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The NSW Trauma Registry Profile of Serious to Critical Injuries

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Executive Summary

Each year around 2000 people are seriously to critically injured in NSW and are admitted to a trauma service. How the NSW trauma system responds to these patients is critical for their long term outcomes and quality of life, and for reducing the overall financial and social cost of trauma to individuals and the whole community.

The key priority for trauma data collection by the NSW Institute of Trauma and Injury Management (NSW ITIM) is to monitor the effectiveness of the NSW Trauma System response to these most seriously injured patients. This group of patients, the serious to critically injured, place the greatest demand on the trauma system and on other agencies and services – not simply for health care, but for a wide range of needs.

This report describes how the NSW trauma system responded to these patients, from the time of the injury and provision of pre-hospital services, through to in-hospital services provided at a trauma service. The report investigates the data to determine whether the NSW trauma system worked as it should, to ensure that the right patient arrived at the right hospital in a timely manner.

The report helps us understand the nature of injuries sustained by those people and how they occurred. This spectrum of trauma contributes to safety and injury prevention efforts and assists other agencies concerned with minimising the likelihood and effects of traumatic injury.

In the 2008 dataset we found the following:

- The numbers of falls recorded in the dataset is rising – for the first time the total numbers of falls and road trauma injuries were almost identical
- Injuries to the head were recorded for almost two thirds of people injured in 2008. Over 77% of injuries within this group were brain injuries (to the brain stem, cerebellum or cerebrum)
- Subdural haematomas were the single most common group of injuries. A relatively high proportion of these injuries were sustained at home by people aged 65 years and older

Data from the Trauma Minimum Data Set is used to provide advice and feedback to clinicians and other stakeholders, and enables research into patterns of service demand and staffing. This data also supports benchmarking and performance improvement activities.

Monitoring the NSW Trauma System

The NSW Trauma system

The NSW trauma system consists of an organised approach to facilitate and coordinate a multidisciplinary system response to provide care to injured patients. The system encompasses a continuum of care that provides injured people with the greatest likelihood of returning to their prior level of function within the community.

This continuum of care includes injury prevention, pre hospital coordination and care, appropriate triage and transport, emergency department trauma care, trauma service team activation, surgical intervention, intensive / critical and general in-hospital care, rehabilitation services, allied health and medical care follow up.

The overall goal of the NSW State Trauma System is to decrease the incidence and severity of injury, as well as to ensure optimal and accessible care to improve health outcomes for those who are injured. Furthermore the trauma system aims to facilitate the treatment of the 'right patient at the right hospital', ensuring that designated trauma services have appropriate resources to meet the complex needs of the injured patient.

Mandate for trauma data in NSW

The NSW Trauma Services Plan requires NSW ITIM to monitor and report on the performance of individual Trauma Services to ensure that performance is consistent with the standard of care, and to manage a state-wide clinical injury data collection process.

The plan also positions NSW ITIM to develop partnerships with injury stakeholders in order to build an improved critical mass for research and education across the spectrum of trauma prevention care and rehabilitation. The collection of trauma data is an important aspect of these activities.

The NSW Trauma Registry

NSW ITIM is responsible for managing the collection of data about seriously to critically injured people admitted to trauma services in NSW. Data collected about these patients is held securely in the NSW Trauma Registry. Data in the registry is submitted regularly from trauma registries at the following hospitals:

- Gosford Hospital
- John Hunter Hospital/John Hunter Children's Hospital
- Liverpool Hospital
- Nepean Hospital
- Prince of Wales Hospital
- Royal North Shore Hospital
- Royal Prince Alfred Hospital
- St George Hospital
- St Vincent's Hospital
- Sydney Children's Hospital
- Tamworth Hospital
- The Children's Hospital at Westmead
- Westmead Hospital
- Wollongong Hospital

The registry contains simple, non-identifiable information about each injured person, the nature and location of the incident resulting in injury, the main injuries sustained, and some details of pre-hospital and in-hospital treatments and services provided to each person. In addition, some data about other (earlier) hospital admissions is collected for patients transferred to a trauma service for trauma services. The trauma data collection tool from which this data is derived is provided at Appendix 2.

Current scope of trauma data collection in New South Wales

Data for this report is drawn from the NSW Trauma Registry, which currently contains de-identified patient records submitted by trauma registries in NSW. The NSW Trauma Registry does not hold data for every injured person admitted to hospital in NSW. Rather, data is only submitted on behalf of patients with the greatest needs – the most seriously injured – who are treated at one of the fourteen hospitals with a trauma registry. The submitted data is known as the NSW Trauma Minimum Data Set, and forms the basis of this report.

As the scope of the current data collection is restricted to these hospitals, which are primarily located within the Sydney Greater Metropolitan area, there may be some data for trauma admissions to other hospitals – particularly in rural areas – which is not included in the NSW Trauma Registry.

A snapshot of trauma activity at Tamworth Hospital in 2008 has been included in this report. While not included in the overall figures, Tamworth Hospital data will be included within general trauma activity figures in all future reports.

Methodology and inclusion criteria

The Abbreviated Injury Score (AIS) and Injury Severity Score (ISS)

The key inclusion criterion for inclusion in the NSW Trauma Registry requires a classification of injuries for trauma patients and an Injury Severity Score (ISS). The ISS is an internationally recognised anatomical scoring system that provides an overall score for patients with multiple injuries. The ISS is a calculated number which is based on an anatomical injury severity classification, the Abbreviated Injury Scale (AIS). The AIS classifies individual injuries by body region on a 6 point severity scale from Minor to Maximum (currently untreatable injury).

The AIS and ISS is used by accredited staff at each hospital trauma registry to score individual patient injuries and their severity, and provides a common tool for comparing and selecting patient records for inclusion in the NSW Trauma Registry. Scoring is undertaken retrospectively, but usually within 24-48 hours after admission to allow for identification of all injuries. On initial evaluation these patients typically have abnormal vital signs or a significant anatomical injury.

Appendix 3 provides details and an example of how an ISS is derived from a set of injuries sustained by a patient. Injuries are individually allocated to one of six body regions, and the severities of the top three injuries in different body regions are used to calculate the ISS. The ISS along with the body regions and injury and severity codes used in this calculation are recorded in the NSW Trauma Registry.

Injury severity ranges from 1 to 6, where 6 is currently an untreatable injury. Patients with an AIS injury code with a severity of 6 are automatically assigned an ISS of 75, the highest possible score.

The calculated ISS value ranges from 1-75. Serious to critically injured trauma patients are defined as those patients with an ISS > 15, which is an internationally recognised indicator of serious injury. In this report ISS is reported in ranges:

16-24 (serious injury); 25-40 (severe injury); and 41-75 (critical injury).

As well as describing the nature of injuries sustained by patients, the AIS and ISS also indicate mortality, quality of life, and trauma care, across such dimensions as:

- Hospitalisation and need for intensive care
- Length of hospital stay
- Treatment cost
- Treatment complexity
- Length of treatment¹

The correlation between ISS and case fatality rates is evident in the NSW Trauma Registry data (Table 1). Case fatality rates rise with each ISS range group and are the highest in the critically injured category of patients.

Table 1: Case fatality rate and mean hospital length of stay by ISS range, 2008

ISS range	Case fatality rate	Mean hospital length of stay (days) ²
16-24	4.4 %	14.77
25-40	23.3 %	20.96
41-75	41.8 %	25.75

¹ Abbreviated Injury Scale 2005: Association for the Advancement of Automotive Medicine, 2005, p5

² Length of stay while classified as an acute care patient

The dataset also demonstrates a relationship between severity of injury and length of stay in hospital as an acute care patient. Patients classified as critically injured (ISS 41-75) have an average length of stay more than one and a two thirds as long as patients classified as seriously injured (ISS 16-24).

The version of AIS in use in 2008 was the Abbreviated Injury Scale 2005. This was the first full year that injuries were scored using the AIS 2005 version, enabling a clearer view of the effect of the updated scoring standard on the profile of serious to critical injuries.

Inclusion criteria

The key criterion for including a patient record in the NSW Trauma Registry is a classification of injuries as serious to critical. Patients with injuries classified as serious to critical are identified for the NSW Trauma Registry when they have an Injury Severity Score greater than 15 (ISS > 15).

Several other criteria are also used to select or filter trauma patient records for the state-wide trauma registry. They include the following:

- The patient must be admitted to a trauma service in NSW
- The patient must be admitted within fourteen days of sustaining an injury

As a result of these criteria patient records submitted for inclusion in the NSW Trauma Registry do not represent all injuries in NSW, nor do they represent the full work or caseload of trauma teams in hospitals, or the full set of data recorded in hospital trauma registries.

The data is however, a very complete and accurate record of the serious to critically injured group of patients. Data submitted for inclusion in the state-wide trauma registry is subject to rigorous checking and validation prior to inclusion in the registry, while missing or invalid data is flagged and returned to individual trauma services for completion.

Missing data however is rare and the state-wide trauma registry has an extremely low rate of incomplete records.

Records may also be excluded from this report if the following key data elements have missing or invalid data recorded in the registry:

- Date of injury
- Injury Severity Score
- Date of admission

No records with an ISS > 15 in 2008 were excluded from this report.

Definitive care

The phrase 'definitive care' is used frequently throughout this report. The concept and dimension of definitive care is important in analysing the progress of the trauma patient through the pre-hospital and hospital system. It also assists to identify transfer patterns and problems, and to identify numbers of injured people, rather than admissions to hospital.

The definitive care hospital is considered to be the hospital where the patient is provided with all treatment and care required for their injuries. Definitive care for serious to critically injured people is provided by an adult major trauma service, paediatric major trauma service, or a regional trauma service.

In 2008, adult major trauma service registries were:

- John Hunter Hospital
- Liverpool Hospital
- Prince of Wales Hospital
- Royal North Shore Hospital
- Royal Prince Alfred Hospital
- St George Hospital
- St Vincent's Hospital
- Westmead Hospital,

Paediatric major trauma service registries were:

- John Hunter Children's Hospital
- Sydney Children's Hospital, and
- The Children's Hospital at Westmead, and

Regional trauma service registries were:

- Gosford Hospital
- Nepean Hospital, and
- Wollongong Hospital

For the most seriously injured patients, the hospital of definitive care for an adult is either an adult major trauma service or regional trauma service, or a paediatric major trauma service for a paediatric patient under the age of 16 years.

2008 data

General observations

The number of records included in the NSW Trauma registry with an ISS > 15 has fallen since the introduction of AIS 2005 in July 2007. Figure 1 below shows the fall appeared to occur immediately in the period after the introduction of the new AIS 2005 scoring standard.

People injured, six monthly periods, 2006-2008

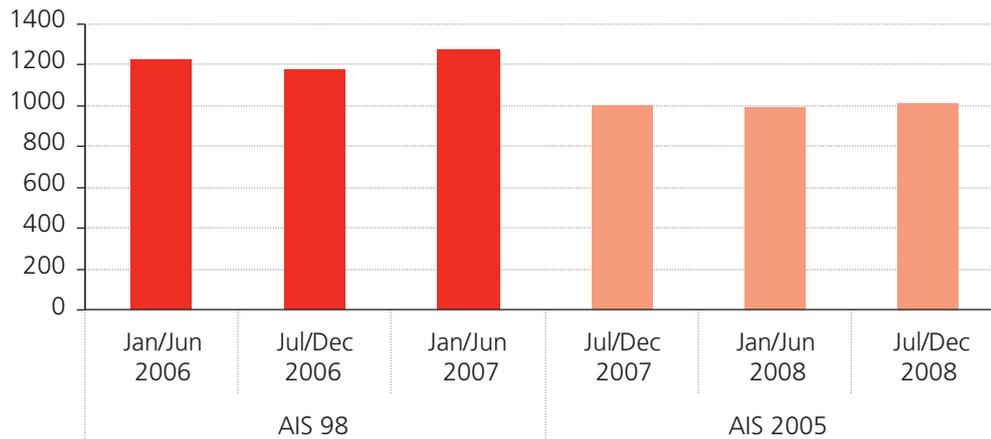


Figure 1: People injured, six monthly periods, 2006-2008, with AIS coding version

Figure 2 indicates that the fall in serious to critical trauma numbers since July 2007 has been distributed across all major mechanisms of injury³. While it appeared that road trauma (which includes motorcycle trauma, motor vehicle collisions drivers and passengers), pedestrian trauma, and pedal cycle trauma) had been falling during the 2006/7 period, further analysis and comparison with other datasets would be required to determine the extent to which the apparently large fall in road trauma in the second half of 2007 is a reflection of an actual decrease in road trauma statistics generally or a result of AIS 2005.

Major Mechanisms of injury, six monthly, 2006-2008

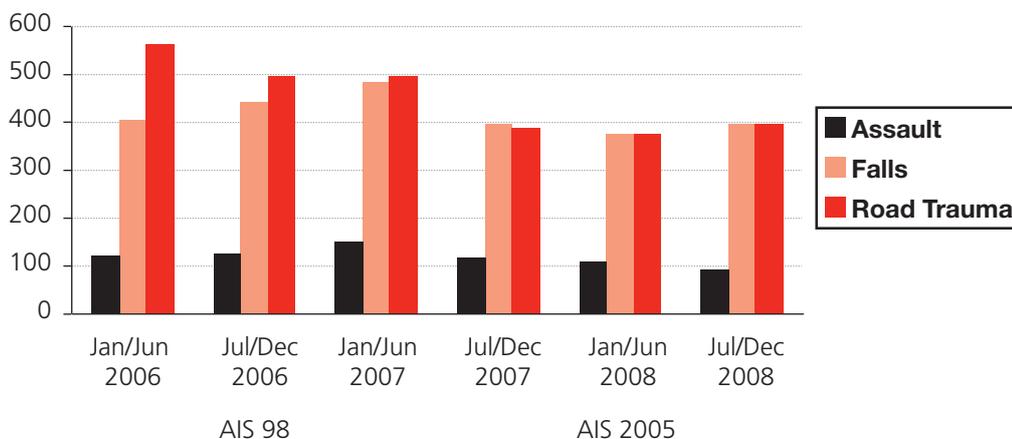


Figure 2: Major mechanisms of injury, six monthly, 2006-2008.

³ This includes all blunt and penetrating assaults as a group (Assault), all falls of varying heights as a group (Falls), and motor cycle, motor vehicle, pedestrian and pedal cycle injuries as a group (Road Trauma).

Demographic profile

The NSW Trauma Registry recorded 2002 people injured with an ISS > 15 in 2008 (Table 2). This represented a decrease in the number of people injured for this group of patients from 2007 of approximately 12%. The overall incidence of serious to critical injuries in NSW for 2008 was approximately 29 people injured per 100,000 in the NSW population⁴.

Table 2: Injured people, summary statistics

Summary statistics, injured people	Summary
Total people injured	2002
Died	13.1% 95% CI 11.6, 14.6 (262 people)
Incidence (ISS>15) per 100,000 NSW pop. (age standardised) ⁵	27.9 95% CI 27.2, 28.6
Deaths (ISS>15) per 100,000 NSW pop. (age standardised)	3.4 95% CI 3.01, 3.87
Age standardised mortality ratio (SMR) ⁶	690

The age standardised mortality ratio (SMR) for this group of patients in 2008 was 690, indicating the rate of deaths of people in the group of serious to critically injured patients was more than 6 times greater than in the general (standard) Australian population. The age standardised death rate for the group for 2008 was 3.4 deaths per 100,000 people in the NSW population. In comparison the age standardised death rate for all deaths in NSW for 2008 was 600.1⁷.

The case fatality rate for this group of patients is the percentage of deaths recorded in this group of serious to critically injured patients.⁸ The case fatality rate for 2008 was 13.1%.

The age distribution within the dataset of people with serious to critical injuries in the NSW Trauma Registry was similar in 2008 to previous years (see Table 3).

Table 3: Age distribution of serious to critically injured people

Age range	Proportion of serious to critically injured people (%)
Age 0 – 15 years	7.1 %
Age 16 – 64 years	65 %
Age 65 years and older	27.9 %

The age-standardised rate of injuries in 2008 was 27.9 people injured per 100,000 people in the NSW population (Table 2), however age-specific rates varied across age groups from 5.2 in the 5-9 years age group to a high of 107.3 in the 85 years and older group of people⁹. The steep rise in rates from the age of 75 years shows that trauma is an increasing issue for people as they reach this age (Figure 3).

4 Source: Australian Bureau of Statistics. *Australian Demographic Statistics*. Catalogue no. 3101.0. Canberra: ABS, 2009

5 Standardised with Australian standard population June 2001. Source: Australian Bureau of Statistics. *Australian Historical Population Statistics 2008*. Catalogue no. 3105.0.65.001. Canberra: ABS, 2009

6 Standardised with Australian standard population June 2001

7 Australian Bureau of Statistics. *Causes of Death, Australia, 2008*. Catalogue no. 3303.0. Canberra: ABS, 2010.

8 These are calculated as follows: Case fatality rate = number of deaths divided by the number of patients in this data collection X 100

9 Rates of injuries per 100,000 people in age group

Age-specific rates of injury

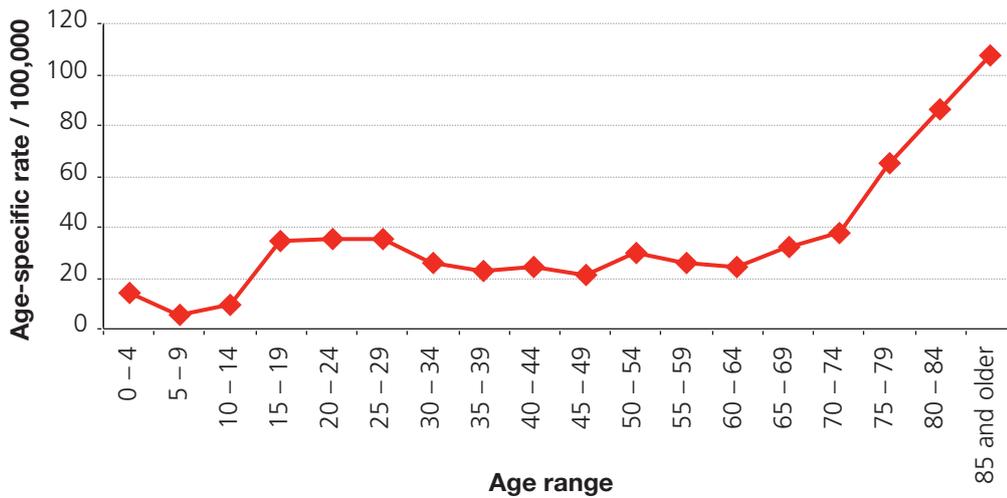


Figure 3: Age-specific rates of injury, NSW population June 2008

Males have higher rates of injury in every age group (figure 4). This correlates with the overall gender distribution of the dataset, where in 2008, 71.6% of people with serious to critical injuries were male. Figure 4 also shows that the gender disparity is pronounced from the ages of 15-29 years. In the 20-24 years group, the rate of injuries for females was approximately 11, while for males the age-specific rate was over 58. Figure 4 also shows that age-specific rates for both males and females increase from the age of 75 years and over.

Age-specific rates of injury by gender

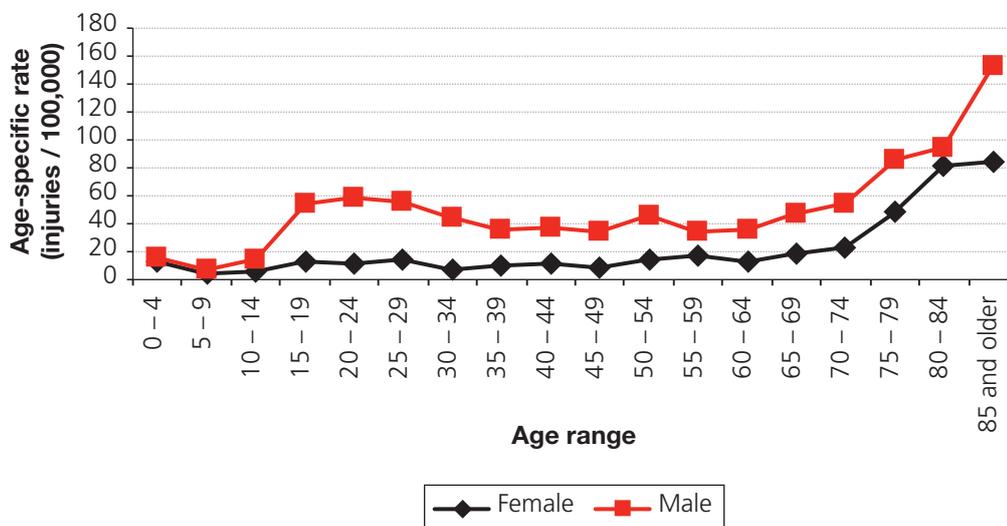


Figure 4: Age-specific rates of injury by gender

The crude death rate for males in 2008 was more than double that of females (5.3 deaths per 100,000 males in NSW compared to 2.2 deaths per 100,000 females).

The age-standardised mortality ratio (SMR) for males was 763, and for females 506, confirming the gender disparity in mortality between the genders in NSW, as well as demonstrating the higher death rates in this population of serious to critically injured people when compared to the standard population.

Monitoring the NSW Trauma System

Males aged between 20 and 24 years have rates of injury only exceeded by people age 75 years and older (figure 5). The age-specific rate of injury for males aged 20-24 years was just over 58 males injured per 100,000 males in the NSW population. Females in this age group had an age-specific rate of injury of 11.3 females injured per 100,000 females in the NSW population. The age-specific death rate for males in the 20-24 years age group also exceeded females in the group by almost 4 to 1 (4.8 males deaths per 100,000 males compared to 1.25 female deaths per 100,000 females in NSW).

Age-specific death rates by gender

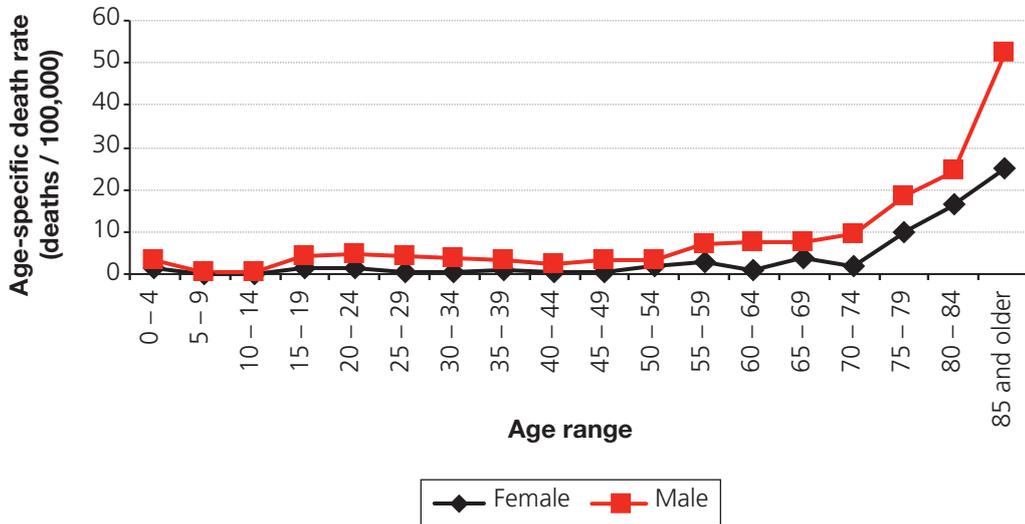


Figure 5: Age-specific death rates by gender

The gender disparity noted above is also apparent in the age distribution within the dataset. People aged from 15-25 have consistently been the largest group represented in the group of patients with serious to critical injuries. For each age band from 15-25 the proportion of males exceeds the 2008 proportion of males of 71.6%. In the 23 years age group the proportion of males is greater than 91%.

Mechanisms of injury

The distribution of mechanisms of injury in 2008 was similar to previous years. As in 2007, injuries caused by falls were almost equal in number to road trauma in the 2008 dataset, and together are the mechanisms of injury for the great majority of records in the dataset (Figure 6).

Mechanisms of injury

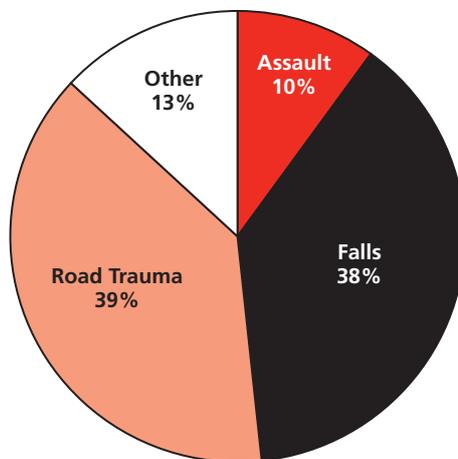


Figure 6: Mechanisms of injury

There were proportionately fewer people injured in rural districts in 2008 following an assault or a fall, compared to their metropolitan counterparts (Table 4)¹⁴. Conversely, the rural group recorded road trauma as the mechanism of injury in over 45% of records, compared to 37.1% for the metropolitan group. In the metropolitan group falls were the most common mechanism of injury, recorded for 40.4% of patients.

Table 4: Mechanism of injury, rural vs. metropolitan place of injury¹⁰

Mechanism	Metropolitan	Rural
Assault	167	27
Falls	652	104
Road Trauma	598	158
All other mechanisms	196	58

The breakdown of specific categories of mechanisms of injury was similar in 2008 to previous years, as shown in Table 5 below. Pedestrian trauma continued to have a higher case fatality rate than other road trauma mechanisms, although motor vehicle collisions were the most frequent cause of injury in the road trauma group.

The most common mechanism of injury was a low to medium fall (<5m). This mechanism was recorded for 34% of serious to critically injured people in the 2008 dataset. Low to medium falls were particularly common in the group of patients aged 65 years and over, where they were recorded as the mechanism of injury for over 70% of patients. In contrast, low to medium falls were recorded as the mechanism of injury for only 19.2% of people aged between 16 and 65 years, and 23.9% of paediatric patients between 0 and 15 years of age.

Table 5: Mechanism of Injury – main mechanisms and categories

Mechanism	People injured	% of Total	Deaths (% of mechanism)
Road Trauma			
MVC	355	17.7%	39 (11%)
MBC	204	10.2%	15 (7.4%)
Pedestrian	147	7.3%	23 (15.6%)
Pedal Cyclist	65	≤ 5%	(≤ 5)
Total Road Trauma	771	38.5%	82 (10.6%)
Fall			
Low/Medium Fall (<5m)	679	34%	101 (14.9%)
High Fall (>5m)	83	4.2%	13 (15.7%)
Fall Unspecified Height	7	≤ 5%	(≤ 5)
Total All Falls	769	38.5%	115 (14.9%)
Assault			
Blunt Assault	109	5.4%	6 (5.5%)
Shooting	27	≤ 5%	10 (37%)
Stabbing	65	≤ 5%	6 (9.2%)
Total All Assaults	201	10%	22 (10.9%)

The average age for falls in 2008 was approximately 61 years (the median was 67 years), and age-specific rates of mechanism of injury demonstrate clearly that falls in the elderly are a serious issue in trauma (see Figure 7). Rates of falls for people aged 75 years and over are the highest in the dataset, rising to over 87 people injured per 100,000 people in the NSW population.

It is also clear that road trauma has a large impact on people aged between 15 and 29 years of age. Rates of road trauma per 100,000 people in the NSW population for this group are higher than all other age groups in the road trauma population. The rate of assaults was also higher in the 15-29 years age groups than in other age groups.

¹⁰ Includes only records where postcode of injury is known (N=1960)

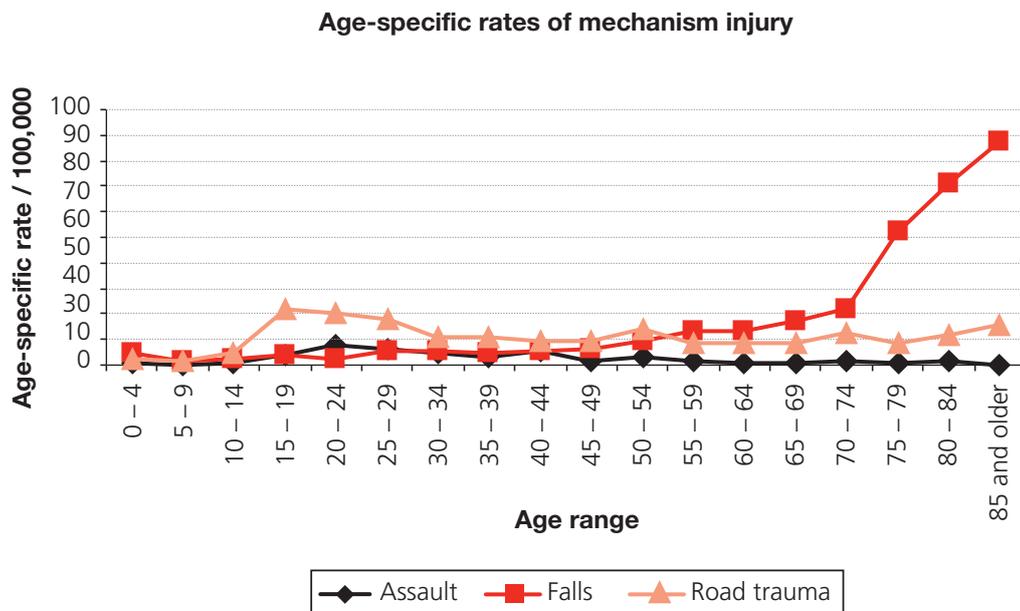


Figure 7: Age-specific rates of mechanism of injury

Time and day of injury

Noon to late afternoon was the most common time of day for serious to critical trauma in 2008 (Figure 8). 37.7% of people were injured between the hours of 12 noon and 6pm, with peak times between 5pm and 6pm (128 people) and between noon and 1pm, and between 2pm and 3pm (120 people).

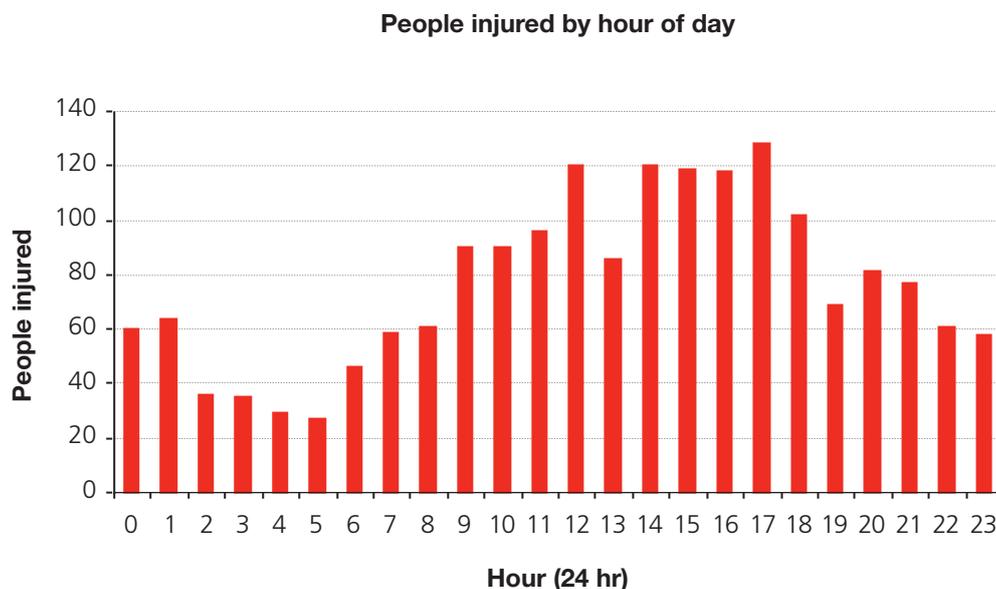


Figure 8: People injured by hour of day when injury occurred

Table 6 demonstrates that serious to critical injuries occurred more frequently on weekends than on other days of the week in 2008, consistent with data from previous years.

Table 6: People injured and admitted, Monday-Friday and weekends

Weekly period	People injured	Mean daily admissions ¹¹
Monday - Friday	1372	5.2
Weekends	725	7

11 For 2008, there were 104 days falling on weekends, and 262 other days (Mondays-Fridays)

Triage and transport

Admission type

NSW ITIM monitors rates and patterns of inter-hospital patient transfers in the NSW Trauma system, to ascertain the effectiveness of the pre-hospital triage tool, Protocol T1 pre-hospital management of major trauma, in the NSW trauma system¹².

Patients may be admitted to a trauma service directly from the scene of injury, or following a transfer from another trauma service or a non-trauma service. In particular, patients requiring the services of a clinical super-specialty network such as the NSW Acute Spinal Cord Injury Service (Adult), NSW Severe Burn Injury Service (Adult), or a paediatric major trauma service may be transferred.

Data regarding transfers is only recorded in the NSW Trauma Registry when a patient is transferred for acute care in another hospital, i.e., when a patient is transferred for 'definitive care'. Other transfers, for example the inter-hospital transfer of a patient for rehabilitation services, are not recorded.

The rate of 'direct from scene' admissions to all trauma services in 2008 was 72% (table 7). The remainder of patients in the data admitted to a trauma service were transferred from either another trauma service or non-trauma service.

The proportion of direct admissions to a major adult trauma service for definitive care in 2008 was 71.3%, slightly lower than the overall rate of direct from scene admissions to all trauma services combined. Direct from scene admissions to paediatric major trauma services was lower at 34.5%, reflecting the high proportion of transfers of children for specialist services at these centres.

Table 7: Admission Types

Admission Type	Admissions	%
Transfer In ¹³	586	28%
Direct From Scene	1511	72%
Direct to definitive care: major adult (N=1728)	1232	71.3%
Direct to definitive care: paediatric major (N=116)	40	34.5%
Direct to definitive care: regional trauma registry (N=132)	120	90.9%

Patients injured in rural districts are less likely to be admitted directly to a trauma service from the scene of the injury than their metropolitan counterparts (table 8)¹⁴. Patients injured in rural districts may be admitted to a facility such as a base hospital initially, where transfer to a major trauma service is arranged.

¹² Ambulance Service of NSW (2010) *Pre-Hospital Management of Major Trauma: Protocol T1*. Ambulance Service of NSW

¹³ Transfer In figures may include secondary transfers from another trauma service

¹⁴ This grouping is performed using the postcode where injury occurred (where known). Metropolitan locations include Greater Metropolitan Sydney, extending from Newcastle City in the North to Wollongong in the South.

Table 8: Definitive care admission type by geographical location of injury¹⁵

Admission Type	Metropolitan Districts	Rural Districts
Transfer In	325 admissions (20.4% of metropolitan patients)	248 admissions (71.3% of rural patients)
Direct From Scene	1272 admissions (79.6%)	100 admissions (28.7%)

Arrival modes are also recorded in the NSW Trauma Registry. These refer to the ways in which serious to critically injured patients are delivered to an admitting trauma service. For patients transferred to a trauma service, arrival modes describe the manner in which they were transferred. Arrival modes are only recorded for admissions to trauma services in NSW.

Arrival modes include:

- Ambulance
- Fixed Wing¹⁶
- Helicopter
- NETS¹⁷
- Private Vehicle
- Other¹⁸

The proportion of ambulance arrivals at trauma services for definitive care was 67.6% in 2008 (table 9). Almost 90% of patients arrived at definitive care facilities by either ambulance or helicopter during the year.

Table 9: Arrival mode at definitive care facility - Top 3 Arrival Modes

Arrival mode	Admissions	% of Total
Ambulance	1336 admissions	67.6%
Helicopter	413 admissions	20.9%
All other modes of transport	227 admissions	11.5%

Over 80% of ambulance journeys recorded in the NSW Trauma Registry in 2008 provided transport directly from the scene of injury to the definitive care trauma service (table 10). In comparison, helicopter arrivals were almost evenly divided between transport direct from the scene of injury and transport for patients transferring from another hospital for definitive care.

Table 10: Modes of transport to definitive care by admission type

Arrival mode	Direct from scene	Transferred
Ambulance (N=1336)	80.1 %	19.9 %
Helicopter (N=413)	52.3 %	47.7 %
Other mode of transport (N=227)	46.7 %	53.3 %

Ambulance was also the most frequently recorded form of transport for patients injured within metropolitan districts surrounding Sydney, regardless of whether they were admitted directly from the scene of injury or transferred from another hospital (table 11). Helicopter transport was more frequently provided in rural districts to assist patients to definitive care.

15 Numbers in this table are included only where postcode of injury is known. Totals in this table may be less than total admission figures for 2008

16 For fixed wing arrival modes, the data represents the primary mode of transport used to deliver the patient to an admitting trauma service.

17 NETS = NSW Newborn & Paediatric Emergency Transport Service. 'NETS' is the emergency service for medical retrieval of critically ill newborns, infants and children in NSW. NETS does not transport from the scene (pre-hospital), but assists with transport for patients too sick for care to continue in their current hospital (source: <http://www.nets.org.au>)

18 Other modes of arrival may include private vehicles, taxis, buses, bicycles etc, as well as patients arriving on foot.

Table 11: Proportion of ambulance and helicopter arrivals at definitive care, direct from scene and transfer admissions, metropolitan vs. rural location of injury

Admission type	Ambulance	Helicopter
Direct from scene to definitive care		
Metropolitan location of injury (N=1255)	82.1 %	11.2%
Rural location of injury (N=99)	26.3 %	71.7%
Case fatality rate	14.9 %	15.3 %
Transferred to definitive care		
Metropolitan location of injury (N=324)	64.8 %	24.7%
Rural location of injury (N=246)	21.1 %	46.7 %
Case fatality rate	9.8 %	15.2 %

Times to definitive care

Times to definitive care for patients with an ISS > 15 admitted to a trauma service provide an indicator of the effectiveness of the NSW trauma system's response to a trauma incident, encompassing the progress of the patient from the scene of injury to admission to their definitive trauma service.

In 2008, 56.2% of all serious to critically injured patients arrived at a definitive trauma service within 2 hours of their injury. For critically injured patients (ISS 41-75) this rate was higher, with 70.6% of patients in this group arriving at a definitive care hospital within 2 hours of their injury.

Numerous factors may impact on the time to definitive care, including:

- How quickly emergency services are notified
- Distance from trauma services
- Difficulties at the scene of the injury, such as entrapment
- Whether or not patients are transported directly from the scene of their injury to a definitive care hospital

Due to these and other factors, a single calculated average time to definitive care¹⁹ does not provide a reasonable indication of the effectiveness of the NSW trauma system. Times to definitive care are therefore analysed in several dimensions in order to minimise these factors. The key dimensions are:

- Whether an injury occurred in a metropolitan or rural district¹⁴, and
- Whether the patient was admitted to a definitive care hospital directly from the scene of their injury.

A patient may be admitted to a hospital for treatment following a traumatic injury, however access to specialist treatment or facilities may require transfer of the patient to a trauma service for definitive care, for example a child may be transferred to a children's hospital for specialised definitive care.

The 2008 data shows that a much higher proportion of rural patients were transferred to a definitive care hospital (71.1% in 2008), compared to patients injured in a metropolitan area (20% in 2008). These transferred rural patients were often first admitted to a base hospital, where transfer to a major trauma service was arranged.

In order to accommodate other factors, in particular how quickly (or whether) emergency services are notified and time required by emergency services at the scene of an injury, times to definitive care are further aggregated into time periods. Individual times to definitive care are calculated for each patient and grouped into these time periods.

¹⁹ The time taken to definitive care is a value calculated from the date and time (where known) of injury to the date and time of admission to the trauma service where definitive care was provided to the patient.

Monitoring the NSW Trauma System

In 2008 a high proportion (81.3%) of people injured in metropolitan areas were admitted directly from the scene of their injury to a definitive trauma service within 2 hours of injury (Table 12). The average time taken for these patients in 2008 was 57 minutes. This large group represented just over 50% of all people injured in 2008.²⁰

Table 12: Time to definitive care for patients admitted directly to a definitive trauma service, rural vs. metropolitan location of injury

Time period	Rural (n=94)	Metropolitan (n=1241)
0-2 hours	45 patients (47.9%) Average 1 hour 19 min	1009 patients (81.3%) Average 57 min
2-6 hours	34 patients (36.2%) Average 3 hours 7 min	82 patients (6.6%) Average 3 hours 2 min
6-12 hours	≤ 5 patients (≤ 5%) Average 6 hours 59 min	30 patients (≤ 5%) Average 9 hours 4 min
12-24 hours	≤ 5 patients (≤ 5%) Average 15 hours 38 min	55 patients (≤ 5%) Average 16 hours 25 min
Greater than 24 hours	≤ 5 patients (≤ 5%) Average 176 hours 24 min	65 patients (≤ 5%) Average 107 hours 19 min

Trauma admissions

Trauma admissions submitted by trauma service registries in 2008 totalled 2,097 for this group of serious to critically injured patients (Table 13). Average daily admissions for the full year were 5.7 admissions per day. In November, the busiest month for trauma admissions, the daily average rose to 6.7 admissions per day.

The hospital of definitive care is identified in the data by the absence of a patient transfer to another hospital for acute care. In 2008 there were 1976 recorded definitive care admissions²¹.

Table 13: Trauma service admissions summary

Summary statistics, trauma service admissions	Summary
Total trauma admissions	2097
Mean daily admissions ²²	5.7
Mean monthly admissions	174
Minimum monthly admissions	155 (June)
Maximum monthly admissions	201 (November)
Definitive care admissions	1976

In 2008 over 80% of all records in the NSW Trauma Registry were provided by an adult major trauma service or paediatric major trauma service registry (Table 14). The remaining records were provided by other trauma registries and generally include less seriously injured patients who did not require a major or paediatric major trauma service, and a number of other patients who were subsequently transferred to a major or paediatric major trauma service for acute care.

20 As numbers in this table only include patients where postcode and time of injury is known, actual figures may be larger.

21 While the registry recorded 121 transfers of patients from a trauma service in 2008 (2097 trauma service admissions) to another trauma service for acute care, 26 records of 2002 people injured do not have a definitive care admission recorded. These records lack a matching record from the hospital where the patient was transferred to, which may result from differences in AIS scoring at the destination hospital (eg following further medical investigation) or because the patient was transferred to an acute care hospital where the Trauma MDS is not currently collected, including the Repatriation General Hospital at Concord, or an interstate or overseas hospital.

22 There were 366 days in 2008 as it was a leap year

Table 14: All admissions recorded in major trauma service registries, paediatric major trauma registries and other trauma registries

Trauma Registry	Admissions
Adult Major Trauma Service Registries	1770
Paediatric Major Trauma Registries	118
Other Trauma Registries	209

The following table shows that the most seriously injured people progress to an adult major or paediatric major trauma service, while less seriously injured people are often managed in a non-major trauma service. A larger proportion of patients remaining in hospitals other than major or paediatric major trauma services had an ISS in the less serious ISS range of 16-24, a smaller proportion in the higher ISS ranges, and a lower mean ISS.

Table 15: Admissions recorded in major trauma service registries, paediatric major trauma registries and other trauma registries by ISS range

Trauma registry	ISS 16-24	ISS 25-40	ISS 41-75	Mean ISS
Adult Major Trauma Service Registries (N=1770)	54.5 %	39.4 %	6.0 %	24.13
Paediatric Major Trauma Registries (N=118)	58.5 %	40.7 %	≤ 5 %	21.78
Other Trauma Registries (N=209)	59.3 %	33.5 %	7.8 %	24.02
Other Trauma Registries (not transferred for acute care) (N=132)	68.2 %	26.5 %	5.3 %	22.65

Table 16 shows admissions recorded in all trauma registries for 2008. Admissions recorded in the John Hunter Hospital/ John Hunter Children's Hospital trauma registry generally exceed those in other trauma registries each year as the hospital is the only trauma service in the former Hunter/New England Area Health Service

Table 16: Admissions to trauma services

Trauma registry	Admissions
Gosford Hospital	59
John Hunter Hospital	362
Liverpool Hospital	247
Nepean Hospital	96
Prince of Wales Hospital	39
Royal North Shore Hospital	348
Royal Prince Alfred Hospital	209
St George Hospital	231
St Vincent's Hospital	133
Sydney Children's Hospital	33
The Children's Hospital at Westmead	64
Westmead Hospital	222
Wollongong Hospital	54

Time and day of admission

Over 64% of admissions of serious to critically injured people during 2008 occurred between 4pm and overnight to 8am (Table 17). The busiest times for trauma services were the four hours between 5pm and 9m, with 510 admissions or almost 25% of all admissions during the year.

Table 17: Admissions by time of day

Time of day	Admissions (%)
Midnight – 8am	21.3%
8am – 4pm	34.9%
4pm - Midnight	43.8%

Injuries

An Injury Severity Score (ISS) greater than 15 (ISS>15) is a key criterion for inclusion of a patient record in the NSW Trauma Registry. Table 18 below shows the distribution of ISS scores according to the ranges: 16-24 (serious injury), 25-40 (severe injury) and 41-75 (critical injury).

The distribution of ISS scores in 2008 was consistent with previous years, although there was a slight increase in the proportions of people injured with an ISS in the 25-40 range and the 41-75 range.

Table 18: ISS Range

ISS Range	People (%)	Mean / median
ISS 16 – 24 ²³	1130 (56 %)	18.3 / 17
ISS 25 – 40	768 (38.4 %)	28 / 26
ISS 41 - 75	112 (5.6 %)	50.8 / 45

Table 19 shows the top 5 specific injuries recorded for these patients, where the injury has an AIS severity code greater than 2. The final or post-dot code indicates the severity of the injury.

Table 19: Top five specific injuries where injury severity code is greater than 2

Specific injury	Injury severity	People with injuries	% ²⁴
Small or moderate subdural haematoma – cerebral	4	194	10.4
Large; massive or extensive subdural haematoma - cerebral	5	170	9.1
Three or more rib fractures	3	155	8.3
Small; moderate epidural or extradural haematoma - cerebral	4	66	3.5
Major spleen laceration [OIS IV]	4	49	2.6

The table above shows that three of the top five specific injuries were head injuries, recorded for 23% of patients. In total, with all other injuries to the head included, injuries to the head were recorded for 1182 people in the 2008 dataset.

After injuries to the head, the next most frequently recorded injuries were found in the thorax, and in the lower extremities. This can also be seen in figure 9 below, which shows the ISS body regions recorded in 2008. These body regions differ from the chapter groups used in the table above, and combine different groups of injuries for the purpose of ISS calculation. For example injuries in the AIS head body region include injuries to the brain, skull, neck and cervical spine fractures.

²³ ISS range proportions and age range proportions are calculated for group of people injured (N=2002)

²⁴ Rate injury appears in records where injury codes were recorded (N=1871)

ISS Body Regions

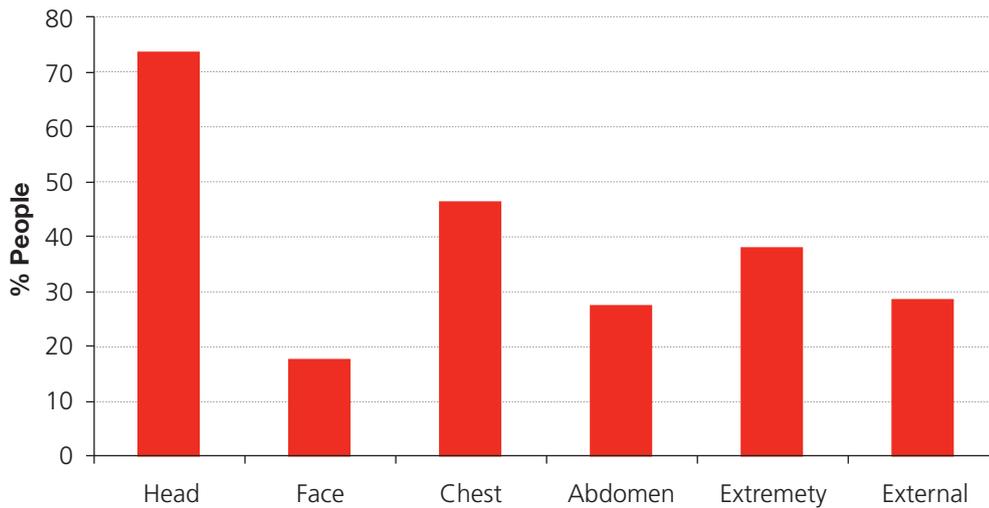


Figure 9: ISS body regions

Table 20 lists the top five injuries for people who died in 2008. These five injuries alone were recorded for over 36% of people who died (where injury recorded, N=247). Four of these five injuries were brain injuries, with large subdural haematomas the most frequent, recorded for 17% of people who died in 2008.

Table 20: Top 5 injuries for deceased patients

Injury	Injury severity	People with injuries	% ²⁵
Large; massive or extensive subdural haematoma - cerebral	5	42	17
Large, bilateral subdural haematoma – cerebral	5	13	5.3
Drowning with cardiac arrest	5	12	4.9
Small or moderate subdural haematoma - cerebral	4	12	4.9
Large intracerebral haematoma	5	11	4.5

The following table shows the major mechanisms of injury – assault, falls and road trauma and their discreet categories, with the top three groups of injuries for each mechanism. Grouping injuries can provide a better indication of the type of injury that may be associated with a mechanism. The groups of injuries used in the table below however are not exhaustive.

Head injuries were commonly associated with assaults in 2008 (especially blunt assaults) and with falls, in particular falls from less than 5m (Table 21). Thoracic and pelvic injuries were associated strongly with motor vehicle and motorcycle accidents, and pelvic injuries were a strong feature of pedestrian accidents.

25 Rate injury recorded in the group of deceased patients (where AIS code recorded, N=247). Note that a single patient may have injuries recorded twice in this data, eg patient may have a subdural haematoma as well as a scalp laceration.

Table 21: Main mechanism of injury, top 3 injury groups

Mechanism	Top 3 injury groups	Injuries	%
Assault			
Blunt assault (N=99)	Subdural haematoma	44	44.4
	Extradural haematoma	17	17.2
	Skull fractures	6	6.1
Shooting (N=27)	Haemothorax	4	14.8
	Liver injury	4	14.8
	Haemopneumothorax/Spleen injury/ Subdural haematoma	2	7.4
Stabbing (N=63)	Haemopneumothorax	7	11.1
	Liver injury	5	7.9
	Pneumothorax	4	6.3
Falls			
Low/medium fall (<5m) (N=644)	Subdural haematoma	317	49.2
	Extradural haematoma	55	8.5
	Lumbar dislocation and/or fracture (no cord)	28	4.3
High fall (>5m) (N=81)	Pelvic and acetabulum fractures	21	25.9
	Lumbar dislocation and/or fracture (no cord)	16	19.7
	Subdural haematoma	12	14.8
Road trauma			
Motorcycle (N=186)	Lung injury	33	17.7
	Pelvic and acetabulum fractures	31	16.7
	Three or more rib fractures	25	13.4
Motor vehicle (N=319)	Lung injury	66	20.7
	Three or more rib fractures	55	17.2
	Pelvic and acetabulum fractures	52	16.3
Pedal cycle (N=60)	Three or more rib fractures	11	18.3
	Extradural haematoma	8	13.3
	Thoracic dislocation and/or fracture (no cord)	8	13.3
Pedestrian (N=139)	Pelvic and acetabulum fractures	39	28%
	Subdural haematoma	29	20.9
	Three or more rib fractures	16	11.5

Treatments and outcomes

Surgical procedures

The following surgical procedures are recorded in the Trauma Minimum Data Set, if the procedure was performed within 24 hours of admission to a trauma service:

- Craniotomy
- Laparotomy
- Open (compound) fractures (called Open Ext# in the Trauma Minimum Data Set)
- Thoracotomy
- All other surgical procedures are recorded as 'Other' in the Trauma Minimum Data Set.

In 2008 over 32% of patients in the dataset required surgical procedures. The majority of surgical procedures were performed in operating suites at Major Trauma Services (78.5%). Excluding 'Other procedures', the most common procedure recorded were craniotomies (34.8%) which reflects the high frequency of head injuries and subdural injuries recorded in the 2008 data (Table 22).

Table 22: Admissions recorded in major trauma service registries, paediatric major trauma registries and other trauma registries, patients for operating suite

Registry	Craniotomy	Laparotomy	Open Ext#	Thoracotomy	Other procedure	Total patients for OS (procedures)
Major Trauma Service Registries	201 ²⁶	143	109	22	216	580 (626)
Paediatric Major Trauma Registries	25	≤ 5	≤ 5	-	34	54 (62)
Other Trauma Registries	24 ²⁷	13 ²⁸	18	≤ 5	37	22 (30)

Intensive Care Unit admissions

Due to the severity of their injuries, patients in this data collection are often admitted to an intensive care unit at a trauma service. An intensive care unit (ICU) is a designated ward of a hospital which is specially staffed and equipped to provide observation, care and treatment to patients with critical injuries. The ICU provides special expertise and facilities for the support of vital functions and utilises the skills of medical, nursing and other staff trained and experienced in the management of these problems.²⁹

In 2008 47.5% of injured people recorded in the NSW Trauma Registry were admitted to an ICU. The ICU length of stay differed between Major Trauma Service, Paediatric Major Trauma Service and other Trauma registries in 2008 (Table 23). The ICU admission rate in Major Trauma Services was 45.8%, and the average ICU length of stay was higher than the Other Trauma Registry group, reflecting the greater severity of injuries treated at Major Trauma Services.

26 Count of procedures

27 Craniotomies recorded at other trauma registries: Nepean Hospital (2), Prince of Wales Hospital (2), St Vincent's Hospital (19), Wollongong Hospital (1)

28 Laparotomies recorded at other trauma registries: Gosford Hospital (1), St Vincent's Hospital (8), Wollongong Hospital (4)

29 National Health Data Committee 2003. *National Health Data Dictionary*. Version 12, Volume 1, AIHW cat. No. HWI 43. Canberra: Australian Institute of Health and Welfare

Table 23: Intensive Care Unit admissions, major trauma service registries, paediatric trauma registries and other trauma registries

Registry	ICU admission (%)	Average ICU length of stay (days)
Major Trauma Service Registries	836 (47.2%)	8.87
Paediatric Major Trauma Registries	72 (61%)	4.82
Other Trauma Registries	51 (24.4%)	7.88

The data also shows a higher rate of ICU admission for more seriously injured patients (Table 24). Over two thirds of critically injured patients (ISS 41-75) were admitted to an intensive care unit in 2008, compared to just over 36% of patients with an ISS in the 16-24 range. Average ICU lengths of stay and average hospital lengths of stay (for the period of acute care admission) were also correspondingly higher for the critically injured group admitted to an ICU.

Table 24: ICU admission statistics by ISS range

ISS Range	ICU admission (%)	Mean ICU LOS	Mean hospital LOS (patients admitted to ICU)
16-24	36.2%	6.77 days	22.43 days
25-40	56%	9.41 days	28.19 days
41-75	67.5%	12.33 days	35.61 days

Hospital lengths of stay

The hospital length of stay recorded in the NSW Trauma Minimum Data Set is the length of stay in a trauma service while classified as an acute care patient. Additional days in hospital, for example while attending rehabilitation, are not included in these figures. For patients admitted to more than one trauma service, lengths of stay in each centre are counted separately.

The average overall hospital length of stay (for the period of acute care admission) for 2008 was 17.82 days. The average hospital length of stay for patients admitted to a Major Trauma Service was 18.74 days, which was higher than the average hospital length of stay than patients recorded in Paediatric and Other trauma registries (Table 25).

Table 25: Admissions recorded in major trauma service registries, paediatric trauma registries and other trauma registries, mean hospital length of stay (days)

Registry	Mean hospital length of stay (days)
Major Trauma Service Registries	18.8
Paediatric Trauma Registries	16.4
Other Trauma Registries	10.7

Hospital length of stay is associated with severity of injury, as the following table demonstrates. As the calculated severity of injury rises, so does the average hospital length of stay. The most seriously injured people with an ISS between 41 and 75 had the longest average length of stay, at 25.75 days in 2008 (Table 26).

Table 26: Mean length of stay in hospital (LOS) by ISS Range

ISS Range	Mean hospital length of stay (days)
16-24	14.77 days
25-40	20.96 days
41-75	25.75 days

People with injuries in more than one ISS body region also have longer average lengths of stay. People with injuries in three ISS body regions in 2008 had the longest average length of stay in hospital at 20.49 days (Table 28).

Table 27: Mean length of stay in hospital (LOS) by count of ISS body regions

ISS Body regions	Mean hospital length of stay (days)
Single body region	13.92 days
Two body regions	17.03 days
Three body regions	20.49 days

Rural dataset – Tamworth Hospital trauma registry

In 2007 the NSW Rural Trauma Clinical Nurse Consultant Pilot Project commenced at Tamworth Hospital. This project enabled prospective data collection identifying the spectrum of serious trauma admissions to hospitals in the region. The process will now be adapted in other areas to provide data, monitoring of patient outcomes and trauma system function in rural areas of NSW.

The following table provides a snapshot of trauma activity at Tamworth Hospital in 2008. This data is not currently included elsewhere in this report; however Tamworth Hospital figures will be included within general trauma activity figures in all future reports.

Some of the features of the Tamworth Hospital data for 2008 include a higher than average proportion of road trauma injuries than in the data elsewhere in this report (over 56% road trauma compared to 39% reported for all other trauma services), and a higher proportion of horse related injuries.

Table 28: Trauma data profile, Tamworth Hospital

Summary data	
Total admissions	32
Mean monthly admissions	2.7
Case fatality rate	≤ 5%
Gender	
Female / male	21.9% / 78.1%
Injury Severity Score ranges (inc. case fatality rate)	
16-24	75%
25-40	21.8%
41-75	≤ 5%
Mechanisms of injury	
Assault	9.4%
Fall	18.7%
Horse	6.2%
Road trauma	56.2%
All other injuries	9.4%
Admission type and arrival modes (pre hospital system indicators)	
Direct admission	62.5%
Transfer	37.5%
Hospital system indicators	
ICU admissions	75% (of patients)
Mean ICU length of stay	4.5 days
Mean hospital length of stay	7.6 days
Transfers to major trauma services ³⁰	17 (53.1%)

30 Includes transfers for specialist burns services at Repatriation General Hospital (Concord)

Monitoring the NSW Trauma System

Over 53% of people in the Tamworth dataset were transferred from Tamworth Hospital to a major trauma service for definitive care. Figure 10 demonstrates the ISS distribution for each of the groups that stayed or were transferred from this hospital, and confirms that more seriously injured people were transferred for definitive care services.

Tamworth Hospital, ISS distribution by transfer out status

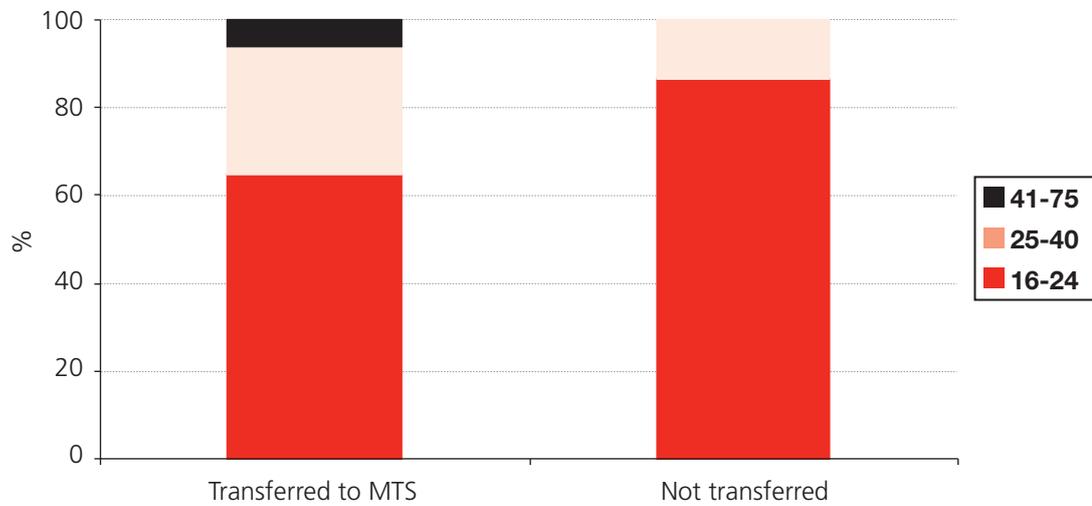


Figure 10: Tamworth Hospital, ISS distribution by transfer out status

Appendix 1:

Hospital data summaries

Gosford Hospital

Table 29: Trauma data profile, Gosford Hospital

Summary data	
Total admissions	59
Mean monthly admissions	4.9
Case fatality rate	5.1%
Gender	
Female / male	30.5% / 69.5%
Age ranges	
0-14	16.9%
15-24	18.6%
25-34	18.6%
35-44	6.8%
45-54	6.8%
55-64	6.8%
65-74	6.8%
75-84	15.2%
85-94	≤ 5%
Mean / Median age	39.5 / 32 years
Injury Severity Score ranges	
16-24	54.2%
25-40	37.3%
41-75	8.5%
Mean / Median ISS	24.4 / 21
Mechanisms of injury	
Assault	5.1%
Falls	42.4%
Road trauma	35.6%
All other injuries	13.6%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	100%
Ambulance	84.7%
Helicopter	-
Private Vehicle	13.6%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	6
ICU admissions	10.2% (of patients)
Mean ICU length of stay	1.67 days
Mean Hospital length of stay	3.73 days

John Hunter Hospital/John Hunter Children's Hospital

Table 30: Trauma data profile, John Hunter Hospital/John Hunter Children's Hospital

Summary data	
Total admissions	362
Mean monthly admissions	30.2
Case fatality rate	10.5%
Gender	
Female / male	21.5% / 78.5%
Age ranges	
0-4	≤ 5%
5-9	≤ 5%
10-12	≤ 5%
13-14	≤ 5%
(15 years – included in paediatric group)	(5.8%)
15-24 (includes patients aged 15 years)	16.8%
25-34	13.5%
35-44	13%
45-54	14.9%
55-64	10.2%
65-74	9.1%
75-84	8%
85-94	≤ 5%
95 and older	≤ 5%
Mean / median age	46.8 / 46 years
Injury Severity Score ranges	
16-24	60.2%
25-40	35.4%
41-75	≤ 5%
Mean / median ISS	23 / 20
Mechanisms of injury	
Assault	9.1%
Falls	34%
Road trauma	46.7%
All other injuries	10.2%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	70.2%
Ambulance	60.8%
Helicopter	35.6%
Fixed wing	≤ 5%
Private Vehicle	≤ 5%
Hospital system indicators	
Patients for operating suite	83
ICU admissions	35.6% (of patients)
Mean ICU length of stay	4.98 days
Mean hospital length of stay	15.39 days

Liverpool Hospital

Table 31: Trauma data profile, Liverpool Hospital

Summary data	
Total admissions	247
Mean monthly admissions	20.6
Case fatality rate	11.7%
Gender	
Female / male	33.6% / 66.4%
Age ranges	
0-14	≤ 5%
15-24	20.6%
25-34	12.5%
35-44	11.3%
45-54	10.9%
55-64	10.1%
65-74	9.3%
75-84	16.6%
85-94	6.1%
95 and older	-
Mean / median age	48.6 / 49 years
Injury Severity Score ranges	
16-24	54.7%
25-40	38.5%
41-75	6.9%
Mean / median ISS	24 / 24
Mechanisms of injury	
Assault	8.9%
Falls	34.8%
Road trauma	46.2%
All other injuries	10.1%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	72.1%
Ambulance	87%
Helicopter	10.9%
Fixed wing	-
Private Vehicle	≤ 5%
Other	-
Hospital system indicators	
Patients for operating suite	104
ICU admissions	52.6% (of patients)
Mean ICU length of stay	7.84 days
Mean Hospital length of stay	16.85 days

Nepean Hospital

Table 32: Trauma data profile, Nepean Hospital

Summary data	
Total Admissions	96
Monthly Average	8
Case fatality rate	12.5%
Gender	
Female / male	22.9% / 77.1%
Age ranges	
0-14	≤ 5%
15-24	25%
25-34	18.7%
35-44	5.3%
45-54	18.7%
55-64	7.3%
65-74	≤ 5%
75-84	9.4%
85-94	≤ 5%
95 and older	-
Mean / median age	40.6 / 38 years
Injury Severity Score ranges	
16-24	67.7%
25-40	27.1%
41-75	5.2%
Mean / median ISS	22.7 / 21
Mechanisms of injury	
Assault	10.4%
Falls	17.7%
Road trauma	58.3%
All other injuries	13.5%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	89.6%
Ambulance	54.2%
Helicopter	18.7%
Other	27.1%
Hospital system indicators	
Patients for operating suite	7
ICU admissions	43.7% (of patients)
Mean ICU length of stay	9 days
Mean hospital length of stay	18.7 days

Prince of Wales Hospital

Table 33: Trauma data profile, Prince of Wales Hospital

Summary data	
Total admissions	39
Mean monthly admissions	3.2
Case fatality rate	12.8%
Gender	
Female / male	12.8% / 87.2%
Age ranges	
0-14	-
15-24	17.9%
25-34	25.6%
35-44	23.1%
45-54	10.2%
55-64	10.2%
65-74	10.2%
75-84	-
85-94	≤ 5%
95 and older	-
Mean / median age	40.4 / 37 years
Injury Severity Score ranges	
16-24	53.8%
25-40	38.4%
41-75	7.8%
Mean / median ISS	24.2 / 24
Mechanisms of injury	
Assault	7.7%
Falls	28.2%
Road trauma	43.6%
All other injuries	20.5%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	69.2%
Ambulance	64.1%
Helicopter	25.6%
Fixed wing	10.3%
Other	-
Hospital system indicators	
Patients for operating suite	21
ICU admissions	69.2% (of patients)
Mean ICU length of stay	8.52 days
Mean hospital length of stay	25.44 days

Royal North Shore Hospital

Table 34: Trauma data profile, Royal North Shore Hospital

Summary data	
Total admissions	348
Mean monthly admissions	29
Case fatality rate	16.4%
Gender	
Female / male	32.2% / 67.8%
Age ranges	
0-14	≤ 5%
15-24	15.8%
25-34	13.8%
35-44	10.3%
45-54	10.1%
55-64	10.1%
65-74	11.5%
75-84	16.1%
85-94	10.9%
95 and older	≤ 5%
Mean / median age	53.4 / 54 years
Injury Severity Score ranges	
16-24	47.7%
25-40	46.5%
41-75	5.7%
Mean/ median ISS	24.6 / 25
Mechanisms of injury	
Assault	5.2%
Falls	50.6%
Road trauma	30.2%
All other injuries	14.1%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	56%
Ambulance	59.5%
Helicopter	26.4%
Fixed wing	11.5%
Private vehicle	≤ 5%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	94
ICU admissions	66.4% (of patients)
Mean ICU length of stay	11.37 days
Mean hospital length of stay	26.21 days

Royal Prince Alfred Hospital

Table 35: Trauma data profile, Royal Prince Alfred Hospital

Summary data	
Total admissions	209
Mean monthly admissions	17.4
Case fatality rate	10%
Gender	
Female / male	26.8% / 73.2%
Age ranges	
0-14	≤ 5%
15-24	13.4%
25-34	15.8%
35-44	11%
45-54	12.4%
55-64	14.3%
65-7	11.5%
75-84	13.9%
85-94	5.3%
95 and older	-
Mean / median age	50.4 / 52 years
Injury Severity Score ranges	
16-24	62.2%
25-40	32.1%
41-75	5.7%
Mean / median ISS	23 / 20
Mechanisms of injury	
Assault	17.7%
Falls	52.2%
Road trauma	20.6%
All other injuries	9.6%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	78.5%
Ambulance	70.8%
Helicopter	12%
Fixed wing	-
Private vehicle	≤ 5%
Other	12.9%
Hospital system indicators	
Patients for operating suite	66
ICU admissions	38.3% (of patients)
Mean ICU length of stay	8.34days
Mean hospital length of stay	13.98 days

St George Hospital

Table 36: Trauma data profile, St George Hospital

Summary data	
Total admissions	231
Mean monthly admissions	19.2
Case fatality rate	12.5%
Gender	
Female / male	28.1% / 71.9%
Age ranges	
0-14	≤ 5%
15-24	19.5%
25-34	15.1%
35-44	13.4%
45-54	12.1%
55-64	10.4%
65-74	≤ 5%
75-84	14.3%
85-94	6.9%
95 and older	-
Mean / median age	46.7 / 44 years
Injury Severity Score ranges	
16-24	51.9%
25-40	36.8%
41-75	11.2%
Mean / median ISS	26.2 / 24
Mechanisms of injury	
Assault	8.7%
Falls	36.4%
Road trauma	40.7%
All other injuries	14.3%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	71.9%
Ambulance	69.7%
Helicopter	22.5%
Fixed wing	≤ 5%
Private vehicle	≤ 5%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	73
ICU admissions	35.5% (of patients)
Mean ICU length of stay	9.85 days
Mean hospital length of stay	17.95 days

St Vincent's Hospital

Table 37: Trauma data profile, St Vincent's Hospital

Summary data	
Total admissions	133
Mean monthly admissions	11.1
Case fatality rate	11.3%
Gender	
Female / male	27.8% / 72.2%
Age ranges	
0-14	≤ 5%
15-24	15%
25-34	21.8%
35-44	16.5%
45-54	10.5%
55-64	11.3%
65-74	10.5%
75-84	8.3%
85-94	5.3%
95 and older	-
Mean / median age	46.5 / 43 years
Injury Severity Score ranges	
16-24	56.4%
25-40	38.3%
41-75	5.3%
Mean / median ISS	23.9 / 22
Mechanisms of injury	
Assault	23.3%
Falls	45.9%
Road trauma	22.6%
All other injuries	8.3%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	92.5%
Ambulance	89.5%
Helicopter	≤ 5%
Fixed wing	≤ 5%
Private vehicle	≤ 5%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	44
ICU admissions	57.9% (of patients)
Mean ICU length of stay	7.78 days
Mean hospital length of stay	17.01 days

Sydney Children's Hospital

Table 38: Trauma data profile, Sydney Children's Hospital

Summary data	
Total admissions	33
Mean monthly admissions	2.7
Case fatality rate	12.1%
Gender	
Female / male	39.4% / 60.6%
Age ranges	
0-4	54.5%
5-9	15.1%
10-12	15.1%
13-14	9.1%
(15)	6.1%
Mean / median age	5.9 / 4 years
Injury Severity Score ranges	
16-24	54.5%
25-40	42.4%
41-75	≤ 5%
Mean / median ISS	22.4 / 21
Mechanisms of injury	
Assault	≤ 5%
Falls	42.4%
Road trauma	24.2%
All other injuries	30.3%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	21.2%
Ambulance	45.5%
Helicopter	18.2%
Fixed wing	≤ 5%
NETS	18.2%
Private vehicle	12.1%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	13
ICU admissions	57.6% (of patients)
ICU average length of stay	3.53 days
Hospital average length of stay	9.18 days

The Children's Hospital at Westmead

Table 39: Trauma data profile, The Children's Hospital at Westmead

Summary data	
Total admissions	64
Mean monthly admissions	5.3
Case fatality rate	≤ 5%
Gender	
Female / male	42.2% / 57.8%
Age ranges	
0-4	46.9%
5-9	17.2%
10-12	10.9%
13-14	21.9%
(15)	≤ 5%
Mean / median age	6.7 / 5 years
Injury Severity Score ranges	
16-24	60.9%
25-40	39.1%
41-75	-
Mean / median ISS	21.7 / 19.5
Mechanisms of injury	
Assault	7.8%
Falls	15.6%
Road trauma	35.9%
All other injuries	40.6%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	32.8%
Ambulance	25%
Helicopter	15.6%
Fixed wing	≤ 5%
NETS	46.9%
Private vehicle	9.4%
Other	-
Hospital system indicators	
Patients for operating suite	36
ICU admissions	64.1% (of patients)
Mean ICU length of stay	5.51 days
Mean hospital length of stay	21.33 days

Westmead Hospital

Table 40: Trauma data profile, Westmead Hospital

Summary data	
Total admissions	222
Mean monthly admissions	18.5
Case fatality rate	14.4%
Gender	
Female / male	30.2% / 69.8%
Age ranges	
0-14	≤ 5%
15-24	16.7%
25-34	20.7%
35-44	11.3%
45-54	14.9%
55-64	9.5%
65-74	7.7%
75-84	14%
85-94	5.4%
95 and older	≤ 5%
Mean / median ISS	47.6 / 46 years
Injury Severity Score ranges	
16-24	50.4%
25-40	46.8%
41-75	≤ 5%
Mean / median ISS	24.2 / 24
Mechanisms of injury	
Assault	9%
Falls	32.4%
Road trauma	45.9%
All other injuries	12.6%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	80.6%
Ambulance	73%
Helicopter	19.4%
Fixed wing	≤ 5%
Private vehicle	≤ 5%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	101
ICU admissions	41.4% (of patients)
Mean ICU length of stay	9.51 days
Mean hospital length of stay	19.37 days

Wollongong Hospital

Table 41: Trauma data profile, Wollongong Hospital

Summary data	
Total admissions	54
Mean monthly admissions	4.5
Case fatality rate	27.8%
Gender	
Female / male	29.6% / 70.4%
Age ranges	
0-14	9.3%
15-24	16.7%
25-34	9.3%
35-44	14.8%
45-54	13%
55-64	≤ 5%
65-74	7.4%
75-84	14.8%
85-94	11.1%
95 and older	-
Mean / median age	48.3 / 45.5 years
Injury Severity Score ranges	
16-24	50%
25-40	40.7%
41-75	9.3%
Mean / median ISS	25.8 / 24.5
Mechanisms of injury	
Assault	≤ 5%
Falls	24.1%
Road trauma	53.7%
All other injuries	20.4%
Admission type and arrival modes (pre hospital system indicators)	
Direct Admission	96.3%
Ambulance	83.3%
Helicopter	11.1%
Private vehicle	≤ 5%
Other	≤ 5%
Hospital system indicators	
Patients for operating suite	9
ICU admissions	5.6% (of patients)
Mean ICU length of stay	4.33 days
Mean hospital length of stay	3.93 days

Appendix 2:

Trauma data collection tool

NSW Trauma System - Minimum Data Set

Criteria: All trauma admissions with ISS > 15 or ICU Admission or Death (Excluding isolated #NOF Death)

Data Collection Form

Hospital Name		
Gender	male / female	Age
Residential Postcode	Injury Postcode	
Date and time of Injury		
Mechanism		
Place of Injury	Home/Not at Home	
Date and time of arrival		
Mode of arrival (At your hospital)		
Transfer in	yes / no	
Transfer From		
Op suite at 1st hospital	yes / no	
If Yes, Type of OS at 1st Hospital		
Transfer out	yes / no	
Transferred to		
Transfer out Reason	Burns, Paediatric, Spinal, Other	
Op Suite 1st 24 hrs	yes / no	
If yes, Type of OS		
ICU admit	yes / no	
ICU LOS	Total ICU LOS in Patient days	
Outcome	survived / died	
AIS body regions		
ISS		
Length of Stay	Total Hospital LOS in Patient days	

Data Dictionary

Mechanism	MVC driver, MVC pass, MBC rider, MBC pillion, Pedestrian, Pedal Cyclist, fall<1m, fall 1-5m, fall>5m, shooting, stabbing, blunt assault, organised sport, recreational sport, burns, Industrial -includes all work related, Horse, Other - specify
Mode of arrival	Ambulance, Helicopter, Private vehicle, Fixed Wing, NETS, Other
AIS body regions	list the 3 most injured i.e. used to calculate the ISS
Type of OS	craniotomy, thoracotomy, laparotomy, open ext#, other
Length of stay	If LOS is > 6 weeks then put >42 days

Appendix 3:

Calculation of the Injury Severity Score (ISS)

An injury severity score (ISS) is calculated for each patient based on the AIS injury severity classification of their specific injuries. The ISS value ranges from 1-75 and is calculated as:

$$ISS = A^2 + B^2 + C^2$$

Where A, B, and C are the highest AIS severity codes in each of the (up to) three most severely injured ISS body regions³¹. The six ISS body regions are:

1. Head or neck
2. Face
3. Chest
4. Abdominal or pelvic contents
5. Extremities or pelvic girdle
6. External

The following example shows how an ISS is calculated from a set of injuries.

ISS Body region	Injury	AIS Severity Code	Include in ISS calculation?
Head or Neck	Small Sub dural haematoma	AIS-4	Yes
Chest	Bilateral lung contusion	AIS-4	No
Chest	Bilateral flail chest	AIS-5	Yes
Abdominal or pelvic contents	Superficial spleen laceration	AIS-2	Yes
Extremities or pelvic girdle	Left phalange (little toe) fracture	AIS-1	No

On the basis of the above injuries, the ISS is calculated as:

$$ISS = 4^2 + 5^2 + 2^2$$

$$ISS = 45$$

³¹ Abbreviated Injury Scale (AIS) 2005: Association for the Advancement of Automotive Medicine, p29

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