A SUMMARY OF PAEDIATRIC INJURIES TREATED IN QUEENSLAND

2006
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On behalf of CONROD and the QTR, I am pleased to provide this, the fifth statewide annual report of paediatric injuries treated at QTR hospital sites throughout Queensland. This is also the seventh presentation of paediatric injuries treated at the two Paediatric Specialty Hospitals: Royal Children’s Hospital and Mater Children’s Hospital. This report covers the twelve-month period from January to December 2006.

The QTR was established at the two Paediatric Specialty Hospitals in Brisbane in 2000 and was established at the other sites throughout the state progressively between 1998 and 2002. The QTR has been able to support the quality assurance process for trauma management through a joint Paediatric Trauma Review Committee (TRC). The QTR endeavours to review all trauma cases where care has varied from predefined standards of trauma management or who die during hospitalisation by utilising a multidisciplinary group of members that form the TRC. Where appropriate, these reviews have led to changes in the trauma system being implemented to reduce the likelihood of future deviations in care. Additional benefits of the QTR have been gained by utilising the Registry data to determine the multi-faceted causes of injury in the paediatric population and assess numbers and outcomes of paediatric patients experiencing spinal injuries, head injuries and those involved in road traffic crashes. It is pleasing to note the multidimensional benefits being realised from the operation of the QTR.

This report describes the causes, types, severity and outcomes of serious paediatric injury treated throughout Queensland in 2006. The similarities and differences in injury characteristics and outcomes of children treated at specialty paediatric compared to all other Trauma Registry hospitals (non-Paediatric Specialty Hospitals) in the state are also presented. These data should prove useful for clinicians involved in the care of paediatric trauma patients, hospital and health service personnel involved in quality assurance programs, health system personnel responsible for planning resource needs and those working in injury prevention.

Professor Nicholas Bellamy
Director
CONROD
EXECUTIVE SUMMARY

This is the fifth annual report of aggregate data collected by the QTR on patients aged between zero and 14 years admitted to hospital for 24 hours or more for the acute treatment of injury. A total of 1,929 cases were eligible for inclusion in the QTR, of which 142 patients met the criteria for major trauma.

Pertinent characteristics of this cohort include:

- Sixty-five percent of paediatric cases were male
- Males tended to be older than females when injured
- Incidence of trauma in children was 253 admissions per 100,000 population
- Forty-four percent of cases admitted to the Royal Children’s and Mater Children’s Hospitals were referred from another hospital
- A greater number of children of Aboriginal and/or Torres Strait Islander origin were treated at non-Paediatric Specialty Hospitals compared to Paediatric Specialty Hospitals
- Falls accounted for the highest proportion of paediatric injuries recorded by the QTR
- Road traffic crashes accounted for the highest proportion of major paediatric injuries recorded by the QTR
- The majority of children were involved in a leisure activity when injured
- Fractures were the most common nature of main injury and the upper extremity was the most common body location of main injury
- The full cohort of paediatric injury cases had a median hospital length of stay of two days, although major injury cases had a median hospital length of stay of seven days
- Eight percent of the total bed days used at the Royal Children’s and Mater Children’s Hospitals were trauma-related bed days
- Approximately 8% of the cohort required admission to ICU
- More major injury cases were treated at Paediatric Specialty Hospitals compared to non-Paediatric Specialty Hospitals
- In-hospital mortality across the full paediatric cohort was 0.9%
- One performance indicator, ‘referring hospital transfer greater than six hours’, was most commonly flagged over the three years between 2004 and 2006 as being outside agreed benchmarks.

These details confirm the extent and nature of hospitalisations due to paediatric injury across Queensland in 2006. It is imperative that management of injured patients while in hospital is reviewed regularly to improve process and decision making, inform quality assurance programs, develop educational programs to meet identified needs and ensure optimal treatment and outcomes.
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<tr>
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<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AIS</td>
<td>Abbreviated Injury Scale</td>
</tr>
<tr>
<td>ATSI</td>
<td>Aboriginal and/or Torres Strait Islander</td>
</tr>
<tr>
<td>CONROD</td>
<td>Centre of National Research on Disability and Rehabilitation Medicine</td>
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<tr>
<td>CT scan</td>
<td>Computerised Axial Tomography scan</td>
</tr>
<tr>
<td>DDA</td>
<td>Died During Admission</td>
</tr>
<tr>
<td>DID</td>
<td>Died in Emergency Department</td>
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<tr>
<td>DVT</td>
<td>Deep Vein Thrombosis</td>
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<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>EDH</td>
<td>Extradural Haematoma</td>
</tr>
<tr>
<td>EDIS</td>
<td>Emergency Department Information System</td>
</tr>
<tr>
<td>ETT</td>
<td>Endotracheal Tube</td>
</tr>
<tr>
<td>Ext</td>
<td>Extremity</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>ICD-10-AM</td>
<td>International Statistical Classification of Diseases and Related Health Problems (10th Revision) - Australian Modification</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>inj</td>
<td>injury</td>
</tr>
<tr>
<td>ISS</td>
<td>Injury Severity Score</td>
</tr>
<tr>
<td>MAIC</td>
<td>Motor Accident Insurance Commission</td>
</tr>
<tr>
<td>MBC</td>
<td>Motor Bike Crash</td>
</tr>
<tr>
<td>multi</td>
<td>multiple</td>
</tr>
<tr>
<td>MVC</td>
<td>Motor Vehicle Crash</td>
</tr>
<tr>
<td>OT</td>
<td>Operating Theatre</td>
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<tr>
<td>PE</td>
<td>Pulmonary Embolism</td>
</tr>
<tr>
<td>QTR</td>
<td>Queensland Trauma Registry</td>
</tr>
<tr>
<td>req</td>
<td>required</td>
</tr>
<tr>
<td>Resident instlttn</td>
<td>Residential institution</td>
</tr>
<tr>
<td>RFDS</td>
<td>Royal Flying Doctor Service</td>
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<tr>
<td>RTC</td>
<td>Road Traffic Crash</td>
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<tr>
<td>RTS</td>
<td>Revised Trauma Score</td>
</tr>
<tr>
<td>SDH</td>
<td>Subdural Haematoma</td>
</tr>
<tr>
<td>TRC</td>
<td>Trauma Review Committee</td>
</tr>
<tr>
<td>TRISS</td>
<td>Trauma and Injury Severity Score</td>
</tr>
<tr>
<td>UR number</td>
<td>Unit Record number</td>
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<tr>
<td>UTI</td>
<td>Urinary Tract Infection</td>
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BACKGROUND

The QTR was operated by CONROD in 14 sites across Queensland during 2006, with the purpose of maximising the benefits of care provided by the Public Health System to people hospitalised in Queensland following serious injury. Information was collected on the circumstances, type and severity of injury as well as all phases of treatment from pre-hospital to discharge or death. Funds from Queensland Health to CONROD supported the Trauma Registry Nurse positions at The Townsville, Royal Brisbane & Women’s and Princess Alexandra Hospitals and the Clinical Coder position at Mater Children’s and Royal Children’s Hospitals. The Motor Accident Insurance Commission provided funding to CONROD for the infrastructure, remaining sites and the core positions of Manager/Senior Research Fellow, Database Manager, Quality Assurance & Training Officer, Research Officers and Health Information Managers.

Problem being addressed

Overall, injury represents a major cost to injured individuals, the healthcare system and society, and is also a leading cause of preventable mortality and morbidity in Queensland, Australia and the World. Injury is the leading cause of child mortality in Australia and is the second most common cause of hospitalisation. In particular, falls and accidental poisoning are the most common reasons for injury hospitalisation for children aged between zero and 14 years in Australia. In Queensland in 1996-98, injury and poisoning caused one third of all deaths in children. Initiatives like the ‘National Injury Prevention Plan: Priorities for 2001 – 2003’ and the ‘Health Outcomes Plan: Injury Prevention and Control 2000 – 2004’ aim to reduce the burden of falls and accidental poisoning in children. In this context, the value of trauma registries for the collection and analysis of injury data on a statewide level has been described as a major tool for assessing the management of patient care.

Trauma registries are well established in a number of countries and have been used to change legislation, promote trauma prevention and to evaluate trauma system effectiveness. Trauma registries have also been shown to be more useful and accurate than administrative databases in assessing quality of care and diagnostic and therapeutic interventions. In addition to the recognised function of trauma registries of enabling clinicians to evaluate the effectiveness of trauma systems, trauma registries are essential to assessing and improving standards of trauma care. Overall, trauma registries are necessary tools for preventive strategies, quality assurance practices, health planning and evaluation, and monitoring the epidemiology of serious injury.

Objectives of the Queensland Trauma Registry

The QTR maximises the benefits of care provided by the Public Health System to people hospitalised in Queensland for serious injury by:

- Determining the incidence, cause, location, explanatory variables, treatment and outcomes of serious injury in Queensland
- Establishing benchmarks and identifying variations in accepted standards of care for people who experience serious injury in Queensland
- Facilitating clinical review and recommendations for changes in trauma management throughout Queensland, and
- Conducting scientific research to reduce future incidence and burden of injury and improve trauma management and outcomes.
METHODOLOGY

Study design

A prospective cohort design with chart based data acquisition at point of hospital separation was used for the operation of the QTR.

Sample population

All patients who met the eligibility criteria for the QTR and were admitted to any one of the QTR hospitals for 24 hours or more for the treatment of trauma in 2006 were included in the QTR. In 2006, there were 14 hospitals included in the QTR across Queensland:

**Northern Area**
The Townsville Hospital*
Cairns Base Hospital
Mackay Base Hospital

**Central Area**
Royal Brisbane & Women’s Hospital*
Royal Children’s Hospital*
Rockhampton Hospital
Nambour Hospital
Redcliffe Hospital
Caboolture Hospital

**Southern Area**
Princess Alexandra Hospital*
Mater Children’s Hospital*
Toowoomba Hospital
Ipswich Hospital
Gold Coast Hospital

* Tertiary Referral Hospitals
# Paediatric Specialty Hospitals

Criteria / Case definition

Cases were identified via Emergency Department Information System (EDIS) using the following criteria:

- > 14 years of age and admitted to a registry hospital site for ≥ 24 hours on initial presentation for treatment of an injury **AND** are codeable to an ICD-10-AM category from S00-S99, T00-T35, T63, T66-T71, T75
- ≤ 14 years of age and admitted to a registry hospital site for ≥ 24 hours on initial presentation for treatment of an injury **AND** are codeable to an ICD-10-AM category from S00-S99, T00-T75, T78
- Admission via Emergency Department (ED) or transferred from another hospital (bypassing ED) for the acute treatment of an injury.

QTR also includes cases of injury where patients:
- Die during ED presentation after active treatment was undertaken in ED
- Die during hospital admission.

It is important to note that each case on the registry represents only a single trauma event for a single patient. If a patient is transferred between QTR sites for a single trauma event, they will only appear on the registry for the site at which they received the majority of their definitive care.

Discharge Diagnosis Reports were also accessed via the Clinical Benchmarking Unit at the relevant hospitals using ICD 10-AM codes. These reports were crosschecked with the information retrieved via EDIS, and were used to identify cases that bypassed ED or cases who were not initially identified as meeting the inclusion criteria for the QTR.

Cases are excluded where:
- Fracture is pathological
- Dislocation is spontaneous
- Injury occurred in hospital and did not represent through ED
- Treatment is for psychiatric condition rather than injury
• Treatment is for medical condition rather than injury
• Treatment is for complication of injury (e.g. cellulitis)
• Admission is for convalescence, not treatment
• Admission is for social reasons.

Minor Trauma cases
ISS <16; deaths subsequent to fractured neck of femur (NOF) in those aged ≥ 65 years (#NOF ICD-10-AM codes S72.00 – S72.2, or AIS codes 851808.3, 851810.3, 851812.3 or 851818.3); cases where an ISS is not able to be calculated, including those who die subsequent to overdose / poisoning or drowning.

Major Trauma cases
ISS ≥16, die in the Emergency Department (where definitive care undertaken) or died during admission (other than deaths subsequent to overdose / poisoning or # NOF in those aged ≥ 65 years).

Data collected
A guide to data fields collected for major and minor injury cases is included in Appendix A. It is important to note that injury details are collected in a variety of ways:
• Main body location of injury is defined by AIS body regions
• Main nature of injury is defined by NDS-IS
• External cause, Place, Intent and Activity are defined by ICD-10-AM.

Data quality
A series of processes were in place to optimise the reliability and validity of the data, with CONROD employing both a Quality Assurance & Training Officer and a Database Manager to implement these strategies. These processes can be grouped under three main strategies - education, database validation rules and quality assurance checks. Specifically these strategies included:
1. Updating the coding manual, which is used for specifying inclusion and exclusion criteria and for guiding staff through the data collection and documentation process
2. Accessing and cross-checking multiple sources of data (ED, ICU and hospital discharge lists) to ensure all relevant patients were identified
3. Optimising coding accuracy through training
4. Producing quarterly coding newsletters to inform coders of relevant coding issues
5. Providing a coding help desk service
6. Performing dual coding of a subset of cases by a senior Health Information Manager
7. Conducting a series of automatic and manual audits on all data.

Data capture
The data presented in this report relates to serious paediatric injury (admitted to hospital for ≥ 24 hours) throughout Queensland. It is appropriate to note that this is an underestimation of the incidence of serious paediatric injury in Queensland given that no hospitals in the Wide Bay region were included in the QTR in 2006. These trauma cases represent significant workload and expenditure for the trauma system, including retrieval, transport and acute care. QTR data collection and analysis concentrates on characteristics of the injury and patient management until discharge from definitive care. It should also be acknowledged that there is ongoing burden, to the individual, the health system and society, as a result of these injuries.
Ethical considerations

The operation of the QTR was approved by the research and ethics committees of each relevant hospital, as well as The University of Queensland, in accordance with the National Health and Medical Research Council Guidelines.
STATEWIDE ANALYSIS OF PAEDIATRIC TRAUMA IN QUEENSLAND

RESULTS

This section provides information on all trauma patients aged between zero and 14 years who were admitted to one of the 14 QTR hospitals and met the inclusion criteria and were eligible for entry on the QTR. There were 1,929 cases of injury that met these criteria between January and December 2006. Over recent years, the number of eligible paediatric cases entered onto the QTR has fluctuated, from 1,782 cases in 2004, to 1,942 cases in 2005, to 1,929 cases in 2006.

Major/Minor Classification

Of the 1,929 paediatric patients admitted to QTR hospitals in 2006, 92.6% (1,787) were classified as minor injury cases (ISS <16 and deaths from poisoning) and 7.4% (142) were classified as major injury cases (ISS ≥ 16 or died in ED or died during hospitalisation). For the total cohort, the median ISS was five (IQR = 4 – 9).

Within the major injury category, the largest number of cases fell into the lowest category of severity (ISS = 16-20) (Figure 1). Overall, 87% (124) of major injury cases had an ISS between 16 and 30.

2004 – 2006

The percentage of major paediatric injury cases in Queensland has remained relatively stable over recent years, with 6.6% (118) in 2004, 6.2% (120) in 2005, and 7.4% (142) in 2006 being major injury cases. For the total cohort, median ISS was five in all three years.

Demographic Characteristics

Age and sex of injury cases

Males accounted for 65% (1,249) of all injury cases, with the 10 to 14 year age group recording the highest number of injuries (603 cases) (Figure 2). For females, the highest number of injury cases was recorded for the five to nine year age group (240 cases). All age groups had a higher percentage of males compared to females (Figure
3). Overall, the average age at injury was 8.4 years (SD = 4.4) for males and 7.2 years (SD = 4.2) for females.

**Commentary**

The finding that 65% of injuries occurred in males is consistent with previous literature where males accounted for more admissions to hospital because of injury than females in Queensland and Australia.

![Graph showing age group and sex of injured patients](image1)

**Figure 2: Age group and sex of injured patients (n = 1,929)**

Forty-three percent (829) of all injury cases were aged between 10 and 14 years. This was higher than the proportion of children in this age range across the state of Queensland (34%)\(^{20}\). Children aged five to nine years accounted for 31% (597) of the injured population, while those aged zero to four years accounted for 26% (503). Both of these proportions from the injured population were lower than the proportion of children in these age ranges across the state of Queensland (34% and 32% respectively)\(^{20}\).

Overall in Queensland, there were 253 injury admissions to QTR hospitals per 100,000 residents aged between zero and 14 years in the Queensland population\(^{20}\). For males, the highest incidence of injury occurred in the 10 to 14 year age group, with a rate of 454 injury admissions per 100,000 population. For females, the highest incidence of injury occurred in the five to nine year group, with a rate of 189 injury admissions per 100,000 population (Figure 4).
Place of residence

Queensland postcodes of usual residence for patients treated in 2006 ranged from 4001 to 4895. Twenty-three percent (437) of patients admitted to one of the 14 QTR hospitals resided within the Brisbane Statistical Division. Overall, 96.5% (1,863) of patients resided within Queensland, with 3% (52) of cases residing interstate, and 0.5% (12) being overseas visitors. Of the 52 interstate patients, 38 were from New South Wales. Postcode was unknown for two cases.

Aboriginal and/or Torres Strait Islander origin

One hundred and forty-three patients (9% of sample) chose to identify themselves as being of Indigenous origin, with 143 patients (7.4%) being of Aboriginal origin, 13 patients (0.7%) being of Torres Strait Islander origin and 17 patients (0.9%) being of both Aboriginal and Torres Strait Islander origin. Overall, 1,714 patients (89%) were recorded as being of neither Aboriginal nor Torres Strait Islander origin, and for 42 patients (2%), this information was not recorded.

Commentary

The percentage of Indigenous children admitted to hospital for 24 hours or more for the treatment of injury was higher than for the total Indigenous population for those aged zero to 14 in Queensland (5.9%).\textsuperscript{20} Despite the widespread acknowledgement of government departments and other researchers regarding the extent of the problem of injury in Aboriginal and/or Torres Strait Islander communities, the burden persists\textsuperscript{3, 21, 22}.

Injury Event Characteristics

External cause of injury

The external cause of injury was specified for 1,899 of the 1,929 cases of injury included in this report. Falls were the most common cause of injury (823 cases), with 50% (414) suffering a fall of less than one metre. The percentage of total injuries for each sex accounted for by falls was higher for females (48%) than males (41%) (Figure 5).
Figure 5: External cause of injury by sex (n = 1,899)*
* Those categories with n ≤ 5 were not included in this figure: ‘Breathing’ and ‘Firearm’

**Commentary**

‘The Health Outcomes Plan: Injury Prevention and Control 2000 – 2004’ outlines the scope of the problem of falls in children and adolescents and presents prevention strategies, specific trauma management and rehabilitation strategies for falls in this group. Establishing the burden of falls in children is necessary in order to improve the well being of the paediatric population, however the need to implement these approaches to reduce the incidence of falls in younger people is also apparent.

Road traffic crashes (RTC’s) were the second most common cause of injury (471 cases), with 77% (365) of these patients being male. The RTC category included cyclists (178), motorbike (MB) riders (113), motor vehicle (MV) passengers (64), pedestrians (53), MB passengers (23), MV drivers (5) and other modes of transport (35) (Figure 6).

Figure 6: Percentage of patients for each type of RTC (n = 471)

**Commentary**

The fact that cyclist injuries make up the highest percentage of RTC-related injury in children in this cohort is consistent with previous data, confirming the extent of the problem in terms of morbidity and mortality. Consistent with data from Victoria, males (118 cases in 2006), and those aged between 10 and 14 years (97 cases in 2006), were highly represented in the motorbike crash category. The fact that off-road motorbikes (e.g. four-wheeled bikes and trail bikes) do not require registration in Queensland, often leads to an underestimation of the occurrence of motorbike injuries in children.
As would be expected, external cause of injury varied according to age. Burns, poisonings, drownings and machinery-related injuries were most commonly recorded in the zero to four year age group. Falls were most common in those aged five to nine years with RTCs, animal-related injuries, collisions with a person or object and cutting injuries were most commonly recorded for those aged between 10 and 14 years. (Table 1). Twenty-eight of the 29 poisoning cases aged between zero and nine years were accidental poisonings. This is in contrast to the 10 to 14 year age group, where 18 of the 20 cases of poisoning were classed as intentional self harm. Of these 18 patients, 83% (15) were female.

**Commentary**

The finding that 83% of the poisoning cases in the 10 to 14 year age group were female is in line with previously reported data describing the high presentation rate to hospital for preadolescent females following intentional poisoning in Queensland. Appropriate interventions and counselling services for this age group to prevent repeat attempts would be highly beneficial.

### Table 1: External cause of injury by age group (n = 1,899)*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Fall</th>
<th>RTC</th>
<th>Collision</th>
<th>Animal</th>
<th>Cutting</th>
<th>Burns</th>
<th>Poisoning</th>
<th>Machinery</th>
<th>Drowning</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>212</td>
<td>53</td>
<td>41</td>
<td>26</td>
<td>14</td>
<td>51</td>
<td>29</td>
<td>10</td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td>5-9</td>
<td>331</td>
<td>128</td>
<td>40</td>
<td>29</td>
<td>14</td>
<td>11</td>
<td>6</td>
<td>4</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>280</td>
<td>290</td>
<td>88</td>
<td>45</td>
<td>44</td>
<td>7</td>
<td>20</td>
<td>9</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>823</td>
<td>471</td>
<td>169</td>
<td>100</td>
<td>72</td>
<td>69</td>
<td>52</td>
<td>25</td>
<td>18</td>
<td>96</td>
</tr>
</tbody>
</table>

* Those categories with n ≤ 5 were not included in this table: ‘Breathing’ and ‘Firearm’.

Differences were noted between major and minor injury cases for external cause of injury. The most common external cause for minor injury cases was a fall, followed by RTC’s and collisions with an object or person (Figure 7), whereas for major injury cases, involvement in an RTC was the most common external cause, followed by falls and collisions with an object or person.

**Figure 7: External cause of injury for major and minor injury cases (n = 1,899)**

* Those categories with n ≤ 5 were not included in this figure: ‘Breathing’ and ‘Firearm’

### Body location and nature of main injury

Of the 1,929 patients included in this report, the most frequent body location of main injury was the upper extremities (40%). The most frequent nature of main injury was a fracture (57%). Of the 1,103 patients who sustained a fracture, 60% (666) of these were fractures to the upper extremities, while 32% (355) were fractures to the lower
extremities. Intracranial injury (194) and open and superficial wounds (147) were the second and third most common nature of injury (Table 2).

Differences were noted between major and minor injury cases for nature and body location of main injury. Seventy percent (99) of all major injury cases had sustained an intracranial injury, while 61% (1,098) of all minor injury cases had suffered a fracture. Overall, the most common body location of major injury was the head (99), and for minor injury cases, injury to the upper extremities (772) was the most common.

Table 2: Nature by body location of main injury (n = 1,929)

<table>
<thead>
<tr>
<th>Nature of main injury</th>
<th>Head</th>
<th>Face</th>
<th>Neck</th>
<th>Thorax</th>
<th>Abdo/pelvis</th>
<th>Spine</th>
<th>Upper Ext</th>
<th>Lower Ext</th>
<th>External‡</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>51</td>
<td>21</td>
<td>1</td>
<td>9</td>
<td>666</td>
<td>355</td>
<td>-</td>
<td>1,103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracranial inj</td>
<td>194</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>194</td>
</tr>
<tr>
<td>Open wound/superficial</td>
<td>9</td>
<td>48</td>
<td>1</td>
<td>17</td>
<td>19</td>
<td>51</td>
<td>1</td>
<td>147</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inj internal organ</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>85</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>113</td>
</tr>
<tr>
<td>Inj nerve/muscle/tendon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>52</td>
<td>29</td>
<td>-</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn/corrosion</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>74</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Poisoning</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>51</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Crush/amputation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>12</td>
<td>-</td>
<td>36</td>
</tr>
<tr>
<td>Strain/dislocation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>9</td>
<td>7</td>
<td>-</td>
<td>28</td>
</tr>
<tr>
<td>Other†</td>
<td>-</td>
<td>50</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>15</td>
<td>30</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>254</td>
<td>119</td>
<td>7</td>
<td>28</td>
<td>102</td>
<td>22</td>
<td>469</td>
<td>496</td>
<td>156</td>
<td>1,929</td>
</tr>
</tbody>
</table>

† ‘Other’ includes eye injury, foreign body, drowning, asphyxia, electrical injury, effect of venom and multiple natures of injury
‡ ‘External’ includes burns, inhalation injuries, electrical injuries, hanging, drowning, poisoning and envenomation injuries

Commentary

Injuries were coded using the Abbreviated Injury Scale 1990 (AIS) which is divided into nine body regions: head, face, neck, thorax, abdomen and pelvic contents, spine, upper extremity (upper ext), lower extremity (lower ext) and external (incl. burns and other trauma). Nature of main injury was coded using the National Data Standards for Injury Surveillance – version 2.1 (NDSIS).

Place of injury

The place where injury occurred was specified for 1,280 cases. In line with the number of injuries caused by falls and RTC’s, 46% (588) of patients were injured in the home and 15% (188) were injured on a street or highway. In addition, 13% (163) were injured at a sports area with a further 12% (157) injured at a school. The remaining cases were injured elsewhere (Figure 8).

For the zero to four year and five to nine year age groups, the most common place of injury was the home. For those aged between 10 and 14 years the most common place of injury was a sports area. The home was the place of injury for 58% of all children aged zero to four years of age. The 10 to 14 year age group accounted for the largest proportion of patients injured at a sports area (81%) and on a street or highway (59%) (Table 3).
The large number of home-injuries is consistent with other data from Queensland\textsuperscript{26} and confirms the need for continuing interventions and programs aimed at improving safety in the home. As injuries occurring on streets and highways were also common, this highlights the importance of bicycle helmet policies, parental supervision, roadway construction and road safety education.

**Commentary**

The majority of injuries, 96.5% (1,862), were coded as accidental, with 1.3% (26) coded as assault and 1.2% (23) coded as intentional self-harm. The intent was not determined for 18 cases.

**Intent of injury**

The type of activity engaged in when injured was specified for 1,115 cases. Sixty percent (673) of cases were engaged in a sports or leisure activity when injured, 6% (67) were engaged in a personal activity (e.g. eating, sleeping, personal hygiene), while 3% (32) were engaged in other types of work (Figure 9). The remaining patients were injured while engaged in other types of activities.
Day and month of injury

Analysis revealed that injuries were more likely to occur on certain days, as opposed to having an even spread of occurrence over the entire week ($\chi^2 = 62.63, p < 0.001$). More injuries occurred on Sunday (364 cases), with 36% (695) of all injuries occurring on the weekend (Figure 10). Injuries were also more likely to occur during certain months of the year ($\chi^2 = 29.04, p < 0.05$), with the lowest number of injuries occurring in November (130) and the highest number of injuries occurring in October (198) (Figure 11).
Hospitalisation Characteristics

**Time of hospital presentation**

Time of hospital presentation was available for 1,787 patients. The highest percentage of patients was admitted to hospital between 4pm and 8pm (Figure 12).

![Figure 12: Time of hospital presentation (n = 1,787)](image)

When time of hospital presentation was broken down into injury types, patients suffering a head injury, injuries to the thorax/abdomen and extremity injuries were most likely to present to hospital between 4pm and 8pm (Figure 13). These findings give some indication of the workload each specialty within the hospital could face during different times of the day.

![Figure 13: Time of hospital presentation by injury type (n = 1,636)](image)

**Patient Status**

**Triage**

The Australasian Triage Scale is a five-point scale that categorises the urgency of treating a patient according to the following question: “This patient should wait for medical care no longer than..?” The five-point scale consists of the following options: 1 – resuscitation (immediate), 2 – emergent (within 10 minutes), 3 – urgent (within 30 minutes), 4 – semi-urgent (within 60 minutes) and 5 – non-urgent (within 120 minutes). The triage score is recorded for patients who present through ED (i.e. do not bypass ED). Of the 1,788 patients for whom this information was recorded, most were classified as ‘urgent’ (52%) (Table 4).
Table 4: Triage categories for patients presenting through ED (n = 1,788)

<table>
<thead>
<tr>
<th>Triage category</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation (immediate)</td>
<td>84 (5%)</td>
</tr>
<tr>
<td>Emergent (within 10 min)</td>
<td>421 (24%)</td>
</tr>
<tr>
<td>Urgent (within 30 min)</td>
<td>934 (52%)</td>
</tr>
<tr>
<td>Semi-urgent (within 60 min)</td>
<td>342 (19%)</td>
</tr>
<tr>
<td>Non-urgent (within 120 min)</td>
<td>7 (0%)</td>
</tr>
</tbody>
</table>

TRISS

A TRISS score is used to quantify the probability of survival as related to severity of injury (range = 0-1; higher is better). It is the combination of anatomic (ISS and a correction for blunt/penetrating injury), physiologic [Revised Trauma Score (RTS) – consisting of GCS, systolic blood pressure and respiratory rate], and age characteristics. These observations are taken at the time of arrival at the first ED that the patient presents to – this will be the first referring hospital if a patient has been referred, otherwise it will be on arrival at the ED of the definitive care hospital. If no observations are available, subjective assessment of the patients GCS (i.e. alert vs unconscious), respiratory rate (breathing normally vs apnoeic) and systolic blood pressure (normal vs no cardiac input) can be given to allow calculation of TRISS.

A TRISS score was calculated for the 1,806 (94%) patients who had complete data (including subjective data) on the characteristics used to calculate TRISS. For these 1,806 patients, scores ranged from 0.0023 to 0.9982, with a median TRISS of 0.9966. When subjective assessments were removed, there were 474 (25%) patients with a calculated TRISS. The range of scores was 0.5095 to 0.9982, with the median being the same as for the larger group.

Those with a calculated TRISS who died (Med = 0.7542, n = 8) had a lower TRISS than those who survived (Med = 0.9966, n = 1,798). Those with a calculated TRISS who were classified as major injury had a lower TRISS (Med = 0.9873, n = 127) than minor injury cases (Med = 0.9971, n = 1,679). All four medians were effectively identical when subjective assessments were removed, except for those patients who died (Med = 0.8793, n = 4; for patients with subjective assessments included Med = 0.7542, n = 8).

Outcome measures

Length of hospital stay

Length of hospital stay ranged from one to 253 days (Med = 2 days; IQR = 2 – 4) for the total cohort. Of the 1,929 patients included in this report, 1,110 spent one or two days in hospital, 408 spent between three and four days, while 146 patients spent between five and six days in hospital (Figure 14).

Differences were noted between major and minor injury cases for length of hospital stay. For major injury cases, length of hospital stay ranged from one to 253 days, with a median stay of seven days (IQR = 3 – 17.5). For minor injury cases, length of stay ranged from one to 79 days, with a median stay of two days (IQR = 2 – 4). The highest percentage of minor injury patients (60.5%) stayed one to two days in hospital, while for major injury patients, fifteen or more days (30%) was the most common length of hospital stay (Figure 15).
A total of 91,851 bed days‡ was utilised by all paediatric patients admitted to QTR hospitals in 2005. Of these, 8,580 bed days (9%) were utilised for the hospitalisation and treatment of trauma patients included in this report. Of the 8,580 bed days utilised by this cohort, 26% (2,229) were used by major injury cases with 74% (6,351) used by minor injury cases.

**Commentary**

The fact that injured paediatric patients used 9% of the total occupied bed days at QTR hospitals in 2006 highlights the extent to which hospitalisation and treatment of injured patients involves high resource utilisation. Hospitalisation of injured patients also represents a high cost, with one estimate of the cost of hospitalisation and treatment of injured patients in the hospital sector throughout Australia being $4 billion dollars per year¹.

**2004 – 2006**

The median length of hospital stay has remained stable over the past three years, with the median length of stay being two days in 2004, 2005 and 2006. For major injury cases, the median length of hospital stay fluctuated slightly from eight days in 2004, to six days in 2005, to seven days in 2006.

‡ All data were obtained from the relevant Health Information Management service at each QTR hospital site – The number of bed days used in 2006 includes acute patients only and does not include patients who stay < 24 hours.
**ICU**

There were 152 cases (8%) admitted to ICU in 2006 (minor = 74, major = 78). A total of 503 bed days was utilised in ICU (minor = 139 days, major = 364 days). Overall, length of stay in ICU ranged from one to 32 days (Med = 1 day; IQR = 1 – 3), with 89 patients admitted for one day only.

**2004 – 2006**

The median length of ICU stay remained relatively stable between 2004 and 2006, with the median length of stay being two days in 2004, one day in 2005 and 2006. The percentage of ICU admissions over the three years fluctuated slightly. In 2004, 9% (162) of injury patients were admitted to ICU, with 7% (135) admitted in 2005, and 8% (153) admitted in 2006.

In terms of major injury cases, the percentage admitted to ICU between 2004 and 2006 decreased. In 2004, 73% (86) of all major cases were admitted to ICU. This percentage then decreased in 2005 to 58% (70) and in 2006 to 55% (78).

**Mortality**

There were 17 deaths (0.9% of cases) recorded as a result of injury. Females accounted for 53% (9) of these deaths, with 16 of the 17 patients being major injury cases. Thirteen deaths occurred in the zero to four year age group, with three deaths in the 10 to 14 year age group and one death in the five to nine year age group. Overall, the mean age at death was 4 years (SD = 4.49).

The death rate (the number of deaths per 100,000 injuries) was calculated for each age group. The group with the highest death rate was the zero to four year age group, with a rate of 2,584 deaths per 100,000 injuries (Figure 16).

TRISS can be used to identify the number of ‘unexpected deaths’ in any given time period, ‘where unexpected death’ in this report is defined as a death of a patient with a calculated TRISS of 0.50 or above. This categorisation of unexpected deaths is consistent with previous uses of TRISS. When considering the entire cohort, 1,802 (99.8%) of the 1,806 patients with a calculated TRISS had a TRISS above 0.50, with an ‘unexpected death’ recorded for five cases. One case had a TRISS of less than 0.50 with two being an ‘unexpected survival’.

TRISS methodology is also used to calculate the Z-statistic, which is used to test whether the observed number of survivors in a specific trauma population is significantly different from the expected number of survivors based on baseline population data established by the Major Trauma Outcome Study (MTOS) (See Commentary). A positive Z-score is desirable, as it reflects more patients survived than predicted by TRISS. TRISS analysis revealed survival outcome to be more than predicted for the 1,806 paediatric patients with a calculated TRISS at QTR hospitals in 2006; Z-score = 1.85. This indicates that the number of survivors in the paediatric trauma population at QTR hospitals was more than expected based on the normative population established by the MTOS, however this difference was not statistically significant.
Commentary

It should be noted that the normative population included in the MTOS was a cohort of trauma patients treated in the United States of America in 1995. While corrections for some trauma characteristics (e.g. penetrating or blunt injury, age) are incorporated into this calculation, it still remains possible that different trauma characteristics account for a difference between the number of expected and observed survivors.

2004 – 2006

The percentage of in-hospital deaths has remained stable over the past three years, with the percentage being 1% in 2004, 0.9% in 2005 and 0.9% 2006.

Complications

Information regarding the development of complications is recorded on the QTR database for major injury cases only. Of the 142 major paediatric injury cases admitted to QTR hospitals in 2006, 76 (53.5%) experienced one or more complications (Note: A single case can have more than one type of complication and can have more than one complication within any given category). Ten (13%) were identified as having one or more neurological complications (Table 7).

<table>
<thead>
<tr>
<th>Table 5: Complications identified for major injury cases (n = 76)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complication category</strong></td>
</tr>
<tr>
<td>Neurological</td>
</tr>
<tr>
<td>Pulmonary</td>
</tr>
<tr>
<td>Infection</td>
</tr>
<tr>
<td>Musculoskeletal/Integumentary</td>
</tr>
<tr>
<td>Renal/Genitourinary</td>
</tr>
<tr>
<td>Cardiological</td>
</tr>
<tr>
<td>Abdominal</td>
</tr>
<tr>
<td>Vascular</td>
</tr>
<tr>
<td>Incomplete hospital record</td>
</tr>
</tbody>
</table>

Figure 16: Death rate by age group (n = 17)
Performance Indicators

Ensuring the maintenance of the highest standards of care within the trauma system through quality assurance and improvement is a major priority. Performance indicators (or quality indicators) are designed to act as audit filters that:

- Can identify problems where a resolution may result in the improvement of patient care and outcomes
- Will identify any deviations from benchmarks of established standards, for which there is possibly a logical reason
- Are specific enough to accurately identify cases that are in need of review and efficient enough to justify the cost of the time required collecting such information.

Caution must be taken when interpreting these percentage deviations from the established benchmarks of trauma care, as they are often based on small numbers and not all performance indicators were relevant for each case. The potential causes of a deviation from established benchmarks are many, and include (but are not limited to) a logical clinical decision to alter care for an individual patient, limited resources, lack of supervision or education and refusal of treatment by the patient.

The following performance indicator information refers only to major injury cases. One hundred and forty-two cases met the criteria for major injury at one of the 14 QTR hospitals across Queensland in 2006. Please refer to Appendix B for a detailed explanation of each performance indicator. Both the number and percentage of cases flagged for the 17 performance indicators are presented in Figure 17.

1. Pre-hospital scene time greater than 20 minutes. Scene time was available for 98 of the 100 patients for whom pre-hospital care information was applicable. Scene time was greater than 20 minutes for 32 (33%) of these patients. Of the 32 patients for whom pre-hospital scene time was greater than 20 minutes, 4 (11%) were transported via helicopter. Although transport via helicopter can increase time at the injury scene, the patient arrives at hospital much sooner than if they travelled via road.

2. Total pre-hospital time greater than one hour. Total pre-hospital time was available for 98 of the 100 patients who had a pre-hospital phase of care. Of these, 23 (23%) patients had a total pre-hospital time greater than one hour.

3. Glasgow Coma Score (GCS) less than nine with no endotracheal tube (ETT) within 10 minutes (at any stage). Forty-one patients had a GCS of less than nine recorded at any stage, with time of intubation known for 35.
Thirteen (37%) of these cases were not intubated within the suggested time frame of 10 minutes.

4. **Greater than 2000 mL of fluid administered without blood.** Four patients received greater than 2000 mL of fluid within the first 60 minutes of treatment, however, two (50%) patients did not receive blood with the fluid.

5. ** Retrieval team turnaround greater than 60 minutes.** There were 47 paediatric trauma patients for whom a retrieval was performed. Turnaround time was known for 37 cases, of which eight (22%) had a turnaround time greater than 60 minutes.

6. **Referring hospital transfer greater than six hours.** The time from arrival at the referring facility to arrival at the receiving facility was available for 67 of the 78 patients who were referred from another hospital. The time taken to reach definitive care was greater than six hours for 40 (60%) of these patients.

7. **GCS less than 15 and no head CT within 24 hours.** All of the 92 patients who had a GCS of less than 15 recorded received a CT scan.

8. **Urgent laparotomy greater than two hours after ED admission.** An urgent laparotomy was indicated and performed for three patients. Two of these three patients (67%) did not receive the procedure within two hours.

9. **Urgent craniotomy greater than four hours after ED admission.** An urgent craniotomy was indicated and performed for 17 patients with all 17 patients receiving the procedure within four hours.

10. **Compound fracture surgery greater than six hours after ED admission.** Surgical intervention for compound fractures was required for 12 patients, of whom five (42%) did not receive the procedure within six hours.

11. **Hypothermia at any stage.** Twelve of the 119 patients (10%) for whom temperature was known, suffered from hypothermia during their hospital admission. Of these 12 patients, six had a body temperature less than 35°C on arrival at the ED of their definitive care hospital, while five cases had a body temperature less than 35°C recorded at some other time during their hospital admission (temperature was unknown for one case).

12. **Reintubation within 48 hours of extubation.** One of the 55 patients (2%) who were intubated required reintubation within 48 hours of extubation.

13. **Unplanned return to operating theatre (OT).** One of the 65 patients (1.5%) who had an operation returned to the operating theatre within 48 hours.

14. **Unplanned admission to ICU.** One of the 77 (1%) admissions to ICU as a result of major injury was unplanned.

15. **Missed injuries with an AIS score greater than two after 24 hours.** Injuries with an AIS score of greater than two were not diagnosed within the first 24 hours of admission in three out of the 134 patients (2%) for whom this information was applicable.

16. **Development of Deep Vein Thrombosis (DVT), Pulmonary Embolism (PE) or decubitus ulcers during admission.** Six of the 142 major injury cases (4%) developed at least one of these complications during admission. Of these six patients, five developed decubitus ulcers and one developed DVT.

17. **Cervical spine injuries not cleared or diagnosed within 24 hours.** Information regarding the clearance/diagnosis of cervical spine injuries was
known for 80 patients. Five of these 80 patients (6%) did not have their cervical spine injuries cleared/diagnosed within 24 hours.

Overall, there were four performance indicators across the 14 QTR hospitals in 2006 that were flagged in over 40% of cases: ‘Greater than 2000 mL fluid administered without blood’, ‘referring hospital transfer greater than six hours’, ‘urgent laparotomy greater than two hours after ED admission’ and ‘compound fracture surgery greater than six hours after ED admission’.

The administration of more than 2000 mL of fluid within the first hour in the ED may occur when blood is not available rapidly, when a clinical decision is made that the patient’s haemoglobin level is sufficient to withstand further crystalloid or colloid infusions or when there is lack of recognition of the importance of haemoglobin for oxygen carrying capacity.

Referring hospital transfer exceeding six hours might be caused by lack of transfer vehicles, aircraft or personnel to meet current requirements, inappropriate weather or light conditions, a clinical decision to monitor the patient for a period of time prior to confirming the need to transfer or a lack of recognition of the need for timely transfer.

Causes of delay in performing urgent laparotomies or repairing compound fractures include other aspects of care taking precedence, operating theatre space or personnel not available, multiple or unnecessary diagnostic evaluations being undertaken, insufficient emergency department personnel available to initiate the process of consultation for surgery or staff with inadequate training to recognise the urgency of the need for surgery or laparotomy.

2004 – 2006

Sixteen of the 17 performance indicators were common in all years between 2004 and 2006 (Figure 18). The performance indicator relating to ‘cervical spine injuries not cleared/diagnosed within 24 hours’ (PI #17) was only included in the QTR database for 2005. Over the three years from 2004 to 2006, one performance indicator was commonly flagged (equal to or greater than 40% in each year): ‘Referring hospital transfer greater than six hours’.

Figure 18: Trends in the flagging of 16 performance indicators between 2004 and 2006 (see text above for a list of the 16 performance indicators denoted numerically in this figure) ($n_{2004} = 118$, $n_{2005} = 120$, $n_{2006} = 142$)

Overall, six performance indicators were consistently flagged at or below 10% over the three-year period:

- GCS less than 15 and no head CT within 24 hours
- Reintubation within 48 hours of extubation
- Unplanned return to OT
- Unplanned admission to ICU
- Missed injury with an AIS score of greater than two after 24 hours
- Development of DVT, PE, decubitus ulcers during admission

**Commentary**

One of the strengths of the QTR is its capacity to identify measures of deviation from established benchmarks of trauma care. Deviations from these benchmarks can occur at any stage during the patient’s care (i.e. during pre-hospital care or at either the transferring or definitive care hospital) and are not a representation of any *individual* hospital’s ability to meet these benchmarks, but rather a reflection of the effectiveness of the trauma system. Overall, this information is recorded on the QTR at the hospital providing definitive care.
ANALYSIS OF INJURY CASES TREATED AT
PAEDIATRIC SPECIALTY HOSPITALS

RESULTS

The two Paediatric Specialty Hospitals in Brisbane, the Royal Children’s Hospital and the Mater Children’s Hospital, provide definitive paediatric care for injury cases directly admitted, as well as for cases transferred from regional and metropolitan hospitals throughout the state of Queensland. Cases that have been transferred to the Royal Children’s and Mater Children’s Hospitals from non-paediatric specialty hospitals will ultimately be coded and entered onto the registry at these specialty paediatric hospitals.

This section provides information on all trauma patients aged between zero and 14 years admitted to either of the two Paediatric Specialty Hospitals between January and December 2006. Six hundred and eighty injury cases admitted to one of the Paediatric Specialty Hospitals in 2006 met the inclusion criteria and were eligible for entry on the QTR. Over recent years, the number of eligible cases entered onto the QTR has fluctuated with 626 cases in 2004, 621 cases in 2005 and 680 cases in 2006.

Major/Minor Classification

Of the 680 patients admitted to Paediatric Specialty Hospitals in 2006, 86% (583) were classified as minor injury cases (ISS <16 and deaths from poisoning) and 14% (97) were classified as major injury cases (ISS ≥ 16 or died in ED or died during hospitalisation). For the total cohort, the median ISS was five (IQR = 4 – 9).

Within the major injury category, the largest number of cases fell into the lowest category of severity (ISS = 16-20) (Figure 19). Overall, 91% (88) of major injury cases had an ISS between 16 and 30.

![Figure 19: ISS of major injury cases – Paediatric Specialty Hospitals (n = 97)](image)

**2004 – 2006**

The percentage of major injury cases treated at Paediatric Specialty Hospitals has fluctuated slightly over recent years, with 14% (81) in 2004, 12% (72) in 2005 and 14% (97) being major injury cases. For the total cohort, median ISS fluctuated slightly also, from five in 2004, to four in 2005, to five in 2006.
Demographic Characteristics

Age and sex of injury cases

Differences in proportions of people in each age group were noted between patients admitted to the Paediatric Specialty Hospitals as a result of injury, and those of the total population of Queensland and the Brisbane Statistical Division. The Brisbane Statistical Division covers an area of 4673.2 square kilometres and incorporates the majority of postcodes within the range of 4000 to 4521.

Thirty-five percent (241) of all injury cases were aged between zero and four years. This was higher than the proportion of children in this age range across the state of Queensland (32%)\textsuperscript{20} and across the Brisbane Statistical Division (32%)\textsuperscript{28}. Children aged 10 to 14 years accounted for 34% (231) of the injured population, which was the same as the proportion of children in this age range across the state of Queensland\textsuperscript{20} and across the Brisbane Statistical Division\textsuperscript{28}. Those aged five to nine years accounted for 31% (208), which was lower than the proportion of children in this age range across the state of Queensland (34%)\textsuperscript{20} and across the Brisbane Statistical Division (34%)\textsuperscript{28}.

Males accounted for 60% (411) of all injury cases, with the 10 to 14 year age group recording the highest number of injuries (160 cases) (Figure 20). For females, the highest number of injury cases was recorded for the zero to four year age group (100 cases). All age groups had a higher percentage of males compared to females (Figure 21). Overall, the average age at injury was 7.2 years (SD = 4.63) for males and 6.5 years (SD = 4.09) for females.

Commentary

As in the previous section (all paediatric cases in Queensland), the finding that 60% of injuries occurred in males is consistent with previous literature\textsuperscript{19} where males accounted for more admissions to hospital because of injury than females in Queensland and Australia.

Figure 20: Age group and sex of injured patients – Paediatric Specialty Hospitals (n = 680)
Queensland postcodes of usual residence for patients treated in 2006 ranged from 4006 to 4807. Fifty-seven percent (387) of patients admitted to Paediatric Specialty Hospitals for the treatment of injury in 2006 resided within the Brisbane Statistical Division. The postcode with the highest number of injuries was 4500 (20 cases), which includes suburbs such as Bray Park, Warner and Strathpine, followed by 4122 (16 cases) which includes suburbs such as Mt Gravatt, Mt Gravatt East, Upper Mt Gravatt and Mansfield.

Overall, 96% (654) of cases resided in Queensland, with 3% (21) residing interstate (18 of which resided in New South Wales), and 1% (3) being overseas visitors. These cases include all those that were injured elsewhere and who were transferred to the Royal Children’s or Mater Children’s Hospitals for definitive care. The highest number of injuries in any one suburb occurred in Forest Lake (13 cases) and Calamvale (7 cases).

Aboriginal and/or Torres Strait Islander origin

Thirty-nine patients (5.7% of the cases admitted to Paediatric Specialty Hospitals in 2006) chose to identify themselves as being of Indigenous origin, with 36 patients (5.3%) being of Aboriginal origin, one patient (0.1%) being of Torres Strait Islander origin and two patients (0.3%) being of both Aboriginal and Torres Strait Islander origin. Overall, 610 patients (89.7%) were recorded as being of neither Aboriginal nor Torres Strait Islander origin, and for 31 patients (4.6%), this information was not recorded.

Commentary

The percentage of Indigenous children admitted to hospital for 24 hours or more for the treatment of injury was higher than for the total Indigenous population for those aged zero to 14 in the Brisbane Statistical Division (1.4%)\(^28\). Despite the widespread acknowledgement of government departments and other researchers regarding the extent of the problem of injury in Aboriginal and/or Torres Strait Islander communities, the burden persists\(^2,\)\(^21,\)\(^22\).
Referral patterns

Of the 680 patients admitted to the Royal Children's and Mater Children’s Hospitals for the treatment of injury in 2006, 44% (302) were referred from another hospital, confirming the role of these hospitals as paediatric tertiary referral hospitals for serious injury. Of these 302 patients, the leading cause of injury was falls (91 cases), followed by RTC’s (70 cases) and burns/scalds (29 cases). Minor injury cases accounted for 79% (239) of the 302 patients who were referred, while major injury cases accounted for 21% (63) of referred cases. The largest number of patients was referred from Logan Hospital (29) (Table 6).

Of the 302 patients referred to Paediatric Specialty Hospitals, 132 (44%) were referred from within the Southern Area, 122 (40%) were referred from a hospital within the Central Area, with six (1%) coming from the Northern Area. There were 42 patients (14%) who came from either private hospitals or a hospital outside Queensland.
Table 6: Referring hospital name for patients transferred to Paediatric Specialty Hospitals for definitive care (n = 302)

<table>
<thead>
<tr>
<th>Referring Hospital</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logan Hospital</td>
<td>29</td>
</tr>
<tr>
<td>Redland Hospital</td>
<td>23</td>
</tr>
<tr>
<td>Caboolture Hospital</td>
<td>19</td>
</tr>
<tr>
<td>Ipswich Hospital</td>
<td>19</td>
</tr>
<tr>
<td>Hervey Bay Hospital</td>
<td>17</td>
</tr>
<tr>
<td>Nambour Hospital</td>
<td>12</td>
</tr>
<tr>
<td>Redcliffe Hospital</td>
<td>12</td>
</tr>
<tr>
<td>Rockhampton Hospital</td>
<td>12</td>
</tr>
<tr>
<td>Toowoomba Hospital</td>
<td>10</td>
</tr>
<tr>
<td>Tweed Heads District Hospital</td>
<td>9</td>
</tr>
<tr>
<td>Bundaberg Base Hospital</td>
<td>8</td>
</tr>
<tr>
<td>Beaudesert Hospital</td>
<td>7</td>
</tr>
<tr>
<td>Gold Coast Hospital</td>
<td>7</td>
</tr>
<tr>
<td>Maryborough Hospital</td>
<td>7</td>
</tr>
<tr>
<td>Wynnum Hospital</td>
<td>7</td>
</tr>
<tr>
<td>Gympie Hospital</td>
<td>6</td>
</tr>
<tr>
<td>Noosa Mayne Health Private Hospital</td>
<td>6</td>
</tr>
<tr>
<td>Queen Elizabeth li Jubilee Hospital</td>
<td>6</td>
</tr>
<tr>
<td>Kingaroy Hospital &amp; Community Health Centre</td>
<td>5</td>
</tr>
<tr>
<td>Mater Children’s Hospital</td>
<td>5</td>
</tr>
<tr>
<td>Wesley Private Hospital, Brisbane</td>
<td>5</td>
</tr>
<tr>
<td>Murgon Hospital</td>
<td>4</td>
</tr>
<tr>
<td>Caloundra Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Emerald Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Gladstone Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Goondiwindi Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Lismore Base Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Mackay Base Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Stanthorpe Hospital</td>
<td>3</td>
</tr>
<tr>
<td>Ballina Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Boonah Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Grafton Base Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Longreach Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Mater Private Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Prince Charles Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Roma Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Royal Brisbane &amp; Women's Hospital</td>
<td>2</td>
</tr>
<tr>
<td>St George Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Warwick Hospital</td>
<td>2</td>
</tr>
<tr>
<td>Alpha Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Barcaldine Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Dalby Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Gatton Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Holy Spirit Northside Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Mater Private Children’s Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Miles Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Monto Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Mount Isa Base Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Nanango Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Princess Alexandra Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Proserpine Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Springsure Hospital</td>
<td>1</td>
</tr>
<tr>
<td>St. Andrew’s Private Hospital, Brisbane</td>
<td>1</td>
</tr>
<tr>
<td>Tara Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Thursday Island Hospital</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>
Injury Event Characteristics

External cause of injury

The external cause of injury was specified for 669 of the 680 cases of injury admitted to Paediatric Specialty Hospitals. Falls were the most common cause of injury (276 cases), with 50% (138) suffering a fall of less than one metre. The percentage of total injuries for each sex accounted for by falls was higher for females (46%) than males (38%) (Figure 22).

![Bar chart showing external causes of injury by sex for Paediatric Specialty Hospitals (n = 669) with categories for Fall, RTC, Collision, Burns, Cutting, Animal, Poisoning, and Other. The chart indicates that falls are the most common cause of injury for both sexes, with a higher percentage for females.](image1)

Figure 22: External cause of injury by sex – Paediatric Specialty Hospitals (n = 669)*
*Those categories with \( n \leq 5 \) were not included in this figure: Breathing, Firearm, Drowning and Machinery.

Commentary

‘The Health Outcomes Plan: Injury Prevention and Control 2000 – 2004’ outlines the scope of the problem of falls in children and adolescents and presents prevention strategies, specific trauma management and rehabilitation strategies for falls in this group. Establishing the burden of falls in children is necessary in order to improve the well being of the paediatric population, however the need to implement these approaches to reduce the incidence of falls in younger people is also apparent.

Road traffic crashes (RTC's) were the second most common cause of injury (149 cases), with 68% (102) of these patients being male. The RTC category included cyclists (42), motor vehicle (MV) passengers (30), pedestrians (28), motorbike (MB) riders (25), MB passengers (4), MV drivers (3) and other modes of transport (17) (Figure 23).

![Bar chart showing percentage of patients for each type of RTC for Paediatric Specialty Hospitals (n = 149) with categories for Cyclist, MV passenger, Pedestrian, MB rider, MB passenger, MV driver, and Other transport. The chart indicates that cyclists are the most common RTC category, followed by MV passengers and pedestrians.](image2)

Figure 23: Percentage of patients for each type of RTC – Paediatric Specialty Hospitals (n = 149)
Commentary

The fact that cyclist injuries make up the highest percentage of RTC-related injury in children in this cohort is consistent with previous data\(^3\), confirming the extent of the problem in terms of morbidity and mortality. Consistent with data from Victoria\(^4\), males (22 cases in 2006), and particularly those aged between 10 and 14 years (15 cases in 2006), were more highly represented in the motorbike crash category. The fact that off-road motorbikes (e.g. four-wheeled bikes and trail bikes) do not require registration in Queensland, often leads to an underestimation of the occurrence of motorbike injuries in children.

As would be expected, external cause of injury varied according to age. Burns/scalds, poisonings, drowning, animal-related and machinery-related injuries were most commonly recorded in the zero to four year age group, with falls most common in those aged five to nine years. RTC's, collisions with a person or object and cutting injuries were most commonly recorded for those aged between 10 and 14 years (Table 7).

Table 7: External cause of injury by age group – Paediatric Specialty Hospitals (n = 669)*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Fall</th>
<th>RTC</th>
<th>Burns</th>
<th>Collision</th>
<th>Animal</th>
<th>Cutting</th>
<th>Poisoning</th>
<th>Machinery</th>
<th>Drowning</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>89</td>
<td>27</td>
<td>34</td>
<td>12</td>
<td>14</td>
<td>5</td>
<td>16</td>
<td>6</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>5-9</td>
<td>102</td>
<td>51</td>
<td>4</td>
<td>14</td>
<td>12</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>10-14</td>
<td>85</td>
<td>71</td>
<td>3</td>
<td>25</td>
<td>11</td>
<td>14</td>
<td>5</td>
<td>3</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>276</td>
<td>149</td>
<td>41</td>
<td>51</td>
<td>37</td>
<td>25</td>
<td>22</td>
<td>11</td>
<td>10</td>
<td>44</td>
</tr>
</tbody>
</table>

* Those categories with n ≤ 5 were not included in this table: ‘Breathing’ and ‘Firearm’.

Differences were noted between major and minor injury cases for external cause of injury. The most common external cause for both minor and major injury cases was a fall, followed by RTC’s. The third most common external cause of injury for minor cases was collision with an object or person, and for major cases it was burns/scalds (Figure 24).

**Body location and nature of main injury**

Of the 680 patients included in this section, the most frequent body location of main injury was the upper extremities (27%). The most frequent nature of main injury was a fracture (43%). Of the 294 patients who sustained a fracture, 51% (150) of these were fractures to the upper extremities, while 34% (99) were fractures to the lower
extremities. Intracranial injury (128) and injury to an internal organ (47) were the second and third most common nature of injury (Table 8).

Differences were noted between major and minor injury cases for nature and body location of main injury. Seventy-three percent (71) of all major injury cases had sustained an intracranial injury, while 50% (290) of all minor injury cases had suffered a fracture. Overall, the most common body location of major injury was the head (71), and for minor injury cases, injury to the upper extremities (181) was the most common.

<table>
<thead>
<tr>
<th>Nature of main injury</th>
<th>Head</th>
<th>Face</th>
<th>Neck</th>
<th>Thorax</th>
<th>Abdo/pelvis</th>
<th>Spine</th>
<th>Upper Ext</th>
<th>Lower Ext</th>
<th>External†</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open wound/superficial</td>
<td>3</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>10</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>Fracture</td>
<td>29</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>150</td>
<td>99</td>
<td>294</td>
</tr>
<tr>
<td>Strain/dislocation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Inj nerve/vessel/muscle/tendon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17</td>
<td>7</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>Crush/amputation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>6</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>Inj internal organ</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>13</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>Burn/corrosion</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Intracranial inj</td>
<td>128</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>128</td>
</tr>
<tr>
<td>Poisoning</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Other†</td>
<td>-</td>
<td>36</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>7</td>
<td>11</td>
<td>57</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>68</td>
<td>4</td>
<td>14</td>
<td>34</td>
<td>11</td>
<td>181</td>
<td>131</td>
<td>77</td>
<td>680</td>
</tr>
</tbody>
</table>

† ‘Other’ includes eye injury, foreign body, drowning, asphyxia, electrical injury, effect of venom and multiple natures of injury
‡ ‘External’ includes burns, inhalation injuries, electrical injuries, hanging, drowning, poisoning and envenomation injuries

Commentary

Injuries were coded using the Abbreviated Injury Scale 1990 (AIS) which is divided into nine body regions: head, face, neck, thorax, abdomen and pelvic contents, spine, upper extremity (upper ext), lower extremity (lower ext) and external (incl. burns and other trauma). Nature of main injury was coded using the National Data Standards for Injury Surveillance – version 2.1 (NDSIS).

Place of injury

The place where injury occurred was specified for 541 cases. In line with the number of injuries caused by falls and RTC’s, 51% (277) of patients were injured in the home and 15% (82) were injured on a street or highway. In addition, 10% (53) were injured at a sports area school, with 9% (51) injured at school. The remaining cases were injured elsewhere (Figure 25).

For the zero to four years, five to nine years, and 10 and 14 years age groups, the most common place of injury was the home. The home was the place of injury for 65% of all children aged zero to four years of age. The 10 to 14 year age group accounted for the largest proportion of patients injured at a sports area (79%) and on a street or highway (49%) (Table 9).
Figure 25: Place of injury occurrence – Paediatric Specialty Hospitals (n = 541)
* Those categories with n ≤ 5 were not included in this figure: ‘Residential Institution’, ‘Industrial area’ and ‘Mine’.

Table 9: Place of injury by age group – Paediatric Specialty Hospitals (n = 541)*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Home</th>
<th>Street/highway</th>
<th>Sports area</th>
<th>School</th>
<th>Farm</th>
<th>Trade/service area</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>156</td>
<td>14</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5-9</td>
<td>75</td>
<td>28</td>
<td>10</td>
<td>26</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>10-14</td>
<td>46</td>
<td>40</td>
<td>42</td>
<td>18</td>
<td>4</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>277</td>
<td>82</td>
<td>53</td>
<td>51</td>
<td>15</td>
<td>12</td>
<td>47</td>
</tr>
</tbody>
</table>

* Those categories with n ≤ 5 were not included in this figure: ‘Residential Institution’, ‘Industrial area’ and ‘Mine’.

For both major and minor injury cases, the most common place of injury was the home (47% and 52% respectively), with the second most common place of injury being a street or highway (31% and 12% respectively).

**Commentary**

The large number of home-injuries is consistent with other data from Queensland and confirms the need for continuing interventions and programs aimed at improving safety in the home. As injuries occurring on streets and highways were also common, this highlights the importance of bicycle helmet policies, parental supervision, roadway construction and road safety education.

**Intent of injury**

The majority of injuries, 96% (654), were coded as accidental, with 14 cases coded as assault and six cases coded as intentional self-harm. The intent was not determined for six cases.

**Activity when injured**

The type of activity engaged in when injured was specified for 383 cases. Fifty-six percent (214) of cases were engaged in a sports or leisure activity when injured, 5% (18) were engaged in a personal activity (e.g. eating, sleeping, personal hygiene), while 4% (16) were engaged in other types of work (Figure 26). The remaining patients were injured while engaged in other types of activities.
Day and month of injury

Analysis revealed that injuries were more likely to occur on certain days, as opposed to having an even spread of occurrence over the entire week ($\chi^2 = 22.92$, $p < 0.001$). More injuries occurred on Sunday (135 cases), with 35% (240) of all injuries occurring on the weekend (Figure 27). Injury occurrence was reasonably uniform over the 12 months of the year, with the lowest number of injuries occurring in September (47) and the highest number of injuries occurring in May (74) (Figure 28).
Hospitalisation Characteristics

**Time of hospital presentation**

Time of hospital presentation was available for 608 patients. The highest percentage of patients was admitted to hospital between 4pm and 8pm (Figure 29).

When time of hospital presentation was broken down into injury types, patients suffering a head injury, those with injuries to the thorax/abdomen and those with extremity injuries were all most likely to be admitted between 4pm and 8pm (Figure 30). These findings give some indication of the workload each specialty within the hospital could face during different times of the day.
Patient Status

Triage

The Australasian Triage Scale is a five-point scale that categorises the urgency of treating a patient according to the following question: “This patient should wait for medical care no longer than..?” The five-point scale consists of the following options: 1 – resuscitation (immediate), 2 – emergent (within 10 minutes), 3 – urgent (within 30 minutes), 4 – semi-urgent (within 60 minutes) and 5 – non-urgent (within 120 minutes). The triage score is recorded for patients who present through ED (i.e. do not bypass ED). Of the 608 patients for whom this information was recorded, most were classified as ‘urgent’ (43%) (Table 10).

<table>
<thead>
<tr>
<th>Triage category</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation (immediate)</td>
<td>43 (7%)</td>
</tr>
<tr>
<td>Emergent (within 10 min)</td>
<td>219 (36%)</td>
</tr>
<tr>
<td>Urgent (within 30 min)</td>
<td>263 (43%)</td>
</tr>
<tr>
<td>Semi-urgent (within 60 min)</td>
<td>81 (13%)</td>
</tr>
<tr>
<td>Non-urgent (within 120 min)</td>
<td>2 (1%)</td>
</tr>
</tbody>
</table>

TRISS

A TRISS score is used to quantify the probability of survival as related to severity of injury (range = 0-1; higher is better). It is the combination of anatomic (ISS and a correction for blunt/penetrating injury), physiologic (RTS – consisting of GCS, systolic blood pressure and respiratory rate), and age characteristics. These observations are taken at the time of arrival at the first ED that the patient presents to – this will be the first referring hospital if a patient has been referred, otherwise it will be on arrival at the ED of the definitive care hospital. If no observations are available, subjective assessment of the patients GCS (i.e. alert vs unconscious), respiratory rate (breathing normally vs apnoeic) and systolic blood pressure (normal vs no cardiac input) can be given to allow calculation of TRISS.

A TRISS score was calculated for the 620 (91%) patients who had complete data (including subjective data) on the characteristics used to calculate TRISS. For these
620 patients, scores ranged from 0.4275 to 0.9982, with a median TRISS of 0.9966. When subjective assessments were removed, there were 150 (22%) patients with a calculated TRISS. The range of scores and the median were similar as for the larger group.

Those with a calculated TRISS who died (Med = 0.8652, n = 3) had a lower TRISS than those who survived (Med = 0.9966, n = 617). Those with a calculated TRISS who were classified as major injury had a lower TRISS (Med = 0.9866, n = 86) than minor injury cases (Med = 0.9971, n = 534). All four medians were effectively identical when subjective assessments were removed.

**Outcome measures**

**Length of hospital stay**

Length of hospital stay ranged from one to 253 days (Med = 3 days; IQR = 2 – 5) for the total cohort. Of the 680 patients included in this section, 330 spent one or two days in hospital, 146 spent between three and four days, while 65 patients spent between five and six days in hospital (Figure 31).

Differences were noted between major and minor injury cases for length of hospital stay. For major injury cases, length of hospital stay ranged from one to 253 days, with a median stay of seven days (IQR = 3 – 23). For minor injury cases, length of stay ranged from one to 79 days, with a median stay of two days (IQR = 2 – 4). The highest percentage of minor injury patients (54%) stayed one to two days in hospital, while for major injury patients, fifteen or more days (32%) was the most common length of hospital stay (Figure 32).

![Figure 31: Length of hospital stay – Paediatric Specialty Hospitals (n = 680)](image-url)
A total of 47,744 bed days was utilised by all patients admitted to the two Paediatric Specialty Hospitals in 2006. Of these, 4,199 bed days (8.4%) were utilised for the hospitalisation and treatment of trauma patients included in this section. Of the 4,199 bed days utilised by this cohort, 43% (1,787) were used by major injury cases with 57% (2,412) used by minor injury cases.

**Commentary**

The fact that injured patients used 8.4% of the total occupied bed days at Paediatric Specialty Hospitals in 2006 highlights the extent to which hospitalisation and treatment of injured patients involves high resource utilisation. Hospitalisation of injured patients also represents a high cost, with one estimate of the cost of hospitalisation and treatment of injured patients in the hospital sector throughout Australia being $4 billion dollars per year.

**2004 – 2006**

The median length of hospital stay remained relatively stable over the past three years, with the median length of stay being three days in 2004, two days in 2005, and three days in 2006. For major injury cases, the median length of hospital stay fluctuated from 11 days in 2004, to six days in 2005, to seven days in 2006.

**ICU**

There were 107 cases (16%) admitted to ICU in 2006 (minor = 47, major = 60). A total of 355 bed days was utilised in ICU (minor = 88 days, major = 267 days). Overall, length of stay in ICU ranged from one to 32 days (Med = 1 day; IQR = 1 – 3), with 66 patients admitted for one day only.

**2004 – 2006**

The median length of ICU stay remained relatively stable between 2003 and 2005, with the median length of stay being one and a half days in 2004, and one day in both

---

‡ All data were obtained from the relevant Health Information Management service at the Royal Children’s and Mater Children’s Hospitals – The number of bed days used in 2006 includes acute patients only and does not include patients who stay < 24 hours.
The percentage of ICU admissions over the three years fluctuated slightly. In 2004, 19% (118) of injury patients were admitted to ICU, with 15% (95) admitted in 2005, and 16% (107) admitted in 2006.

In terms of major injury cases, there was a decrease in the percentage admitted to ICU between 2004 and 2006. In 2004, 81% (66) of all major cases were admitted to ICU. This percentage then decreased in 2005 to 63% (45), and again in 2006 to 62% (60).

**Mortality**

There were eight deaths (1.2% of cases) recorded as a result of injury. Females accounted for 62.5% (5) of these deaths, with all eight patients being major injury cases. Six deaths occurred in the zero to four year age group, with two deaths in the 10 to 14 year age group. Overall, the mean age at death was 3.8 years (SD = 5.47).

The death rate (the number of deaths per 100,000 injuries) was calculated for each age group. The group with the highest death rate was the zero to four year age group, with a rate of 2,490 deaths per 100,000 injuries (Figure 33).

TRISS can be used to identify the number of ‘unexpected deaths’ in any given time period, ‘where unexpected death’ in this report is defined as a death of a patient with a calculated TRISS of 0.50 or above. This categorisation of unexpected deaths is consistent with previous uses of TRISS. When considering the entire cohort, 619 (99.8%) of the 620 patients with a calculated TRISS had a TRISS above 0.50, with an ‘unexpected death’ recorded for three cases. One case had a TRISS of less than 0.50 and they were an ‘unexpected survival’.

TRISS methodology is also used to calculate the Z-statistic, which is used to test whether the observed number of survivors in a specific trauma population is significantly different from the expected number of survivors based on baseline population data established by the Major Trauma Outcome Study (MTOS) (See Commentary). A positive Z-score is desirable, as it reflects more patients survived than predicted by TRISS. TRISS analysis revealed survival outcome to be more than predicted for the 620 patients with a calculated TRISS at Paediatric Specialty Hospitals in 2006; Z-score = 1.32. This indicates that the number of survivors in the trauma population at Paediatric Specialty Hospitals was more than expected based on the normative population established by the MTOS, however this difference was not statistically significant.
Commentary

It should be noted that the normative population included in the MTOS was a cohort of trauma patients treated in the United States of America in 1995. While corrections for some trauma characteristics (e.g. penetrating or blunt injury, age) are incorporated into this calculation, it still remains possible that different trauma characteristics account for a difference between the number of expected and observed survivors.

2004 – 2006

The percentage of in-hospital deaths has remained stable over the past three years, with the percentage being 1.4% in 2004, 1.3% in 2005 and 1.2% 2006.

Complications

Information regarding the development of complications is recorded on the QTR database for major injury cases only. Of the 97 major injury cases admitted to Paediatric Specialty Hospitals in 2006, 65 (67%) experienced one or more complications (Note: A single case can have more than one type of complication and can have more than one complication within any given category) (Table 11).

<table>
<thead>
<tr>
<th>Complication category</th>
<th>No. cases with 1 or more complications</th>
<th>Most common complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>7</td>
<td>Wound infection (2 cases)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Septicaemia (2 cases)</td>
</tr>
<tr>
<td>Musculoskeletal/Integumentary</td>
<td>7</td>
<td>Decubitus Ulcer (5 cases)</td>
</tr>
<tr>
<td>Neurological</td>
<td>7</td>
<td>Seizure in hospital (4 cases)</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>4</td>
<td>Pneumonia (2 cases)</td>
</tr>
<tr>
<td>Cardiological</td>
<td>4</td>
<td>Shock; other (4 cases)</td>
</tr>
<tr>
<td>Renal/Genitourinary</td>
<td>4</td>
<td>Urinary Tract Infection (4 cases)</td>
</tr>
<tr>
<td>Abdominal</td>
<td>2</td>
<td>Ileus – persistent (2 cases)</td>
</tr>
<tr>
<td>Incomplete hospital record</td>
<td>57</td>
<td></td>
</tr>
</tbody>
</table>

Performance Indicators

Ensuring the maintenance of the highest standards of care within the trauma system through quality assurance and improvement is a major priority. Performance indicators (or quality indicators) are designed to act as audit filters that:

- Can identify problems where a resolution may result in the improvement of patient care and outcomes
- Will identify any deviations from benchmarks of established standards, for which there is possibly a logical reason
- Are specific enough to accurately identify cases that are in need of review and efficient enough to justify the cost of the time required collecting such information.

Caution must be taken when interpreting these percentage deviations from the established benchmarks of trauma care, as they are often based on small numbers and not all performance indicators were relevant for each case. The potential causes of a deviation from established benchmarks are many, and include (but are not limited to) a logical clinical decision to alter care for an individual patient, limited resources, lack of supervision or education and refusal of treatment by the patient.
The following performance indicator information refers only to major injury cases. Ninety-seven cases met the criteria for major injury at Paediatric Specialty Hospitals in 2006. Please refer to Appendix B for a detailed explanation of each performance indicator. Both the number and percentage of cases flagged for the 17 performance indicators are presented in Figure 34.

![Figure 34: Percentage of cases flagged (including raw numbers) for each of the 17 performance indicators – Paediatric Specialty Hospitals (see text below for a list of the 17 performance indicators denoted numerically in this figure) (n = 97 major injury cases)](image)

1. **Pre-hospital scene time greater than 20 minutes.** Scene time was available for 70 of the 72 patients for whom pre-hospital care information was applicable. Scene time was greater than 20 minutes for 23 (33%) of these patients. Of the 23 patients for whom pre-hospital scene time was greater than 20 minutes, two (9%) were transported via helicopter. Although transport via helicopter can increase time at the injury scene, the patient arrives at hospital much sooner than if they travelled via road.

2. **Total pre-hospital time greater than one hour.** Total pre-hospital time was available for 70 of the 72 patients who had a pre-hospital phase of care. Of these, 17 (24%) patients had a total pre-hospital time greater than one hour.

3. **Glasgow Coma Score (GCS) less than nine with no endotracheal tube (ETT) within 10 minutes (at any stage).** Thirty patients had a GCS of less than nine recorded at any stage, with time of intubation known for 24. Eleven (46%) of these cases were not intubated within the suggested time frame of 10 minutes.

4. **Greater than 2000 mL of fluid administered without blood.** Two patients received greater than 2000 mL of fluid within the first 60 minutes of treatment, however, one (50%) patient did not receive blood with the fluid.

5. **Retrieval team turnaround greater than 60 minutes.** There were 38 paediatric trauma patients for whom a retrieval was performed. Turnaround time was known for 31 cases, of which six (19%) had a turnaround time greater than 60 minutes.

6. **Referring hospital transfer greater than six hours.** The time from arrival at the referring facility to arrival at the receiving facility was available for 55 of the 63 patients who were referred from another hospital. The time taken to reach definitive care was greater than six hours for 32 (58%) of these patients.

7. **GCS less than 15 and no head CT within 24 hours.** All of the 65 patients who had a GCS of less than 15 recorded received a CT scan.
8. **Urgent laparotomy greater than two hours after ED admission.** An urgent laparotomy was indicated and performed for one patient with this patient receiving the procedure within two hours.

9. **Urgent craniotomy greater than four hours after ED admission.** An urgent craniotomy was indicated and performed for 12 patients with all 12 patients receiving the procedure within four hours.

10. **Compound fracture surgery greater than six hours after ED admission.** Surgical intervention for compound fractures was required for eight patients, of whom three (37.5%) did not receive the procedure within six hours.

11. **Hypothermia at any stage.** Eight of the 82 patients (10%) for whom temperature was known, suffered from hypothermia during their hospital admission. Of these eight patients, four had a body temperature less than 35°C on arrival at the ED of their definitive care hospital, while four cases had a body temperature less than 35°C recorded at some other time during their hospital admission.

12. **Reintubation within 48 hours of extubation.** One of the 44 patients (2%) who were intubated required reintubation within 48 hours of extubation.

13. **Unplanned return to operating theatre (OT) within 48 hours.** One of the 49 patients (2%) who had an operation returned to the operating theatre within 48 hours.

14. **Unplanned admission to ICU.** One of the 59 (1.5%) admissions to ICU as a result of major injury was unplanned.

15. **Missed injuries with an AIS score greater than two after 24 hours.** Injuries with an AIS score of greater than two were not diagnosed within the first 24 hours of admission for one out of the 94 patients (2%) for whom this information was applicable.

16. **Development of Deep Vein Thrombosis (DVT), Pulmonary Embolism (PE) or decubitus ulcers during admission.** Five of the 97 major injury cases (5%) developed decubitus ulcers during admission. There were no cases who had a DVT or PE.

17. **Cervical spine injuries not cleared or diagnosed within 24 hours.** Information regarding the clearance/diagnosis of cervical spine injuries was known for 51 patients. Three of these 51 patients (6%) did not have their cervical spine injuries cleared/diagnosed within 24 hours.

Overall, there were three performance indicators at Paediatric Specialty Hospitals in 2006 that were flagged in over 40% of cases: ‘GCS less than nine and no ETT within 10 minutes’, ‘greater than 2000 mL of fluid administered without blood’ and ‘referring hospital transfer greater than six hours’.

Potential reasons for tripping the ‘GCS less than nine and no ETT within 10 minutes’ indicator include a fluctuating GCS, inadequately trained staff or insufficient numbers of available staff to intubate the patient, lack of recognition of the urgency of achieving definitive airway control, or a specific clinical decision to monitor the patient’s respiratory function for a period of time without intervention.

The administration of more than 2000 mL of fluid within the first hour in the ED may occur when blood is not available rapidly, when a clinical decision is made that the patient’s haemoglobin level is sufficient to withstand further crystalloid or colloid infusions or when there is lack of recognition of the importance of haemoglobin for oxygen carrying capacity.
Referring hospital transfer exceeding six hours might be caused by lack of transfer vehicles, aircraft or personnel to meet current requirements, inappropriate weather or light conditions, a clinical decision to monitor the patient for a period of time prior to confirming the need to transfer or a lack of recognition of the need for timely transfer.

The percentage of cases flagged for each performance indicator for Paediatric Specialty Hospitals was benchmarked against aggregate data for all children (aged 14 years or less) admitted for 24 hours or more to QTR hospitals in Queensland in 2006 (Table 12). Of those indicators with flagged cases, the percentage of flagged cases was different by more than 5% between Paediatric Specialty Hospitals and statewide data for three:

- GCS less than nine and no ETT within 10 minutes (at any stage).
- Retrieval team turnaround greater than 60 minutes
- Urgent laparotomy greater than two hours after ED admission

Table 12: Comparison in percentage of cases flagged for each performance indicator between Paediatric Specialty Hospitals (n = 97) and aggregate Statewide data for those aged 14 years or less (n = 142) in 2006

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Paediatric Specialty Hospitals 2006</th>
<th>2006 Statewide data (age &lt; 14 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total applicable cases</td>
<td>Total flagged cases</td>
</tr>
<tr>
<td>1. Pre-hospital scene time &gt; 20 min</td>
<td>70</td>
<td>23</td>
</tr>
<tr>
<td>2. Total pre-hospital time &gt; 1 hr</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>3. GCS &lt; 9 no ETT within 10 min</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>4. &gt; 2000 mL fluid without blood first 60 min</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Retrieval team turnaround &gt; 60 min</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>6. Referring hospital transfer &gt; 6 hr</td>
<td>55</td>
<td>32</td>
</tr>
<tr>
<td>7. GCS &lt; 15 and no head CT</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>8. Urgent laparotomy &gt; 2 hr post ED</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>9. Urgent craniotomy &gt; 4 hr post ED</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>10. Compound fractures &gt; 6 hr to OT</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>11. Hypothermia at any stage</td>
<td>82</td>
<td>8</td>
</tr>
<tr>
<td>12. Reintubation within 48 hr</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>13. Unplanned return to OT within 48 hr</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>14. Unplanned admission to ICU</td>
<td>59</td>
<td>1</td>
</tr>
<tr>
<td>15. Missed injuries of AIS &gt; 2 after 24 hr</td>
<td>94</td>
<td>2</td>
</tr>
<tr>
<td>16. Development of ulcers, PE, DVT</td>
<td>97</td>
<td>5</td>
</tr>
<tr>
<td>17. C-spine injuries not cleared within 24 hr</td>
<td>51</td>
<td>3</td>
</tr>
</tbody>
</table>
Sixteen of the 17 performance indicators were common in all years between 2004 and 2006 (Figure 35). The performance indicator relating to 'cervical spine injuries not cleared/diagnosed within 24 hours' (PI #17) was only included in the QTR database for 2006. Over the three years from 2004 to 2006, two performance indicators were commonly flagged (equal to or greater than 40% in each year):

- GCS less than nine and no ETT within 10 minutes (at any stage)
- Referring hospital transfer greater than six hours

Figure 35: Trends in the flagging of 16 performance indicators between 2004 and 2006 – Paediatric Specialty Hospitals (see text above for a list of the 16 performance indicators denoted numerically in this figure) (n(2004) = 81, n(2005) = 72, n(2006) = 97)

Overall, seven performance indicators were consistently flagged at or below 10% over the three-year period (including one indicator that was never flagged):

- GCS less than 15 and no head CT within 24 hours
- Urgent laparotomy greater than two hours after ED admission
- Urgent craniotomy greater than two hours after ED admission
- Unplanned return to OT within 48 hours
- Unplanned admission to ICU
- Missed injury with an AIS score of greater than two after 24 hours
- Development of DVT, PE, decubitus ulcers during admission

Commentary

One of the strengths of the QTR is its capacity to identify measures of deviation from established benchmarks of trauma care. Deviations from these benchmarks can occur at any stage during the patient's care (i.e. during pre-hospital care or at either the transferring or definitive care hospital) and are not a representation of any individual hospital's ability to meet these benchmarks, but rather a reflection of the effectiveness of the trauma system. Overall, this information is recorded on the QTR at the hospital providing definitive care.
COMPARISON BETWEEN PAEDIATRIC SPECIALTY AND NON-PAEDIATRIC SPECIALTY HOSPITALS

This section provides information about differences in trauma related hospital admissions between Paediatric Specialty Hospitals (Specialty hospitals) and non-Paediatric Specialty Hospitals (NPS hospitals). The Specialty hospitals are the Royal Children’s and Mater Children’s Hospitals, while the NPS hospitals include: Royal Brisbane & Women’s Hospital, Princess Alexandra Hospital, The Townsville Hospital, Caboolture Hospital, Cairns Base Hospital, Gold Coast Hospital, Ipswich Hospital, Mackay Base Hospital, Nambour Hospital, Redcliffe Hospital, Rockhampton Hospital and Toowoomba Hospital.

Thirty-five percent (680) of patients aged between zero and 14 who were admitted to hospital as a result of injury in Queensland, were admitted to the Specialty hospitals, and 65% (1,249) were admitted to NPS hospitals.

Major/minor classification

There was a significant difference in the percentage of major injury cases between the two hospital categories ($\chi^2 = 73.39, p < 0.001$), with the Specialty hospitals treating significantly more major injury cases (14.3%) compared to NPS hospitals (3.6%) (Table 13).

Table 13: Injury severity details for major and minor injury cases over the two hospital categories (n = 1,929)

<table>
<thead>
<tr>
<th></th>
<th>Specialty hospitals</th>
<th>NPS hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>97 (14.3%)</td>
<td>1,204 (96.4%)</td>
</tr>
<tr>
<td>Median ISS</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>IQR</td>
<td>17 – 26</td>
<td>2 – 9</td>
</tr>
</tbody>
</table>

2004 – 2006

The difference in percentage of major injury cases treated at Specialty hospitals compared to NPS hospitals fluctuated over the past three years, with the difference being 9.7% in 2004 (12.9% at Specialty hospitals & 3.2% at NPS hospitals), 8.0% in 2005 (11.6% at Specialty hospitals & 3.6% at NPS hospitals), and 10.7% in 2006 (14.3% at Specialty hospitals & 3.6% at NPS hospitals)

Demographic Characteristics

Age and sex of injury cases

There was a significant difference in the percentage of injured males treated over the two hospital categories ($\chi^2 = 8.54, p < 0.01$). A significantly higher percentage of male patients were treated at NPS hospitals (67.1%), compared to hospitals (60.4%). For male patients, the 10 to 14 year age group was the most common group treated at Specialty hospitals and NPS hospitals (Figure 36). Overall, there was a significant age difference in males over the two hospital categories ($F = 50.03, p < 0.001$) with males treated at Specialty hospitals being significantly younger ($M = 7.2, SD = 4.6$) than males treated at NPS hospitals ($M = 9.0, SD = 4.1$).
There was a significant difference in the percentage of injured females treated over the two hospital categories ($\chi^2 = 8.54, p < 0.01$). A significantly higher percentage of female patients were treated at Specialty hospitals (39.6%) compared to NPS hospitals (32.9%). For female patients, the zero to four year age group was the most common group treated at Specialty hospitals, while the 10 to 14 year age group was the most common group treated at NPS hospitals (Figure 37). Overall, there was a significant age difference in females over the two hospital categories ($F = 11.43, p < 0.001$), with females treated at Specialty hospitals being significantly younger ($M = 6.5, SD = 4.1$) than those treated at NPS hospitals ($M = 7.6, SD = 4.3$).

**Aboriginal and/or Torres Strait Islander origin**

There was a significant difference in the number of patients over the two hospital categories who identified themselves as being of Aboriginal and/or Torres Strait Islander origin ($\chi^2 = 42.24, p < 0.001$). A significantly higher percentage of patients were of Indigenous origin at NPS hospitals (10.8%), compared to Specialty hospitals (5.7%). Of the 134 patients of Indigenous origin admitted to one of the NPS hospitals, 107 patients were of Aboriginal origin, 12 were of Torres Strait Islander origin and 15 patients were of both Aboriginal and Torres Strait Islander origin.
Injury Event Characteristics

External cause of injury

For both Specialty hospitals and NPS hospitals, the most common external cause of injury was a fall (276 for Specialty hospitals & 547 for NPS hospitals), followed by an RTC (149 & 322), and collision with a person or object (51 & 118) (Figure 38). There was no significant difference between the two hospital categories for the number of falls cases, RTC cases or for the number of collision injury cases treated.

![External cause of injury over the two hospital categories (n= 1,899)*](image)

*Those categories with n ≤ 5 were not included in this figure: ‘Breathing’ and ‘Firearm’.

Nature of main injury

Fractures (294) were the most common nature of main injury for Specialty hospitals, followed by intracranial injury (128) and superficial and injury to an internal organ (47). For NPS hospitals, the most common nature of main injury was a fracture (809), followed by superficial and open wounds (106), intracranial injury (66) and injury to an internal organ (66) (Table 14). There was a significant difference between the two hospital categories in terms of the percentage of intracranial injury identified as the nature of main injury ($\chi^2 = 89.23$, $p < 0.001$), with more intracranial injuries treated at Specialty hospitals (18.8%) compared to NPS hospitals (5.3%). There was no significant difference between the two hospital categories for the number of fractures identified as the nature of main injury.

![Number of patients in each hospital category in the six most common nature of injury categories (n= 1,929)](table)

Table 14: Number of patients in each hospital category in the six most common nature of injury categories (n= 1,929)

<table>
<thead>
<tr>
<th>Nature of main injury</th>
<th>Specialty Hospitals</th>
<th>NPS Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>294 (43.2%)</td>
<td>809 (64.8%)</td>
</tr>
<tr>
<td>Intracranial injury</td>
<td>128 (18.8%)</td>
<td>66 (5.3%)</td>
</tr>
<tr>
<td>Superficial/open wound</td>
<td>41 (6.0%)</td>
<td>106 (8.5%)</td>
</tr>
<tr>
<td>Injury to internal organ</td>
<td>47 (6.9%)</td>
<td>66 (5.3%)</td>
</tr>
<tr>
<td>Injury nerve/vessel/muscle/tendon</td>
<td>24 (3.5%)</td>
<td>58 (4.6%)</td>
</tr>
<tr>
<td>Burn/corrosion</td>
<td>45 (6.6%)</td>
<td>29 (2.3%)</td>
</tr>
</tbody>
</table>

Body location of main injury

The most common body location of main injury for both Specialty hospitals and NPS hospitals was the upper extremities. The second and third most common body location of main injury was the head and the lower extremities for Specialty hospitals,
and the lower extremities and the head for NPS hospitals (Table 15). There was a significant difference in the percentage of patients with upper extremity injuries over the two hospital categories ($\chi^2 = 78.60, p < 0.001$), with significantly fewer patients with upper extremity injuries admitted to Specialty hospitals (26.6%) compared to NPS hospitals (47.3%). There was also a significant difference between the two hospital categories in terms of the percentages of patients with lower extremity injuries ($\chi^2 = 14.55, p < 0.001$) and the percentages of patients with head injuries ($\chi^2 = 98.62, p < 0.001$).

Table 15: Number of patients in each hospital category: Upper extremity, lower extremity and head (n = 1,929)

<table>
<thead>
<tr>
<th>Category</th>
<th>Specialty hospitals</th>
<th>NPS hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper extremity</td>
<td>181 (26.6%)</td>
<td>591 (47.3%)</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>131 (19.3%)</td>
<td>338 (27.1%)</td>
</tr>
<tr>
<td>Head</td>
<td>160 (23.5%)</td>
<td>94 (7.5%)</td>
</tr>
</tbody>
</table>

**Outcome measures**

**Length of hospital stay**

The total number of bed days used was larger for NPS hospitals compared to Specialty hospitals, however the range in length of stay was larger for Specialty hospitals. Median length of stay was three days for Specialty hospital and two days for NPS hospitals (Table 16).

Table 16: Length of stay details between the two hospital categories (n = 1, 929)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specialty hospitals</th>
<th>NPS hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>680 cases</td>
<td>1,249 cases</td>
</tr>
<tr>
<td>Range</td>
<td>1 – 253 days</td>
<td>1 – 53 days</td>
</tr>
<tr>
<td>Median LOS</td>
<td>3 days</td>
<td>2 days</td>
</tr>
<tr>
<td>IQR</td>
<td>2 – 5 days</td>
<td>2 – 3 days</td>
</tr>
<tr>
<td>Total bed days</td>
<td>4,199 days</td>
<td>4,381 days</td>
</tr>
</tbody>
</table>

The most common length of stay for both hospital categories was between one and two days, with 48.5% (330) of patients admitted to Specialty hospitals and 62.4% (780) of patients admitted to NPS hospitals staying for this amount of time (Figure 39). Only 3.2% (40) of patients admitted to NPS hospitals and 7.9% (54) of patients admitted to Specialty hospitals stayed for 15 days or more.

![Figure 39: Length of stay in hospital over the two hospital categories (n = 1,929)](image-url)
Commentary

Any difference between the hospital categories for length of hospital stay characteristics is likely to be due to a higher percentage of major injury cases being treated at Speciality hospitals, where specialist services such as the state-wide burns and spinal units are located. While patients with spinal injuries and those with burns are occasionally managed in a number of locations, the most severe are usually managed at the Speciality hospitals.

2004 – 2006

The difference between the two hospital categories for median length of hospital stay remained relatively stable over the past three years, with the difference being one day in 2004 and 2006, with there being no difference in 2005. Across all three years the median length of stay was two days for NPS hospitals. For Speciality hospitals the median length of stay was three days in 2004 and 2006, and two days in 2005. For major injury cases, the difference in median length of hospital stay between the two hospital categories fluctuated over the three years, with the difference being six days in 2004 (Specialty hospitals = 11 days, NPS hospitals = 5 days), one day in 2005 (Specialty hospitals = 6 days, NPS hospitals = 5 days), and two days in 2006 (Specialty hospitals = 7 days, NPS hospitals = 5 days).

ICU

There was a significant difference in the likelihood of admission to ICU between the two hospital categories ($\chi^2 = 89.28, p < 0.001$), with those admitted to Speciality hospitals more likely to be admitted to ICU (15.7%) than those admitted to NPS hospitals (3.6%). The median length of stay in ICU was one day for both Speciality hospitals and NPS hospitals, with Speciality hospitals recording the widest range of days (Table 17).

| Table 17: ICU length of stay details over the two hospital categories (n = 152) |
|---------------------------------|-------------------------------|
| Specialty hospitals | NPS hospitals |
| Number of patients | 107 (15.7%) | 45 (3.6%) |
| Range | 1 – 32 days | 1 – 25 days |
| Median LOS | 1 day | 1 day |
| IQR | 1 – 3 days | 1 – 3 days |
| Total bed days | 355 days | 148 days |

2004 – 2006

There was no difference between the two hospital categories for median length of ICU stay in 2005 and 2006 (median length of ICU stay was one day for both Speciality and NPS hospitals in each year), with there being a difference of half a day in 2004 (Speciality hospitals = 1.5 days, NPS hospitals = 2 days). For major injury cases, there was a difference of half a day in median length of hospital stay between the two hospital categories for 2004 (Speciality hospitals = 2 days, NPS hospitals = 2.5 days), and 2006 (Speciality hospitals = 2 days, NPS hospitals = 1.5 days) and one day in 2005 (Speciality hospitals = 3 days, NPS hospitals = 2 days).

Mortality

Eight patients (1.2%) in Speciality hospitals died at some stage during their hospital admission, compared to nine (0.7%) deaths in NPS hospitals. For those age groups represented, the death rate (the number of deaths per 100,000 injuries) was highest.
for the zero to four years age group for both Specialty hospitals (2,490 deaths per 100,000 injuries) and NPS hospitals (2,672 deaths per 100,000 injuries) (Figure 40).

![Figure 40: Death rate for each age group across both hospital categories (n = 17)](image)

### Performance Indicators

There was no significant difference in the percentage of flagged cases between the two hospital categories for any of the 17 performance indicator (Table 18).

It should be noted that some indicators were commonly flagged (equal to or greater than 40% of cases) over both Specialty and NPS hospitals: ‘Greater than 2000 mL fluid administered without blood’ (50% & 50% flagged respectively) and ‘referring hospital transfer greater than six hours’ (58% & 67% flagged respectively).

There were also eight performance indicators that were infrequently flagged (less than 10% of cases) or were not flagged over both Specialty and NPS hospitals: ‘GCS less than 15 and no head CT within 24 hours’ (none flagged & none flagged respectively); ‘urgent craniotomy greater than four hours after ED admission’ (none flagged & none flagged respectively); ‘reintubation within 48 hours of extubation’ (2% flagged & none flagged respectively); ‘unplanned return to OT within 48 hours’ (2% flagged & none flagged respectively); ‘unplanned admission to ICU’ (1.5% flagged & none flagged respectively); ‘missed injuries with an AIS score greater than two after 24 hours’ (2% flagged & 2.5% flagged respectively); ‘development of DVT, PE or decubitus ulcers during admission’ (5% flagged & 2% flagged respectively); and ‘cervical spine injuries not cleared or diagnosed within 24 hours’ (6% flagged & 7% flagged respectively).
Table 18: Percentage of flagged cases for each of the 17 performance indicators for both hospital categories (n = 142)

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Specialty hospitals</th>
<th>NPS hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total applicable cases</td>
<td>Total flagged cases</td>
</tr>
<tr>
<td>1. Pre-hospital scene time &gt; 20 min</td>
<td>70</td>
<td>23</td>
</tr>
<tr>
<td>2. Total pre-hospital time &gt; 1 hr</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>3. GCS &lt; 9 no ETT within 10 min</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>4. &gt; 2000 mL fluid without blood first 60 min</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Retrieval team turnaround &gt; 60 min</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>6. Referring hospital transfer &gt; 6 hr</td>
<td>55</td>
<td>32</td>
</tr>
<tr>
<td>7. GCS &lt; 15 and no head CT</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>8. Urgent laparotomy &gt; 2 hr post ED</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>9. Urgent craniotomy &gt; 4 hr post ED</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>10. Compound fractures &gt; 6 hr to OT</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>11. Hypothermia at any stage</td>
<td>82</td>
<td>8</td>
</tr>
<tr>
<td>12. Reintubation within 48 hr</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>13. Unplanned return to OT within 48 hr</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>14. Unplanned admission to ICU</td>
<td>59</td>
<td>1</td>
</tr>
<tr>
<td>15. Missed injuries of AIS &gt; 2 after 24 hr</td>
<td>94</td>
<td>2</td>
</tr>
<tr>
<td>16. Development of ulcers, PE, DVT</td>
<td>97</td>
<td>5</td>
</tr>
<tr>
<td>17. C-spine injuries not cleared within 24 hr</td>
<td>51</td>
<td>3</td>
</tr>
</tbody>
</table>
REFERENCES


ALL CASES

Patient Details
- Age
- Gender
- ATSI status

Injury Details
- Injury date/s
- Injury time
- Postcode of injury
- Dominant injury type
- Nature of injury (NDS-IS)
- Intent of injury (ICD-10-AM)
- External cause of injury (ICD-10-AM)
- Place of injury occurrence (ICD-10-AM)
- Activity at time of injury (ICD-10-AM)
- Injury type/s (AIS codes)
- Body location of main injury (AIS regions)

ED / Hospital Admission
- Presentation date / time
- Mode of arrival
- Means of referral
- Triage category
- Pulse rate / time
  - SpO2 rate / time
  - Respiratory rate / time
  - Systolic BP rate / time
  - Diastolic BP
- Glasgow Coma Score / time
- Temperature / time
- Time treatment started
- Transfer from ED date / time
- Admission date / time
- Disposition

Outcome
- ICU days
- Length of hospital stay (LOS)
- Injury outcome e.g. survived; died
- Death information e.g. place, date, time
- Operation (yes/no)
- Transfer information
- Rehabilitation facility information

Score
- Injury Severity Score (ISS)
- Trauma & Injury Severity Score (TRISS)
- Revised Trauma Score

MAJOR CASES ONLY (ISS ≥ 16)

Pre-hospital
- Incident date
- Request date / time
- Dispatch time
- Scene arrival / departure time/s
- Scene time delay
- Hospital arrival time
- Skill level

- Vehicle type
- Scene time delay
- Pulse rate / time
- SpO2 rate / time
- Respiratory rate / time
- Systolic BP rate / time
- Diastolic BP
- Glasgow Coma Score / time
- Temperature / time
- CPR
- Airway type / time
- Inter-costal catheter
- Fluid type / volume

Referral details
- Hospital name (for Minors also)
- Arrival date / time
- Departure date / time
- Pulse rate / time
- SpO2 rate / time
- Respiratory rate / time
- Systolic BP rate / time
- Diastolic BP
- Glasgow Coma Score / time
- Temperature / time
- CPR
- Airway type / time
- Inter-costal catheter
- Fluid type / volume
- CT scan
- Ultrasound
- Triage category

Interfacility
- Transfer date
- Vehicle type
- Transfer provider
- Skill level
- Activation time
- Arrival time
- Departure time
- Definitive care arrival time
- CPR
- Airway type / time
- Inter-costal catheter
- Fluid type / volume

ED Treatment
- CPR
- Airway type / time
- Intercostal catheter
- Fluid type / volume
- CT scan
- Ultrasound
- Angiography
- Transoesophageal / Trans-thoracic ECG
- Anti-coagulation
- Trauma team activation

Performance Indicators
Please contact QTR for a full explanation of the Indicators listed over the page
APPENDIX B – PERFORMANCE INDICATORS

1. Pre-hospital scene time greater than 20 minutes.

The length of time a patient spends at the scene of the accident can have significant bearing on the eventual outcome. It is important that patients are transported to hospital for definitive management as soon as possible. Patients are not flagged if the responding pre-hospital team spent less than 20 minutes at the scene. Difficult extrications and other events affecting this indicator are also recorded.

2. Total pre-hospital time greater than one hour.

The length of time it takes to transport a patient to hospital and the type of care the patient receives in this time can have a significant bearing on the eventual outcome of the patient. Pre-hospital time is calculated from ambulance (QAS) request time to ED arrival time.

3. GCS less than nine with no ETT within 10 minutes (at any stage)

Patients with a decreased level of consciousness are deemed to be at an increased risk of airway compromise and should have a mechanical airway established as soon as practicable. Intubation should be performed within 10 minutes of recording a GCS of less than nine (at any stage from arrival at first hospital). Patients are not flagged if they were intubated within 10 minutes. A patient is deemed to be not applicable if their GCS was never less than nine, ETT was pre-hospital, where they died before intervention was possible or for those who mechanical ventilation was never intended e.g. NFR.

4. Greater than 2000 mL of fluid administered without blood

When a patient requires fluid resuscitation for blood loss, blood is preferred rather than high-volume crystalloid and colloid because the haemo-dilution effect of the latter is harmful. This indicator measures the number of patients who are administered intravenous fluids in excess of 2000 mL and who do not receive blood in the first 60 minutes. (Note: Patients outside the normal weight range may invalidate the indicator). It refers ONLY to the administration of colloid or crystalloid without blood transfusion during the resuscitation period in any ED (pre-hospital fluids and maintenance fluid, i.e. one litre > four hours are not included). Children receiving greater than 40 mL/kg without blood should be included. A patient is deemed to be not applicable if ≤ 2000 mL or no intravenous fluid was administered or they were a burns patient.

5. Retrieval team turnaround greater than 60 minutes

When the Medical Retrieval Team is used to transfer a patient from the referring hospital, we want to measure how long the retrieval team spends at the referring hospital. This indicator measures the length of time from arrival at the referring hospital bedside to departure from referring hospital bedside.

6. Referring hospital transfer greater than six hours

A patient who requires secondary or tertiary referral should reach definitive care as soon as possible. This indicator measures the length of time from arrival at the referring facility to arrival at the receiving facility.

7. GCS less than 15 and no head CT within 24 hours

A GCS of less than 15 may indicate significant head injury. This indicator flags those patients with a GCS of less than 15 either on arrival in the resuscitation room, or whose level of consciousness decreases below 15 while they are in ED. A patient is deemed to be not applicable if their GCS was 15 at all phases, they died or had no documented head injury.

8. Urgent laparotomy greater than two hours after ED admission

When urgent laparotomy is required for a patient who has suspected intra-abdominal bleeding with haemodynamical instability, this should occur without delay. This refers to the amount of time from arrival in ED to commencement of anaesthetic for surgery. A patient is deemed to be not applicable if an urgent laparotomy was indicated and not performed (patient died) or if no urgent laparotomy was indicated.

9. Urgent craniotomy greater than four hours after ED admission

This refers to a patient with an acute subdural (SDH) or acute extradural haematoma (EDH) that warrants urgent drainage and refers to the amount of time from arrival in ED to commencement of the anesthetic for surgery. (Note: ‘Acute’ is defined as presentation ≤ 24 hours post injury).
monitor insertion and elevation of depressed skull fractures are not included. A patient is deemed to be not applicable if an urgent craniotomy was indicated and not performed (patient died) or if no urgent craniotomy was indicated.

10. Compound fracture surgery greater than six hours after ED admission

The risk of infection and subsequent disability is increased where the required surgical intervention is delayed during definitive care. This refers to the amount of time from arrival in ED to commencement of anaesthetic for surgery. A patient is deemed to be not applicable if they sustained no compound fractures.

11. Hypothermia at any stage

Maintenance of adequate body temperature is important - hypothermia is associated with a poor outcome for patients with injury. It can occur as a result of several factors including prolonged scene time or patient exposure, loss of blood or rapid infusion of cold intravenous fluid. This indicator is used to flag any patient whose temperature is ≤ 35°C at any time (i.e. including pre-hospital, referring hospital and definitive care phases). A patient is deemed to be not applicable if active cooling was undertaken or temperature was unknown (e.g patient died in ED).

12. Reintubation within 48 hours of extubation

This indicator includes endotracheal and tracheotomy tubes and specifically refers to the decision to extubate. If a patient is unintentionally or self-extubated and the decision is made to observe their respiratory status and later require reintubation, this case would not be flagged. A patient is deemed to be not applicable if they were never intubated or intubated for OT only.

13. Unplanned return to OT within 48 hours

Ideally, all operations will be anticipated and planned following ED assessment. Unplanned operations include return to operating theatre for post-operative haemorrhage, unexpected surgery for missed injuries, or unexpected deterioration of patient’s condition. A patient is deemed to be not applicable if they had no initial visit to OT.

14. Unplanned admission to ICU

This refers to those patients that were transferred to the ward and whose condition deteriorates, requiring prompt re/admission to the ICU. It includes patients who were:
- Transferred from ICU to the ward and back to ICU
- Transferred from ED to a ward then ICU
- Transferred from ED to OT, intended to go to the ward but were admitted to ICU.

A patient is deemed to be not applicable if they had no admissions to ICU.

15. Missed injuries with an AIS score greater than two after 24 hours

Ideally, all injuries will be diagnosed during the first 24 hours of care. Any injury that is not diagnosed during the first 24 hours constitutes a missed injury. If a patient has missed injuries, but these injuries do not have an AIS score of greater than two, then the case will NOT be flagged. A patient is deemed not applicable if investigations were incomplete e.g. Death or transfer within 24 hours.

16. Development of DVT, PE or decubitus ulcers during admission

The development of these complications during an admission may result in longer hospital inpatient days and result in differing mortality rates. Where a complication was present during admission, the type was documented.

17. Cervical spine injuries not cleared or diagnosed within 24 hours

This performance indicator includes the suspicion of a cervical spine injury, which is not cleared or diagnosed within 24 hours of admission to ED and results in unnecessary prolonged use of a hard cervical collar. A patient is deemed not applicable if there was no suspected cervical spine injury or they died in less than 24 hours.
2005
SERIOUS INJURY DUE TO ROAD TRAFFIC CRASHES IN QUEENSLAND