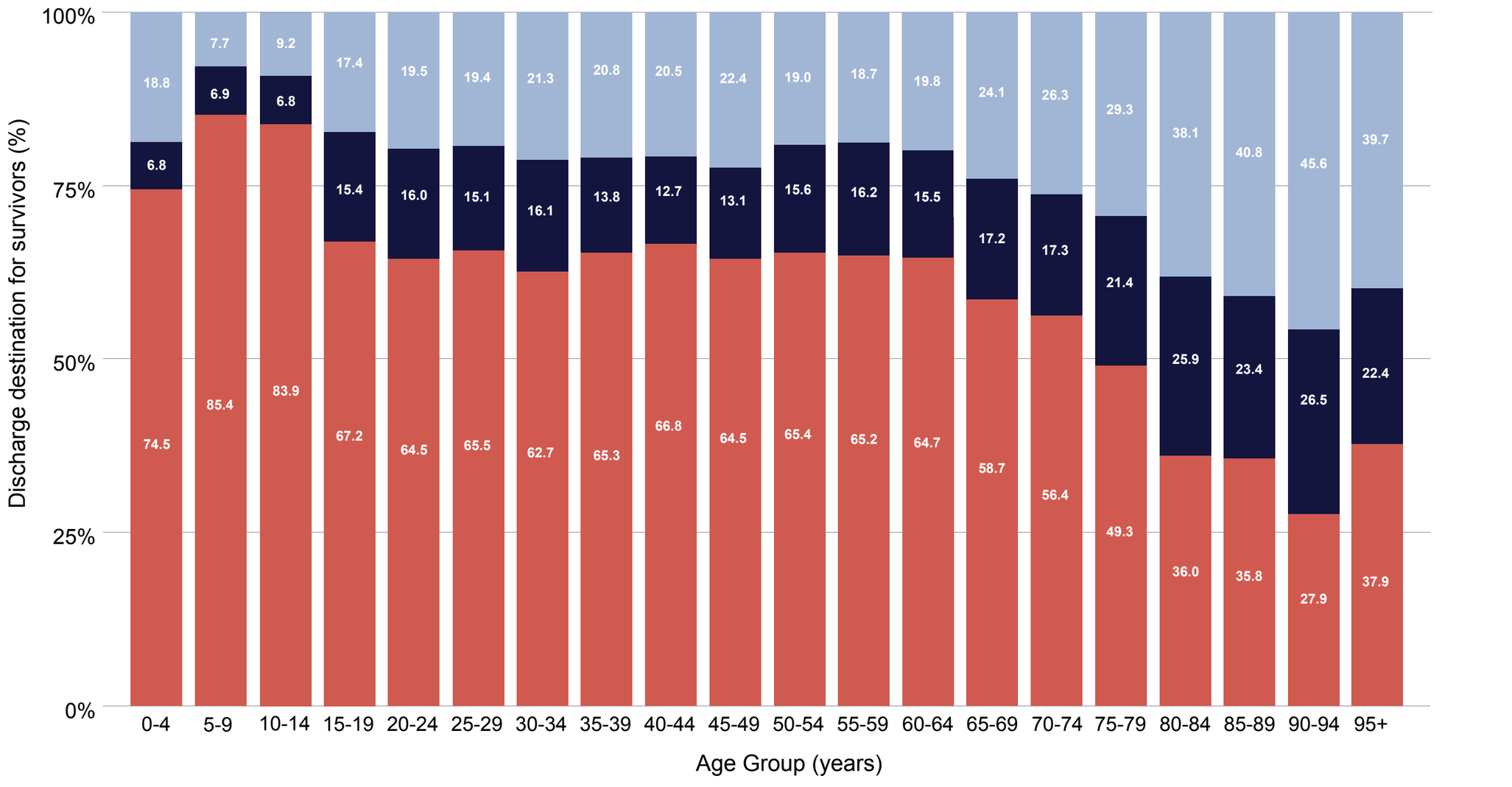
DISCHARGE DESTINATION

A known discharge destination was provided for 99.4% of patients. For patients discharged alive, the proportion of patients discharged home decreased as injury severity increased. As age increased, the likelihood of being discharged home decreased and being discharged to inpatient rehabilitation decreased.

60% discharged **HOME**

16.5% discharged to **INPATIENT REHABILITATION**

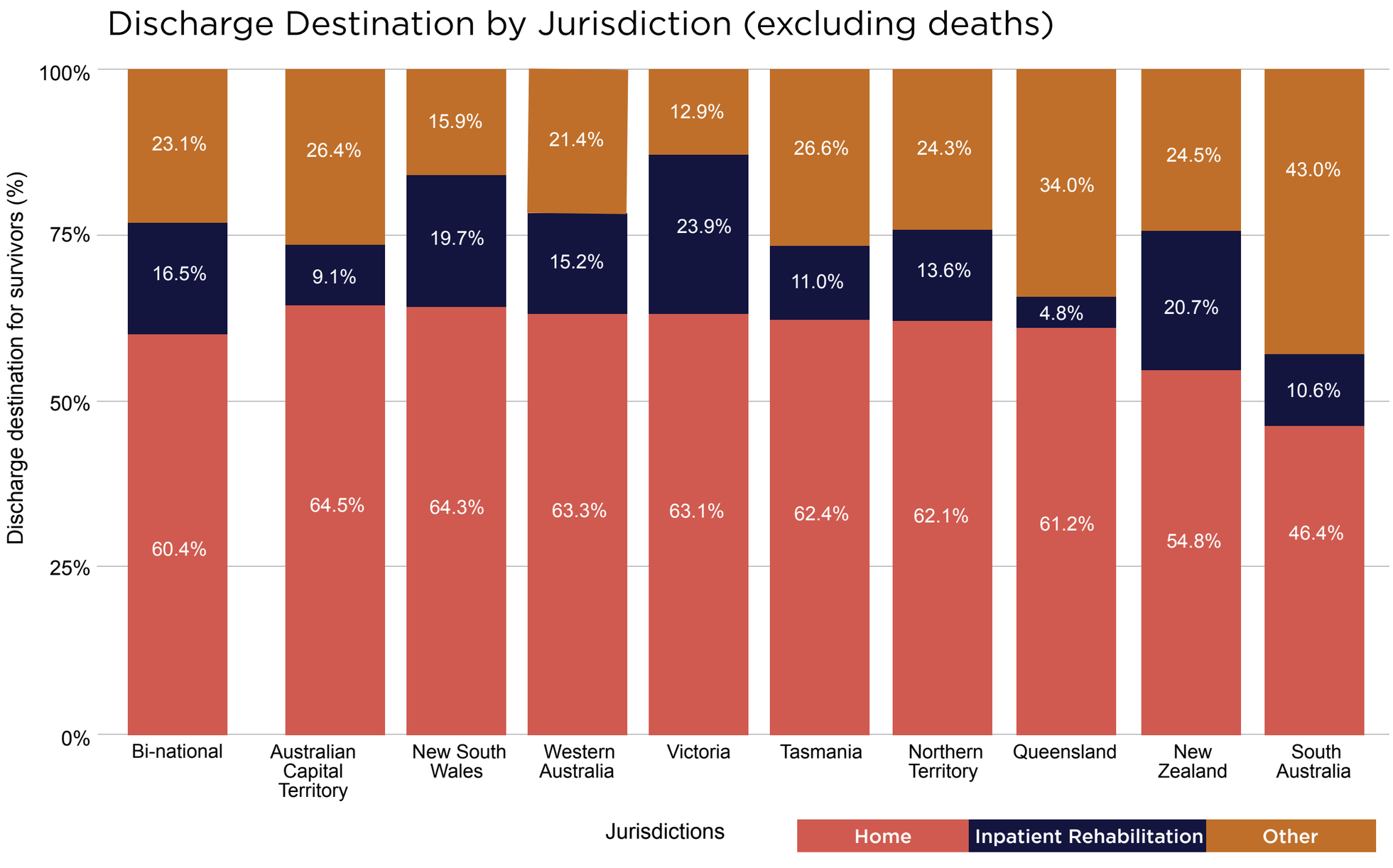
Discharge Destination by Age Group



*The discharge destination 'other' includes residential aged care or nursing home, special accommodation, hospital for convalescence, left against medical advice and acute hospital for further definitive care. If the patient is discharged back to the usual or original place of residence such as anaged care facility or special accommodation, this is coded as discharge to home.

DISCHARGE DESTINATION BY JURISDICTION

When looking at discharge destination by jurisdiction the proportion of patients discharged to home and inpatient rehabilitation vary greatly. The reasons for this will be investigated further. Importantly, discharge to inpatient rehabilitation has decreased over time as new models of home rehabilitation and recovery have been developed[8].



PAEDIATRICS (0-15 YEARS OLD)

More than 61,000 children aged 0-14 were hospitalised following injury in Australia in 2022-23, according to the Australian Institute of Health and Welfare[9]. The Australia New Zealand Trauma Registry collects trauma data on only the most severe injuries - those who are hospitalised with an Injury Severity Score (ISS) of greater than 12 or death after injury.

Seven hundred and sixty children aged zero to 15 years were reported across Australia and New Zealand for the period 1 July 2022 to 30 June 2023, accounting for 6.3% of all severe injuries.

760 SEVERELY INJURED | accounting for **6.3%** OF ALL SEVERLEY INJURED

CHILDREN AGED 0-4 YEARS

Children aged zero to four years accounted for just over one quarter of paediatric injuries (n=210, 27.6%) Children aged zero to four years accounted for just over one quarter of paediatric injuries (n=210, 27.6%) and half (51.4%) of all paediatric deaths. The most common known mechanism was low fall (n=59, 28.1%), followed by high fall (n=35, 16.7%). Sixty-five were classified as having a mechanism injury as 'other'; within this category 20 (9.5%) had an other specified external cause and 18 (8.6%) had the injury cause 'struck by or collision with object'.

Drownings and hanging are not included in this report.

The majority of cases in this age group had an ISS in the range of 16-24 (43.3%) followed by an ISS in the 25-40 range (33.3%).

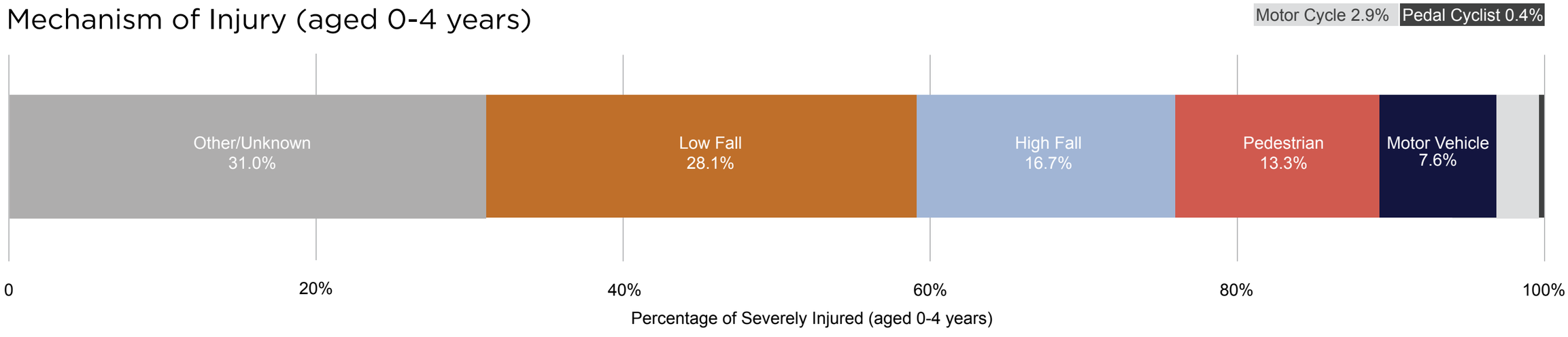
The in-hospital mortality rate in children aged 0-4 years was 8.6%, lower than the bi-national mortality rate of 9.7% and a decrease compared with the previous financial year (14.2%). The most common known cause of death was for pedestrian injuries (n=4). For 47.1% of deaths in this age group, injury intent was not specified.

73.7% of children aged 0-4 years were discharged home, and 6.7% to inpatient rehabilitation. 63.3% of injuries occurred in the home, followed by 16.2% on the road.

51.4% 0-15 yo deaths were **AGED 0-4**

63.3% occurred in **HOME**

16.7% occurred on **THE ROAD**



PAEDIATRICS (0-15 YEARS OLD)

CHILDREN AGED 5-15 YEARS

Children aged five to fifteen years accounted for over two thirds of paediatric severe injuries (n=550, 72.3%), which is slightly higher than 65% the previous year. The most common cause was transport related (n=317, 57.6%) followed by falls (n=126, 22.9%) which is consistent with the previous year. The majority of cases had an ISS within the range 16-24 (n=253, 46.0%) followed by ISS 25-40 (n=154, 28.0%).

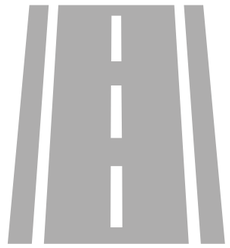
CAUSE OF INJURY

57.6% TRANSPORT **RELATED**

22.9% FALLS related

PLACE OF INJURY

39.6% ROAD



15.4% HOME

12.8% sports & ATHLETICS AREA

OUTCOME

3.1% DIED in-hospital

52.9% deaths TRANSPORT **RELATED**

OUTCOME

3.1% (n=17) of severely injured children aged 5-15 years died in hospital. This is below the bi-national mortality rate of 9.7% and a decrease compared to last year (n=28, 5.79%). 52.9% of deaths were transport-related. Of those alive at discharge, 83.6% were discharged home and 7.1% to inpatient rehabilitation. 39.6% of injuries occurred on the road, 15.4% in the home, and 12.8% sports and athletics area.

MAJOR TRAUMA IN OLDER PERSONS (≥50 YEARS)

INTRODUCTION

The World Health Organisation has reported that the pace of global population ageing is outpacing previous projections making it imperative that health systems prepare for this demographic shift[4]. Increasing rates are projected in both Australia and New Zealand, with persons aged 65+ expected to make up nearly one-fifth of the Australian population[5] and one-quarter of the New Zealand population by the 2050s[6]. This is expected to increase demand across the healthcare system, including trauma services.

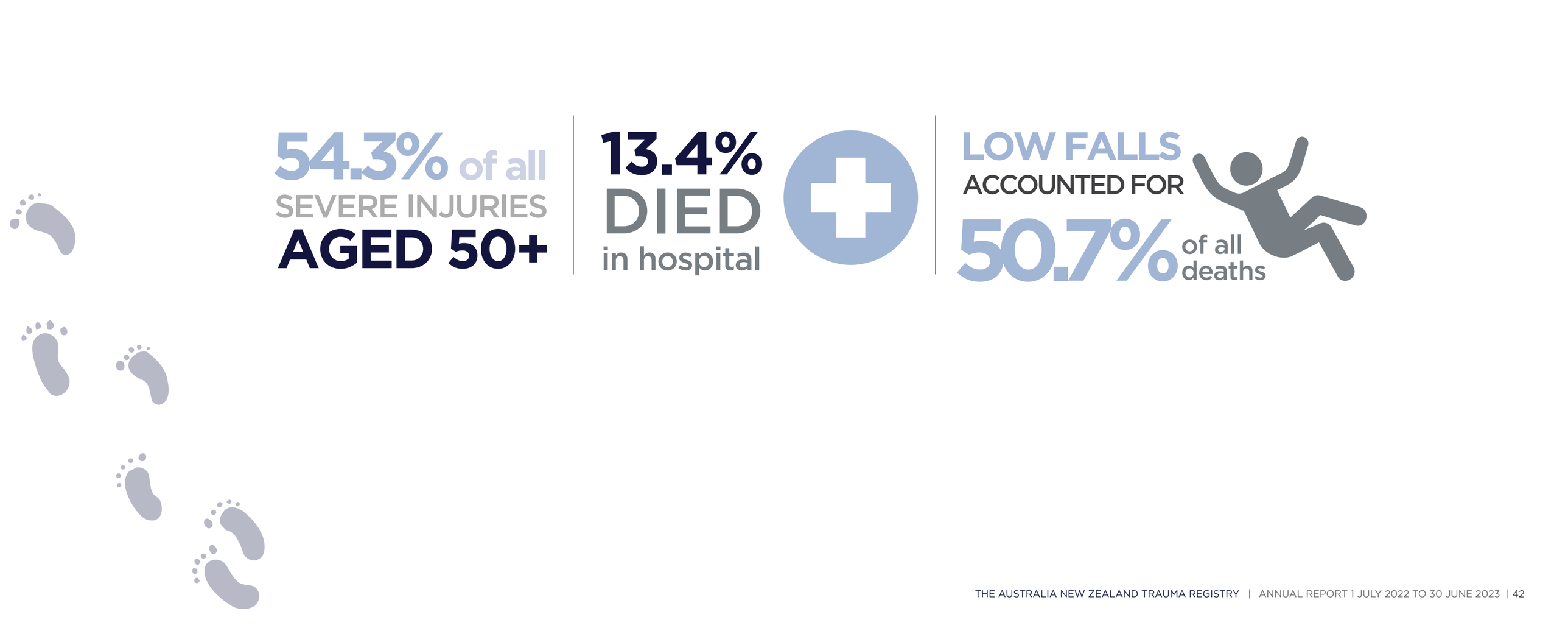
Older persons represent an increasing proportion of the major trauma population in Australia and New Zealand, with older persons injured from low falls the predominant group experiencing major injury and death [1]. Similar trends have been described elsewhere. In the United States, trauma in older adults is increasing in both the number of cases and as a proportion of the total trauma centre volume[2]. In England and Wales, the Trauma Audit and Research Network (TARN) reported that the typical major trauma patient has changed from being young and male to being older with a lower degree of male predominance[3]. Older adults (aged ≥60 years) now account for over 50% of the severely injured patients in the TARN database, with falls being the commonest mechanism of injury in this patient group[3].

For this report, the age range of 50 years and over has been used to describe older persons. This range was chosen to ensure inclusion of older Indigenous Australians and older Maori, and to reflect the gap in life expectancy that occurs for these groups versus the general population[5, 10]. The ANZTR now collects data on ethnicity and frailty, both of which will be used to support analysis of major trauma in older persons in future reports.

ANALYSIS

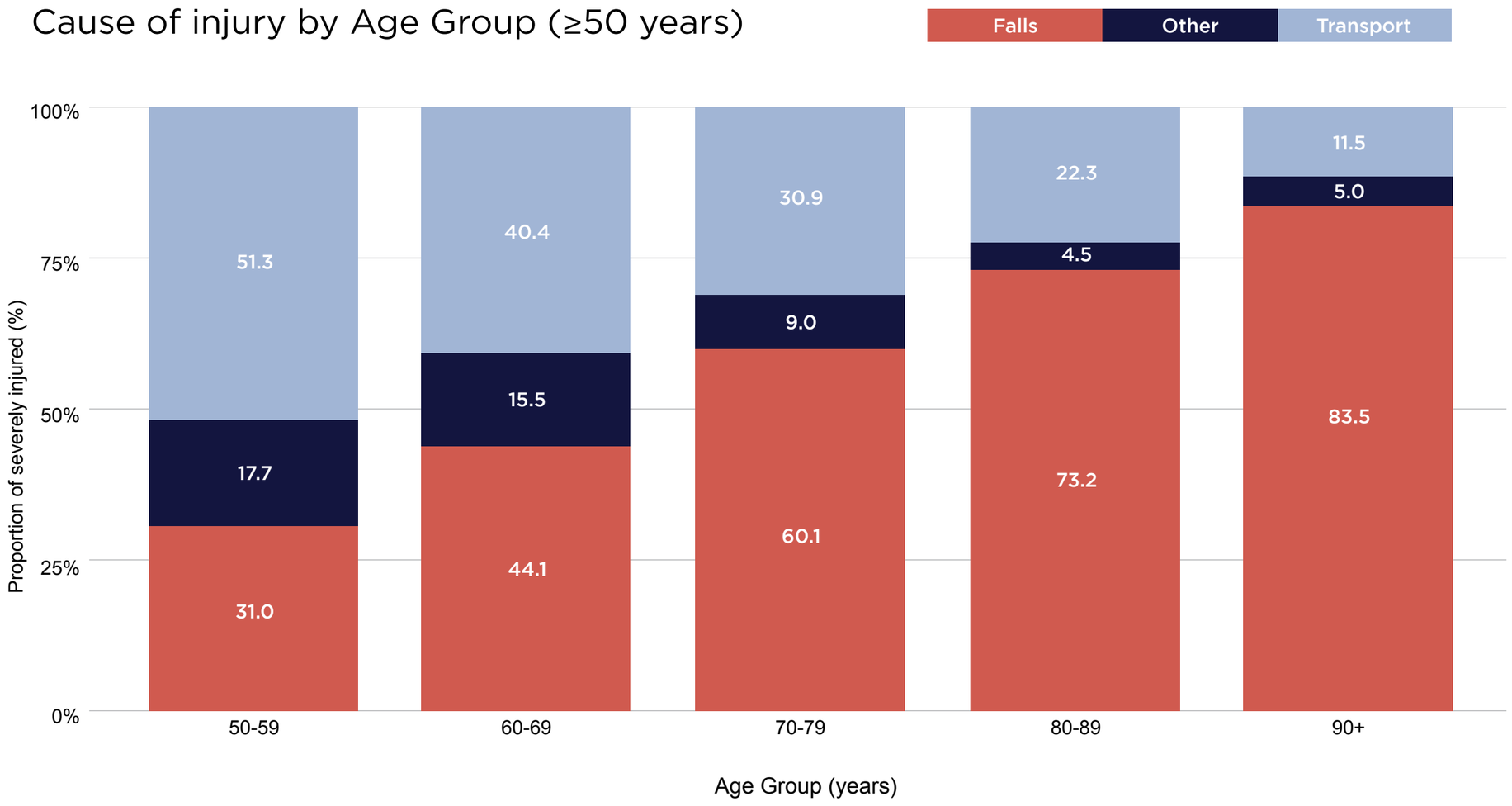
In the 2022/23 financial year, over half of all severely injured were aged 50 years and older (n= 6,573; 54.3%).

With increasing age, the proportion of major trauma due to transport related causes decreased, while those due to falls increased.



MAJOR TRAUMA IN OLDER PERSONS (≥ 50 YEARS)

CAUSE OF INJURY

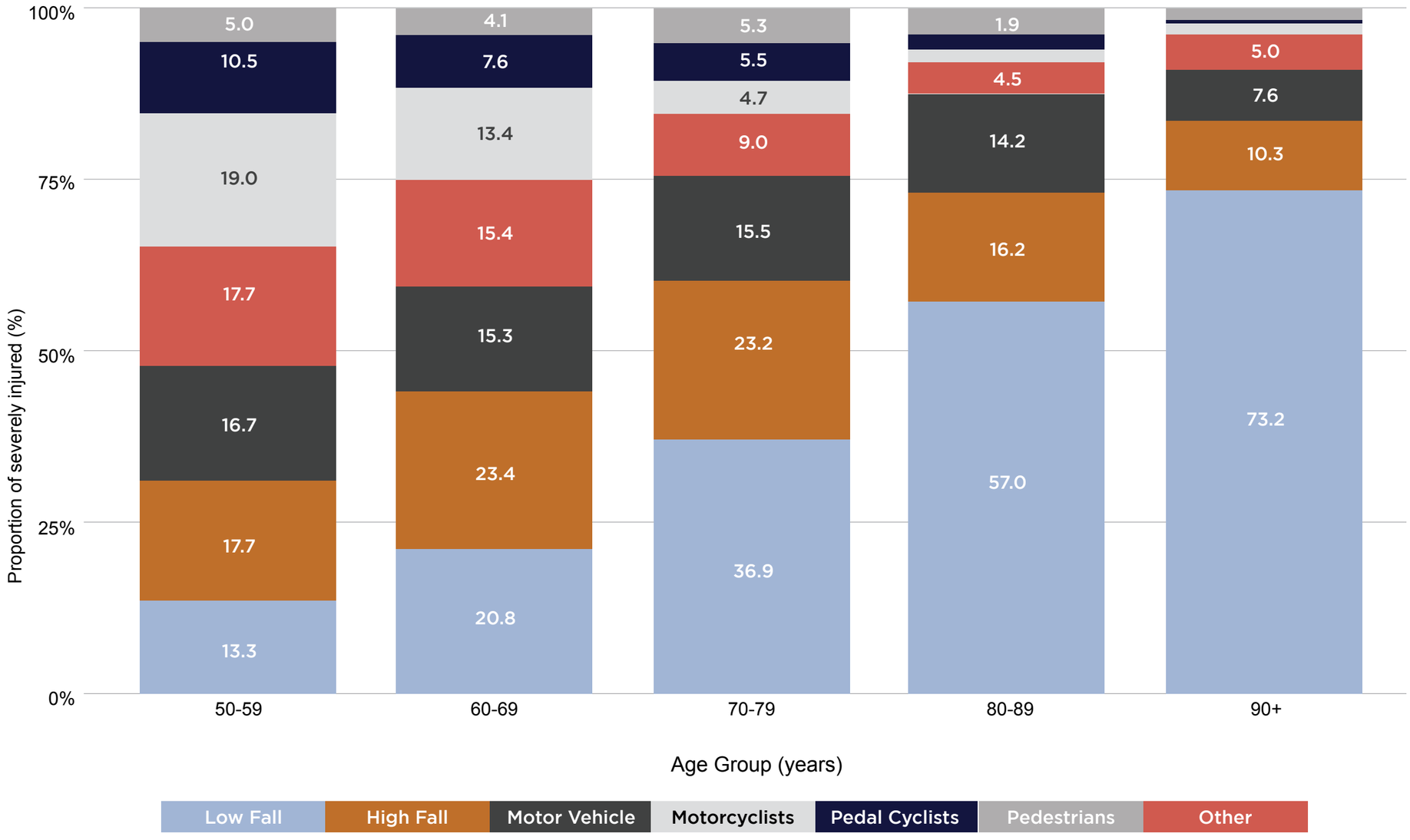


	Transport Related						
	Motor vehicle	Motor cyclist	Pedal cyclist	Pedestrian	Low Fall	High Fall	Other
50-59 years	269	307	170	81	214	286	285
60-69 years	247	217	122	66	336	378	249
70-79 years	249	75	88	86	594	374	145
80-89 years	185	25	27	53	741	210	58
90+ years	33	8	1	8	319	45	22
TOTAL	983	632	408	294	2,204	1,293	759

MAJOR TRAUMA IN OLDER PERSONS (≥ 50 YEARS)

CAUSE OF INJURY

Cause of injury by Age Group (≥50 years)



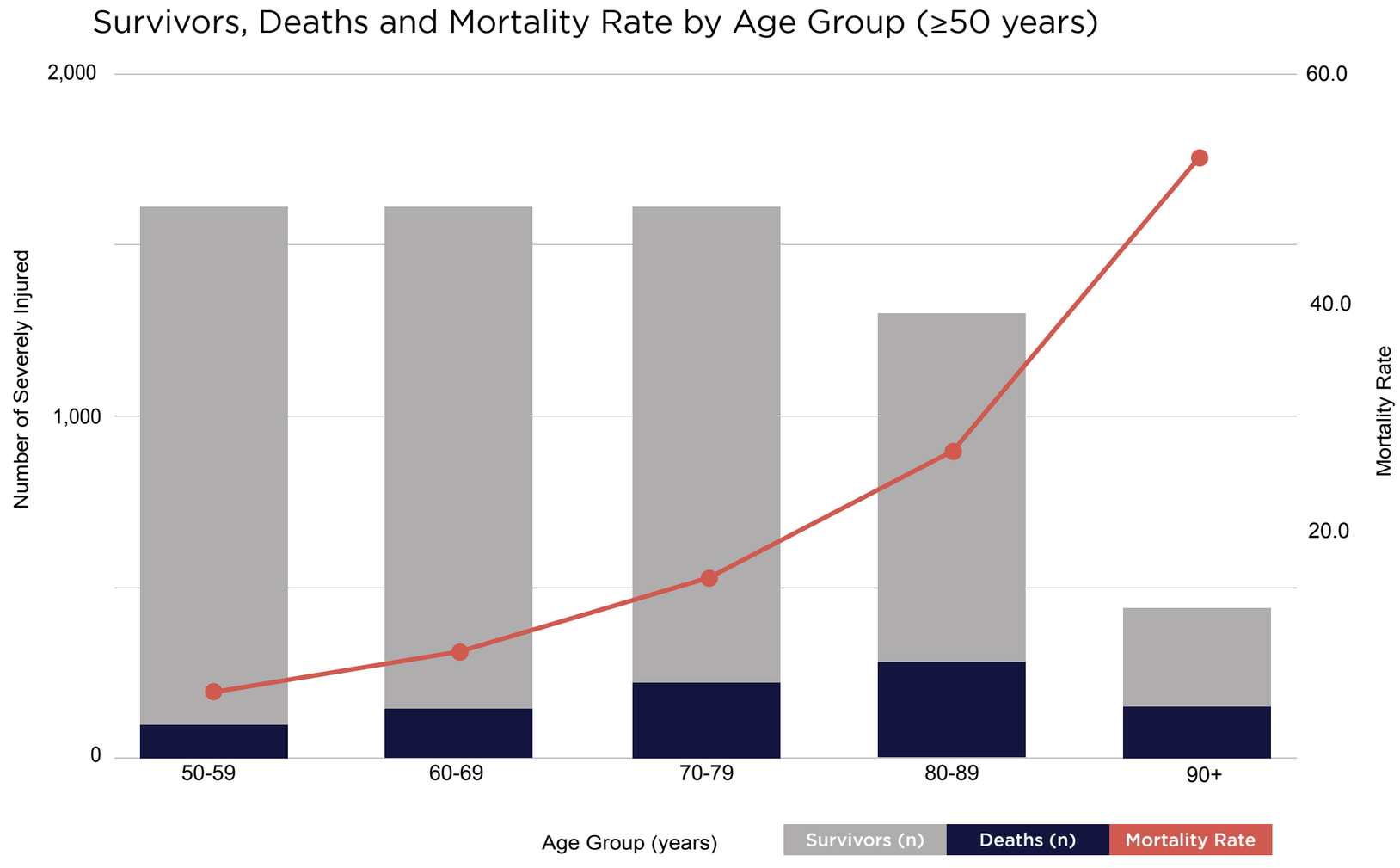
MAJOR TRAUMA IN OLDER PERSONS (≥ 50 YEARS)

MORTALITY

887 (13.5%) of patients aged ≥50 years died in hospital - higher than the overall bi-national mortality rate of 9.7%. Of these deaths, 42 (4.7%) occurred in ED. The mechanism of injury for the majority of deaths in older adults was low falls (n=450, 50.7%), followed by high falls (n=146, 16.5%). The mortality rate increased dramatically with age, particularly from age 70 years and older.

FREQUENCY AND PROPORTION OF DEATHS BY INJURY MECHANISM IN OLDER ADULTS (≥50 YEARS)

	Transport Related						
	Motor vehicle	Motor cyclist	Pedal cyclist	Pedestrian	Low Fall	High Fall	Other
Deaths (n)	102	32	22	46	450	146	89
Deaths (%)	3.6	16.5	50.7	11.5	2.5	5.2	10.0



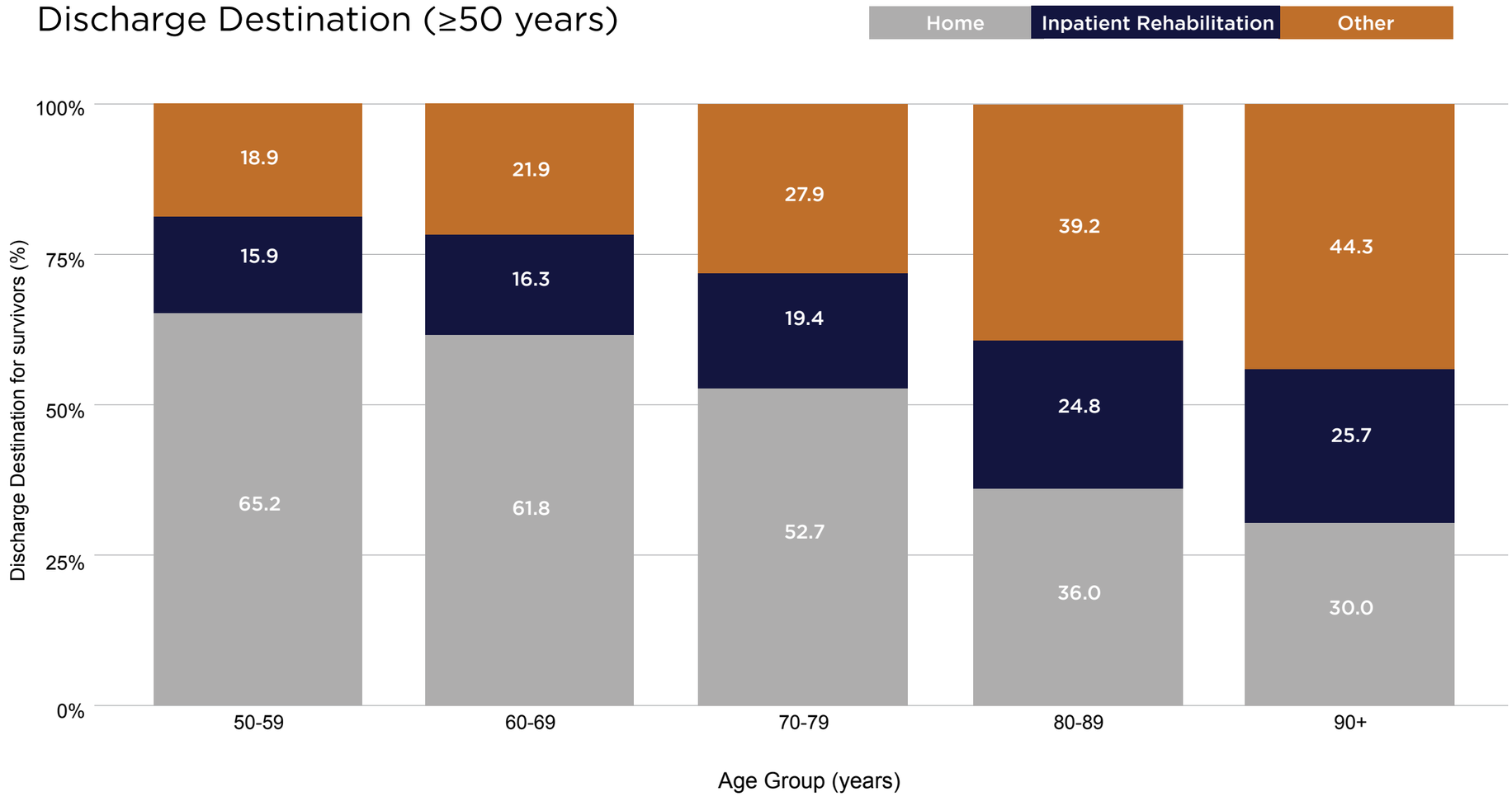
MAJOR TRAUMA IN OLDER PERSONS (≥ 50 YEARS)

TRANSFER RATE

The overall rate of transfer for older adults was similar to the bi-national average (27.3% vs 27.7%), although the rate of transfer decreased from age 75 years and older.

DISCHARGE DESTINATION

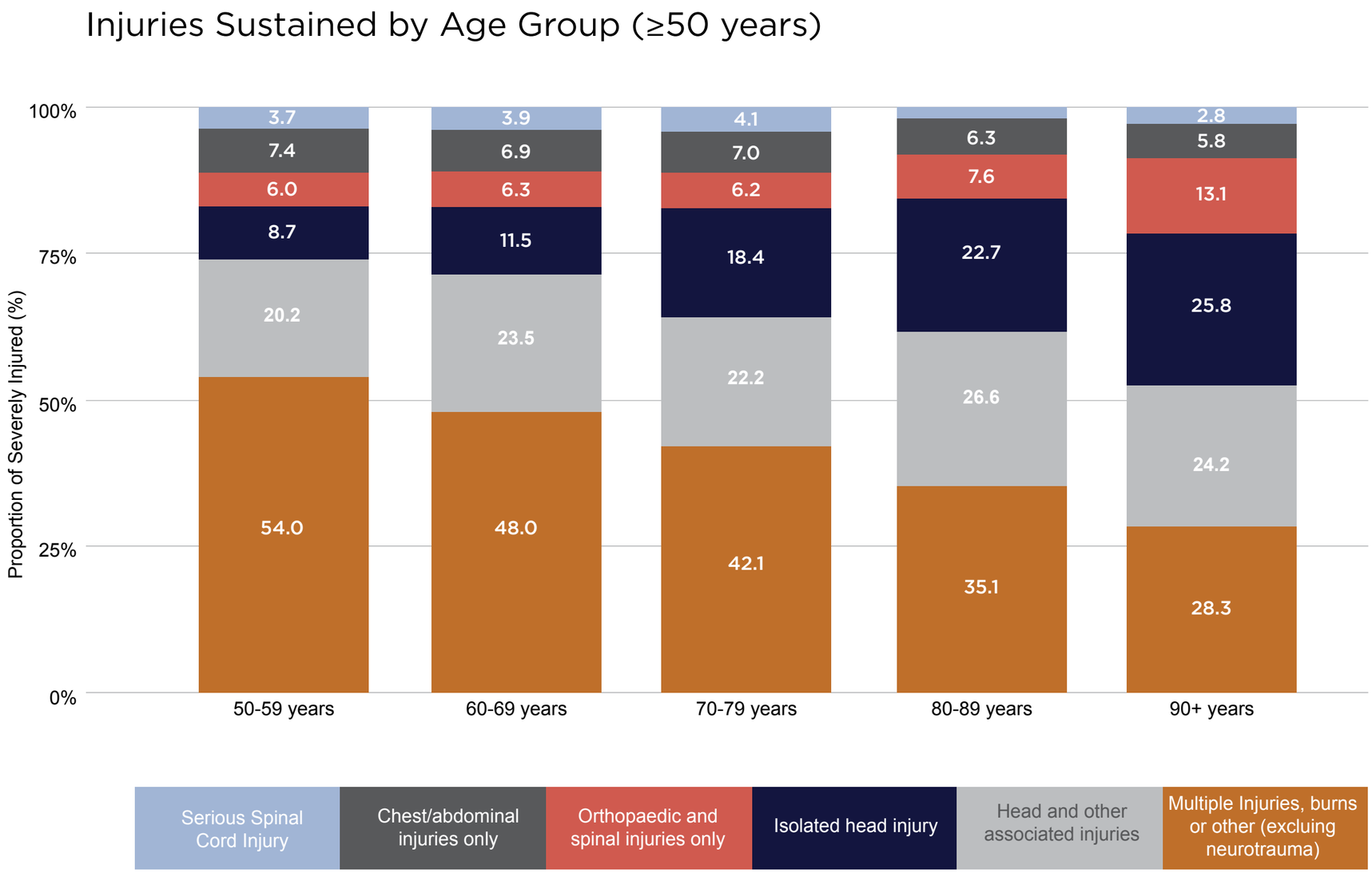
As age increased the likelihood of being discharged home decreased and being discharged to inpatient rehabilitation increased. This trend was evident for older adults, in particular those aged ≥70 years.



MAJOR TRAUMA IN OLDER PERSONS (≥ 50 YEARS)

INJURIES SUSTAINED

The most prevalent injuries sustained for older adults (aged 50 years and over) were the same as the general cohort: multiple injuries (excluding serious neurotrauma) were the most prevalent, followed by 'head and other associated injuries', and 'isolated head injuries'.



The mortality rate for isolated head injuries in those aged 50 years and over was 32.2%, and increased with age - approximately one third of patients aged 65 years and over with an isolated head injury died in hospital, higher than the bi-national average of 19.3%. The majority of deaths in older adults with isolated head injury were due to low falls (n=197, 69.1%).

ROYAL AUSTRALASIAN COLLEGE OF SURGEONS (RACS) TRAUMA QUALITY IMPROVEMENT COMMITTEE AND THE ANZTR

One of the aims of the Royal Australasian College of Surgeons (RACS) Trauma Quality Improvement (TQI) committee has been to support quality improvement for all trauma patients. By using the ANZTR data to establish benchmarks, and providing cross-comparison feedback to each trauma centre, processes of care for improvement within the trauma system can be identified.

The RACS TQI committee developed a set of bi-national process indicators which allows for cross-comparison and benchmarking of key process indicators between sites and jurisdictions. There are eight process indicators, all of which are now incorporated in the bi-national data dictionary. The ANZTR is continuing to work with sites to improve data capture and completeness of these variables so that reporting all of the process indicators will be possible in future.

RACS TQI PROCESS INDICATORS

INDICATORS	1	2	3	4	5	6	7	8
INDICATOR NAME	Mortality	Prehospital transport times	Discharge Destination	Time to CT scan if GCS < 13	Trauma team activation for patients with ISS > 12	Blood alcohol collection in patients with ISS > 12.	Time in first facility, if transferred.	Time in the Emergency Department.
DEFINITION	The rate of in-hospital deaths that occur, either in the Emergency Department or after inpatient admission, in patients admitted following injury.	The mean and/or median times that elapse between the time of injury and the episodes of care that occur prior to arrival at the 1st receiving hospital.	The rate at which patients are discharged to the various destinations other than death, at the conclusion of their hospital admission	The mean and/or median time that elapses between arrival at the reporting hospital and the first head CT performed at that same hospital.	The percentage of patients with major injuries, defined as an ISS > 12, who had a trauma team activated at the time of presentation to the Emergency Department.	The percentage of patients with major injuries, defined as an ISS > 12, who had a blood alcohol level collected and documented within 6 hours of first hospital admission.	The mean and/or median length of time that is spent in the first facility, prior to the transfer to definitive care.	The mean and/or median length of time that is spent in the Emergency Department, prior to discharge to the ward, or other disposition from the ED that is not death.
RATIONALE	To understand the burden of death from injury in patients that are alive on presentation to hospital.	To understand the timeliness of prehospital encounters.	To quantify the varying outcomes of in hospital admissions, with a view to determining resource allocation.	To measure the timeliness of CT investigation of a patient with a suspected brain injury.	To determine the accuracy of trauma team activation.	To measure the recognition of major injury by compliance with blood alcohol collection practice.	To measure the timeliness of transfer to definitive care and evaluate compliance with transfer protocols.	To measure the timeliness and efficiency of the care delivered in the Emergency Department.

APPENDIX A - ANZTR 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. IIn 2012, the NTRI established the Australian Trauma Quality Improvement Program Collaboration Agreement for the purposes of bringing together Australia's 26 designated trauma centres to form the Australian Trauma Registry (ATR) in providing important data on the most severely injured. In 2018, New Zealand joined the collaboration, introducing a further seven designated trauma centres to the registry. The ANZTR is supported by the Department of Health, the Bureau of Infrastructure and Transport Research Economics (BITRE), and Te Whatu Ora- Health New Zealand.

Minimum Dataset

ANZTR data is defined by the Bi-National Trauma Minimum Dataset (BNTMDS). 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 ANZTR. The current version of the minimum dataset (Version 2.1) can be downloaded from the ANZTR website (www.anztr.org.au/data-set).

Inclusion/ Exclusion Criteria

The ANZTR collects data on severely injured patients presenting to one of 35 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) are included in ANZTR 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, elderly patients who die with superficial injury only (contusions, abrasions, or lacerations) and/or have coexisting disease that precipitates injury or is precipitant to death (e.g. stroke, renal failure, heart failure, malignancy, advanced frailty by Rockwood), drowning, hanging.

Data Definitions

Emergency Department length of stay (ED LOS) is calculated by the ANZTR 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 Modification6 (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 MANZTRix (www.cdc.gov/nchs/data/ ice/icd10_transcode.pdf).

Type of injury was based on ICD-10-AM codes. Codes were mapped to injury types in the BNTMDS.

Data Analysis

Risk adjusted outcomes are provided in this report. The primary outcomes were inpatient mortality and length of stay (LOS). Total numbers for risk adjustment have been reduced because the transferred group of patients has been excluded. This resulted in a 30% reduction in numbers. A further reduction in numbers was the exclusion of non-blunt trauma cases such as burns and penetrating injury as they are a small heterogenous group (5%)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 firth logistic regression model was used and the robust linear regression model for LOS, due to right skewness in the data. Only survivors were included in the LOS analysis. The following risk factors were included in the model as they were found to be significant predictors: restricted cubic splines for age with 4 knots, cause of injury, arrival Glasgow Coma Scale (GCS) - motor, shock-index grouped in quartiles, highest and second highest AIS scores. Data analysis was performed in Stata V16.0 (Stata Corp, College Station, Tx, USA) and level of significance set at 5%. The relationship between age and mortality among trauma patients is nonlinear. There are several options to dealing with non-linearity, including categorising based on arbitrary cut-offs, including a quadratic term or including cubic splines. In a recent publication, we compared the various methods and found that cubic splines to be the most appropriate[11]. The model assumes that the relationship is polynomial between the knots, locations set by the model at 18, 52 and 82 years. Although the splines are not easily interpretable, note that this is used in the context of benchmarking and not patient risk-stratification, which would probably require a different approach.

Data Confidentiality

In 2016, Monash University, became the custodian of the ANZTR data and responsible for all reporting. Patient level data is not reported. Only hospital and jurisdictional aggregate data is provided in this report.

Data Quality

Data submitted to the ANZTR 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) 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 [7].

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Royal Darwin Hospital

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