National Trauma Registry Consortium (Australia & New Zealand)

A collaborative initiative of the Royal Australasian College of Surgeons, the Centre of National Research on Disability and Rehabilitation Medicine and the Australasian Trauma Society

The

National Trauma Registry

Consortium (Australia & New Zealand)

Report: 2002

CONROD
CENTRE OF NATIONAL RESEARCH ON DISABILITY AND REHABILITATION MEDICINE

Royal Australasian College of Surgeons

AUSTRALASIAN TRAUMA SOCIETY

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This first national (Australia & New Zealand) report is testament to the commitment of many dedicated individuals who have been involved in the care and management of seriously injured trauma patients throughout Australia and New Zealand during the last 20 years and who have recognised the importance of the collection of quality trauma data. The members of the Steering Committee of the National Trauma Registry Consortium gratefully acknowledge the clinical, administrative and managerial staff at each of the hospitals within Australia and New Zealand who have contributed to the development of this fledgling national trauma registry project in many different capacities.

NTRC (Aust. & NZ) Executive Committee Members:
Mr Cliff Pollard (FRACS), Chair of Steering Committee (RACS); Professor Nicholas Bellamy (CONROD); Associate Professor Mark Fitzgerald (ATS); Associate Professor Peter Danne (RACS); Dr Leanne Aitken (Queensland); and Christine O'Connor (NTRC).

NTRC (Aust. & NZ) Steering Committee Members:
Those listed above and Mr Patrick Bade (FRACS) (Northern Territory); Professor Peter Cameron (Victoria); Professor Danny Cass (New South Wales); Mr William Griggs (FRACS) (South Australia); Mr James Hamill (FRACS) (New Zealand); and Mr Sudhakar Rao (FRACS) (Western Australia);

The Steering Committee also acknowledges that the Consortium's success has been primarily achieved through the willingness of Registry participants to engage in the dialogue process. The following trauma registries have generously contributed data for this report.

Central Registries
New South Wales Institute of Trauma & Injury Management
Queensland Trauma Registry
South Australian Trauma Registry
Victorian State Trauma Registry

Individual Hospital Registries
Auckland City Hospital (New Zealand)
Fremantle Hospital (Western Australia)
Middlemore Hospital (New Zealand)
Princess Margaret Hospital (Western Australia)
Royal Darwin Hospital (Northern Territory)
Royal Perth Hospital (Western Australia)
Sir Charles Gairdner Hospital (Western Australia)
Waikato Hospital (New Zealand)

Please refer to the individual acknowledgements at the end of this report for a list of everyone involved. We sincerely trust that we have included all contributors; if however, we have inadvertently omitted anyone please accept our sincere apologies.

Foreword

During the last decade the vision for a national approach to trauma data collection has slowly taken shape and come to fruition with the production of this first National Trauma Registry Consortium (Australia & New Zealand) Report on major injury based on 2002 Australian and New Zealand data.

The National Trauma Registry Consortium (Australia & New Zealand) was officially launched at the Royal Australasian College of Surgeons Trauma Workshop held in Melbourne in November 2003. The primary purpose of the Consortium is to link together all relevant stakeholders who have an interest in achieving a combined National Trauma Registry within Australia and New Zealand. To successfully achieve this aim the Consortium is committed to the development of strong collaborative relationships based on a consultative process between participating trauma registries and Consortium leaders. Participating registries at this point include all registries (either hospital-based or central registries) that are currently operating in Australia and New Zealand. The Consortium was also able to obtain data from the Northern Territory although there are currently no fully established trauma registries within that Territory.

The publication of this first national report (Australia and New Zealand) describes aspects of major trauma including injured patients' demographics, and causes and outcomes of injuries as recorded by trauma registries participating in the project. The Report also signifies the first step in developing a National Trauma Registry (Australia & New Zealand) with the primary aim of improving patient outcomes by providing quality trauma data to aid in the monitoring, managing and future planning of the Australian and New Zealand trauma care systems.

I am pleased to present this first national report on major trauma in Australia and New Zealand and trust that it will be useful in guiding the future development and collection of major injury data at a national level.

C.W. Pollard (FRACS)
Chair
National Trauma Registry Consortium (Australia & New Zealand)

Table of Contents

List of Figures

List of Tables

Abbreviations and Definitions

AIS	The Abbreviated Injury Scale[1] (AIS) is a consensus derived, anatomically based system that classifies individual injuries by body region on a 6-point ordinal severity scale ranging from AIS 1 (minor) to AIS 6 (currently untreatable). The AIS does not assess the combined effects of multiply-injured patients.
ATS	Australasian Trauma Society
CONROD	Centre of National Research on Disability and Rehabilitation
ICU	Intensive Care Unit
ISS	Injury Severity Score[2] provides an overall score for patients with multiple injuries. The ISS is the sum of the squares of the highest AIS code in each of the three most severely injured ISS body regions.
ISS>15	Injury Severity Score greater than 15
LOS	Length of Stay
NTRC (Aust. & NZ)	National Trauma Registry (Australia & New Zealand)
RACS	Royal Australasian College of Surgeons
Trauma[3]	Defined as "an injury or wound resulting from an external force".

Executive Summary

This publication is the result of an innovative initiative of the National Trauma Registry Consortium (Australia & New Zealand) funded jointly by the Royal Australasian College of Surgeons (RACS), the Centre of National Research on Disability and Rehabilitation Medicine (CONROD) and the Australasian Trauma Society (ATS). The Consortium Steering Committee recognised the importance of a national approach to the monitoring of major trauma in Australia and New Zealand and undertook to facilitate the work required to achieve this goal.

This is the first national (Australia and New Zealand) report to provide an overview of major trauma characteristics within both countries. The report is based on a national minimum data set protocol comprising a set of de-identified data elements concerning major traumatic injury (Injury Severity Score >15) agreed to by participating members of the Consortium for collection and reporting at an Australian and New Zealand level. Data were provided by all trauma registries currently operating in Australia and New Zealand.

The following summary describes the salient features of major injury characteristics obtained from national data collected in 2002:

- A total of 5438 major trauma patients with an Injury Severity Score of >15 (ISS>15) were identified in this cohort;
- Major injuries resulted in a mortality rate of 15% prior to hospital discharge;
- Males comprised 75% of the major injury cohort;
- Survival rates to hospital discharge for males and females were approximately equal;
- Young adults in the 15–24 years age group were more frequently injured (n=1248) in 2002;
- The highest death rate was recorded in the 85+ age group (36%);
- Road trauma crashes accounted for 52% of all major injuries;
- The average length of stay in hospital as a result of major injuries was 16 days; and
- 51% of patients admitted to hospital with major injuries were admitted to an intensive care unit.

The formation of the National Trauma Consortium (Australia and New Zealand) provides a feasible framework to develop a National Trauma Registry. The results of this first report provide a starting point for the collection and evaluation of national trauma data. In addition the size of the cohort sample (n=5438) demonstrates the extent of the human burden that major injuries cause.

The development of a National Trauma Registry (Australia and New Zealand) provides an opportunity to contribute to improving the outcome of trauma patients and as such ought to be a national priority.

1. Introduction

Traumatic injury is a significant health problem in Australia and New Zealand[4]. Individuals often encounter serious physical, cognitive, emotional, social, vocational and financial difficulties following major injury leading to chronic health problems and lifestyle adjustments. In addition, the social and economic burden on families, carers and health service delivery is often overwhelming[5]. Within the framework of providing improved patient care and better health outcomes for seriously injured patients, trauma registries play a vital role in the overall clinical management, planning, quality assurance of systems and research of trauma through optimal systematic data collection and analysis.

In recognition of the contribution trauma registries make to trauma systems performance and management, the National Trauma Registry Consortium [NTRC] (Australia & New Zealand) was formed to facilitate the development of a National Trauma Registry (Australia & New Zealand) based upon an agreed minimum data set. To achieve its aim the Consortium adopted an interdependent model of project development and decision making which recognises the collective within-group expertise of its members, strives to increase the common ground between competing interests through negotiation and values a collaborative and cooperative approach to goal attainment.

Two initial objectives of the NTRC (Australia & NZ) have been successfully achieved primarily through the continuing goodwill of participating trauma registries. First, collaborative relationships have been forged between participating trauma registries and the Consortium. The ongoing development of these relationships underpins the successful establishment of the National Trauma Registry (Australia & New Zealand). The cooperative response and willingness to engage in the provision of data by established trauma registries throughout Australia and New Zealand is evidence of the commitment of participants to establish mutually beneficial relationships within the Consortium.

The publication of this first National Trauma Registry (Australia & New Zealand) Report: 2002 signifies the completion of the second major objective of the Consortium. The report describes a combined Australian and New Zealand sample of major injury (Injury Severity Score >15) based on a minimum de-identified aggregate data set.

2. Methods

2.1 Design

The study used a retrospective cohort design. De-identified data from 2002 was supplied in aggregate form from participating trauma registries.

2.2 Participants

Participants comprised a cohort of 2002 major trauma (Injury Severity Score [ISS] >15) patients admitted to hospitals in Australia and New Zealand whose trauma registries participated in the Consortium project.

The participating trauma registries included four state-based trauma registries that collected data from hospitals included in their central jurisdiction and eight hospital-based trauma registries that collected data within their individual hospital jurisdictions.

Central Registries	**Individual Hospital Registries**
New South Wales Institute of Trauma & Injury Management	Auckland Hospital (New Zealand)
Queensland Trauma Registry	Fremantle Hospital (Western Australia)
South Australian Trauma Registry	Middlemore Hospital (New Zealand)
Victorian State Trauma Registry	Princess Margaret Hospital (Western Australia) Royal Darwin Hospital (Northern Territory) Royal Perth Hospital (Western Australia) Sir Charles Gairdner Hospital (Western Australia)
	Waikato Hospital (New Zealand)

2.3 Inclusion Criteria

Major injuries were defined as ISS>15. Although inclusion criteria for major injuries vary across Australian and New Zealand trauma registries, each participating registry was able to provide data based on this criterion. The Abbreviated Injury Scale (AIS) was used to code injuries and calculate the ISS for each patient and the categorical aggregate results were used in this report.

2.4 Data Collected

A minimum data set of 14 de-identified items was collected from each of the participating trauma registries as aggregate totals. The following items comprised the minimum data set:

- trauma registry
- age in years
- gender
- mechanism of injury
- arrival mode to hospital
- admission type
- overall length of stay in hospital
- ICU admission
- ICU length of stay
- injury day of the week
- injury time of the day
- surgical procedures
- injury severity score >15
- injury outcome

3. Results

This section describes a summary of major trauma (ISS>15) patient demographics and injury characteristics within Australia and New Zealand in 2002 based on de-identified aggregate data provided by participating trauma registries. Two caveats need to be considered when reviewing the data. First, the Report does not capture all major injuries in Australia and New Zealand. This is partly because, although all established trauma registries participated in the project, not all health jurisdictions within the two countries operate trauma registries. In addition, admission to hospital is a standard criterion for inclusion into trauma registries; however, this does not take account of trauma deaths prior to hospital admission. The second caveat relates to the level of data available for the Report. No individual patient data were collected in the study; therefore, no primary data analysis was undertaken. This has necessarily limited the level of data analysis and interpretation of results.

3.1 Patients

A total of 5438 major trauma patients (ISS>15) presented to Australian and New Zealand hospitals participating in this project between January and December 2002. Of this number 15% (n=830) did not survive to hospital discharge (Figure 1).

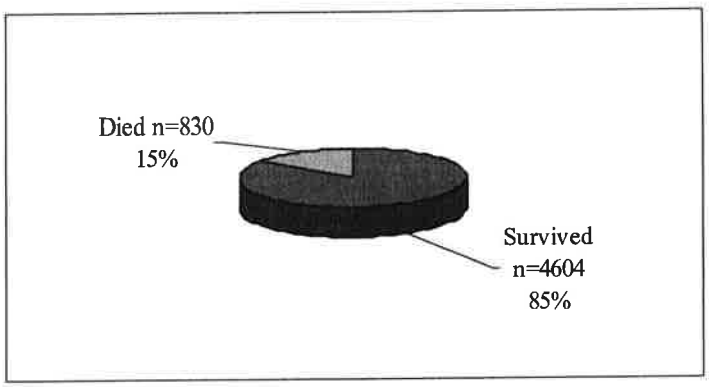

Figure 1: Outcome for major trauma patients with ISS>15 (n=5434)

3.2 Demographic Details

Male and female injury rates differ, with males (75%) being over-represented in this sample when compared with females (25%) (Table 1). However, when outcomes within each group were examined the survival rates were very similar with 82% of females (Figure 2) and 86% of males (Figure 3) surviving their injuries. The greatest number of injured patients was within the young adult age groups with the 15–24 years age group representing 23% and the 25–34 years age group representing 18% of total hospital admissions (Table 2). However, the death rate within each age category was higher for the older groups with rates increasing from the 45–54 years age group. The 85+ years age group recorded the highest death rate (35.7%) (Figure 4).

Table 1: Gender distribution of major injury (ISS>15)

	Number of patients*	% Total
Female	1370	25.37
Male	4031	74.63
Total	**5401**	**100.00**

* Missing data n=37

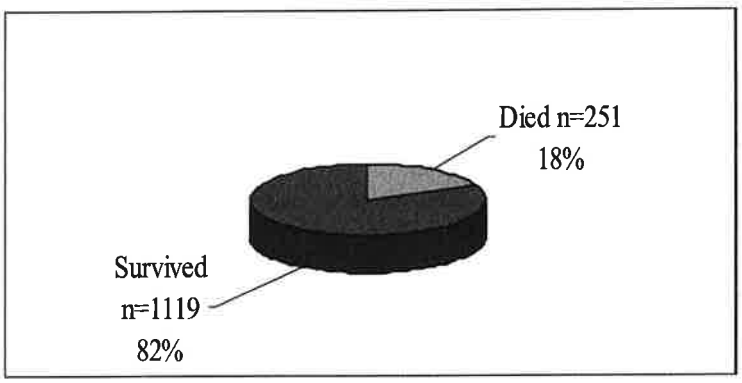

Figure 2: Female patients by outcome (n=1370)

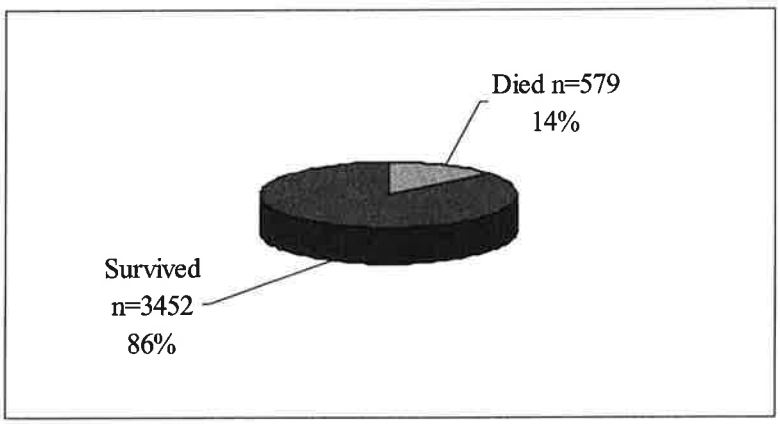

Figure 3: Male patients by outcome (n=4031)

Table 2: Mortality by age group, including number of patients who died expressed as a percentage of age group

Age Range	No. Patients*	% Total	No. Patients died	Deaths as % Age Total
0 to 4	135	2.49	18	13.33
5 to 14	260	4.79	27	10.38
15 to 24	1248	23.00	164	13.14
25 to 34	980	18.06	121	12.36
35 to 44	786	14.49	92	11.72
45 to 54	595	10.97	76	12.79
55 to 64	464	8.55	77	16.59
65 to 74	370	6.84	75	20.27
75 to 84	394	7.26	111	28.24
85+	193	3.56	66	35.68
Total	**5413**	**100.00**	**827**	**15.28**

*Missing data n=25

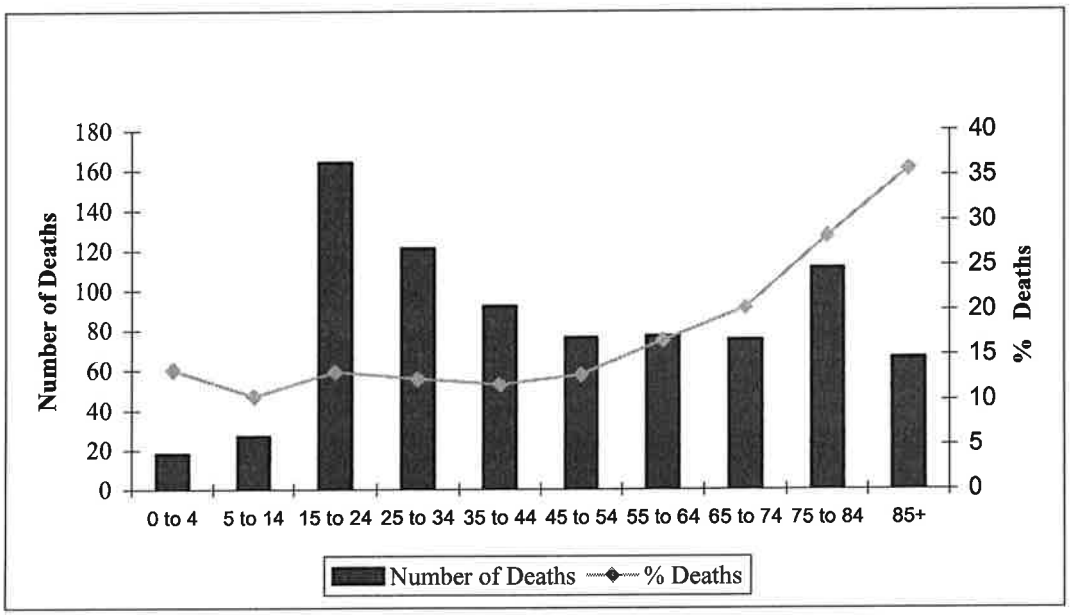

Figure 4: Number of deaths per age group, also shown as percentage of age group (n=827)

3.3 External Causes

Specific external causes of major injury were recorded for a total of 5437 patients (Table 3). Road traffic crashes accounted for over half of all major injuries (52%; n=2849) while falls (n=1331) and the remaining external cause categories combined (n=1257) accounted for 24% and 22% of injury admissions respectively (Figure 5).

Table 3: External causes of injury and survival outcomes

Mechanisms of Injury (External Cause)	Survived	Died	Total No. Patients
Animals	67	2	69
Burns	126	33	159
Compromise to Breathing	27	18	45
Collisions	430	54	485[a]
Cutting, Piercing Object	183	65	248
Falls	1097	233	1331[b]
Road Trauma	2461	388	2849
Other	211	37	251[c]
Total	**4602**	**830**	**5437**[d]

a. Missing data n=1; b. Missing data n=1; c. Missing data n=3; d. Missing data n=1.

Outcome results in relation to external causes of injury categories need to be evaluated with caution (Figure 6). Deaths (n=388) caused by road traffic crashes are under represented in this sample when compared with actual road fatalities (n=1715) recorded in 2002 in Australia alone[6]. This is because pre-hospital deaths data are excluded from trauma registries. Similarly deaths recorded in each of the other external cause categories may also be less than the actual number of deaths that occurred.

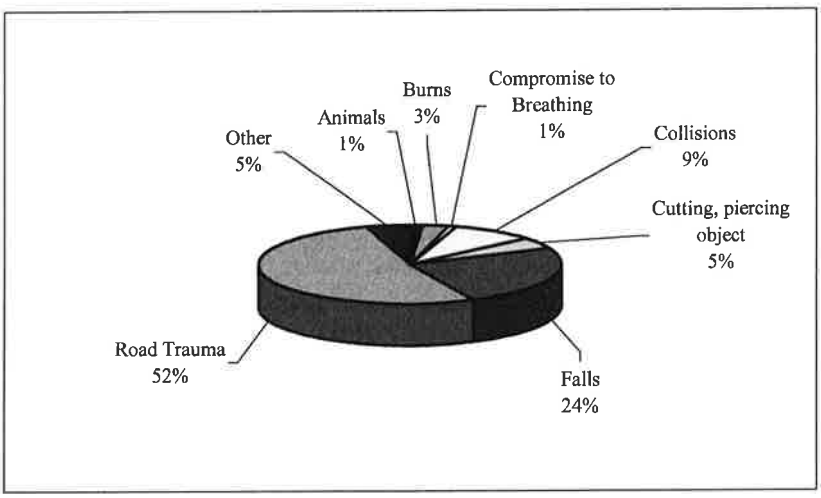

Figure 5: Percentage of external cause of injury incidents (n=5437)

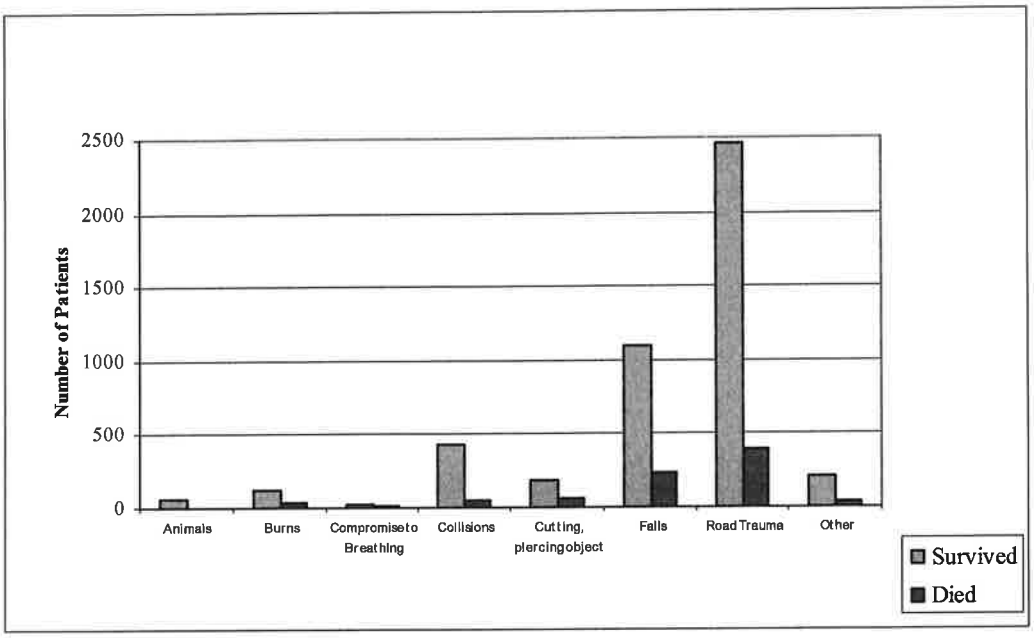

Figure 6: Patient outcome by external cause of injury (n=5437)

Motor vehicle drivers (n=1076) accounted for more road crash injury admissions (38%) than motor vehicle passengers (19%), motor bike drivers (18%) and pedestrians (16%) (Table 4). However, when deaths within each road trauma external cause category are expressed as a percentage of the total hospital admissions for the particular external cause category, the results revealed pedestrians recorded the highest death rate (28%) followed by motor vehicle drivers (16%). In addition, motor vehicle passengers, motor bike drivers, pillion passengers and cyclists recorded very similar death rates (approximately 11% per category) (Figure 7).

Table 4: Mechanism of injury road traffic crashes

Mechanisms of Injury	Survived	Died	Total No. Patients*	% Total Patients
Motor Vehicle Driver	926	148	1076	38.05
Motor Vehicle Passenger	485	57	539	19.06
Motor Bike Driver	464	48	510	18.03
Motor Bike Pillion	26	3	29	1.03
Pedal cyclists	160	19	179	6.33
Pedestrians	362	102	467	16.51
Other	18	8	26	0.92
Motor Bike crashes unknown	2	0	2	0.07
Total	**2443**	**385**	**2828**	**100.00**

* Missing data n=21

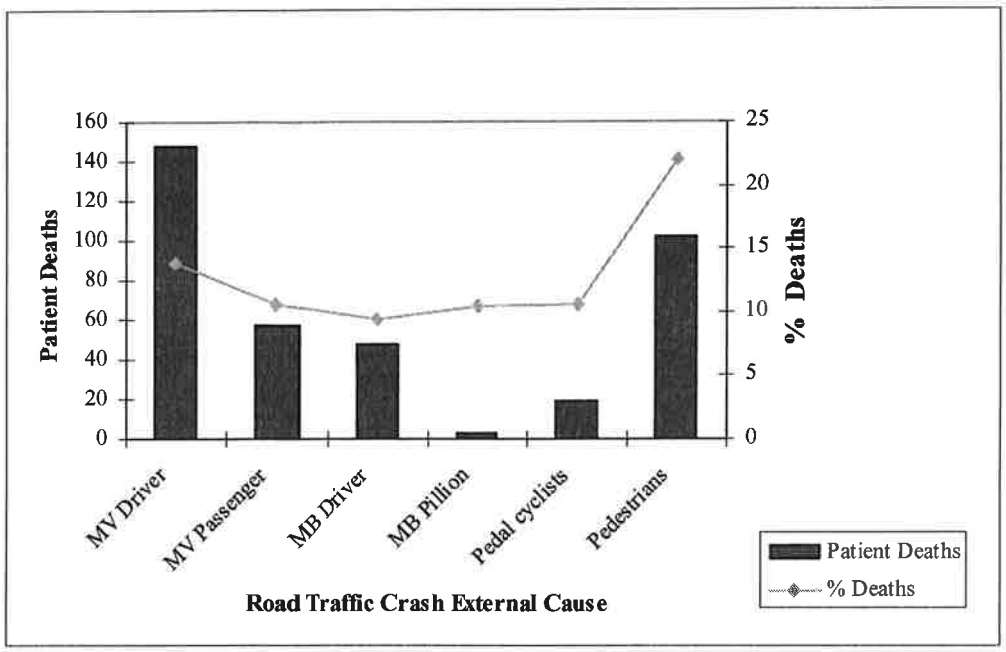

Figure 7: Number of deaths per road traffic crashes, also shown as percentage of road traffic crashes (n=2828)

3.4 Injury Severity Score

The distribution of ISS in this sample of Australian and New Zealand major injury data shows the lowest grouping of injury severity comprised the majority of recorded injuries (Table 5) while the greatest number of deaths was recorded in the highest injury severity category (Figure 8).

Table 5: Injury Severity Score (ISS)

ISS Range	No. Patients*	% Total
16 to 24	2976	55.44
25 to 40	1963	35.78
41 to 75	476	8.78
Total	**5415**	**100.00**

* Missing data n=23

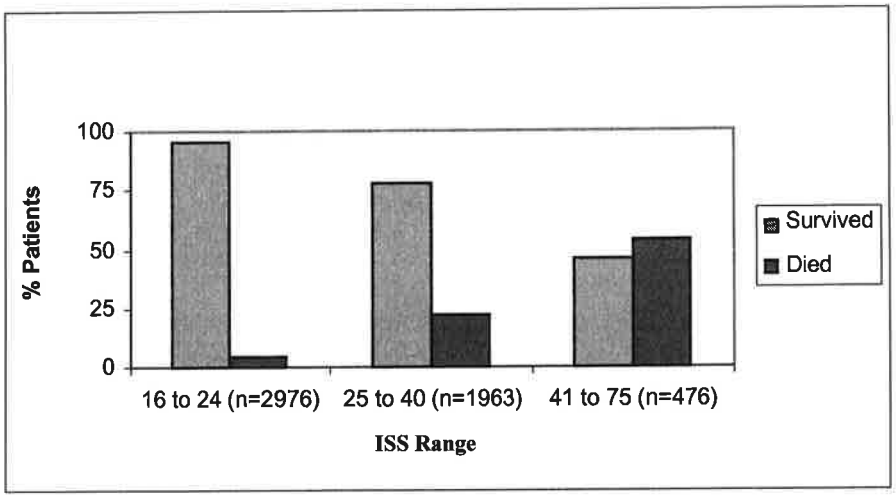

Figure 8: Patient outcome by ISS range (n=5415)

3.5 Timing of Injuries

Frequency of major injuries occurred evenly across Monday to Thursday with an increase of injuries recorded during weekends, particularly Saturdays (19%) (Table 6).

Table 6: Day of injury occurrence

Day of Week	No. Patients*	% Total
Sunday	867	16.00
Monday	642	11.94
Tuesday	683	12.59
Wednesday	660	12.26
Thursday	695	12.83
Friday	845	15.60
Saturday	1007	18.77
Total	**5399**	**100.00**

* Missing data n=39

3.6 Patient Management

3.6.1 Arrival Mode and Outcome

As expected the vast majority of seriously injured patients (62%) were transported to hospital by road ambulance, followed by helicopter (12%), fixed wing aircraft (11%) and private means (5%) (Table 7). Survival rates for each mode of transport were very similar (approximately 85%) except for those patients who arrived via private means (approximately 92%).

Table 7: Total number of patients by arrival mode and outcome

Arrival Mode	Survived	Died	Total*
Helicopter	585	77	661
Fixed Wing	447	84	560
Road Ambulance	2712	517	3243
Private	219	20	239
Other/Unknown/NA	423	111	524

* Missing data n=213

3.6.2 Admission Type and Outcome

Sixty-one percent of patients with major injuries (ISS>15%) were transported to hospital where they received their definitive care directly from the scene of injury while 39% of patients were transferred from referral hospitals (Figure 9). Of those patients transferred directly from the scene 18% (n=578) did not survive to hospital discharge and 11% (n=232) of patients transferred from referral hospitals did not survive to discharge (Table 8).

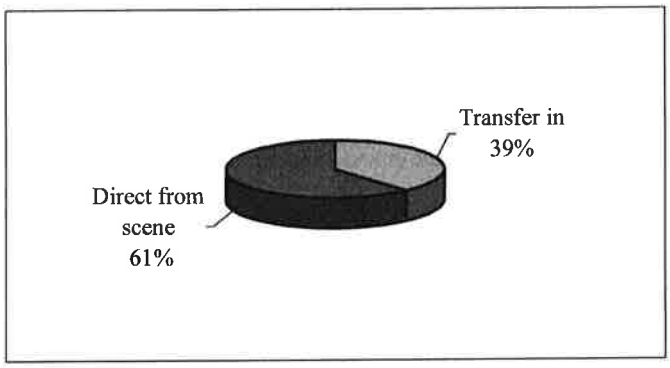

Figure 9: Percentage of patients by type of admission (n=5306)

Table 8: Outcome by admission type

Admission Type	Total Number[a]	Survived Number	Survived %	Died Number	Died %
Transfer In[b]	2033	1801	88.59	232	11.41
Direct From Scene	3273	2695	82.34	578	17.66
TOTAL	**5306**	**4496**		**810**	

a. Missing data n=132; b. Missing data n=37.

3.6.3 Total Length of Stay and Outcome

Patients with major injuries (ISS>15) were hospitalised on average for 16 days but the type of admission to the treating hospital made no difference to length of stay (LOS) (Table 9). However, patients who survived to hospital discharge remained in hospital an average of 18 days while those patients who did not survive spent an average of only six days in hospital (Figure 10).

Table 9: Total length of hospital stay (LOS) in days and outcome

LOS	All	Survived	Died
Overall Average LOS	16.2	18.1	6.0
Direct Admission Average LOS	15.7	17.8	5.7
Transfer In Admission Average LOS	17.2	18.6	6.8

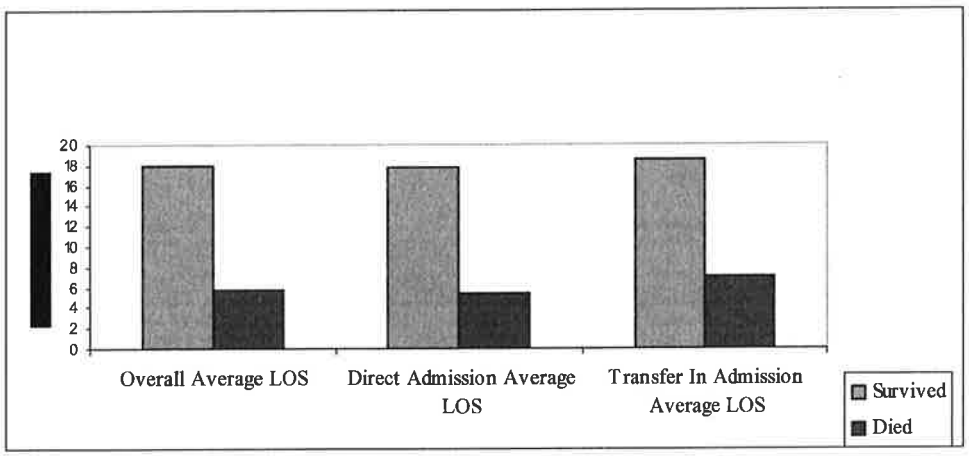

Figure 10: Average length of hospital stay (LOS) in days and outcome by admission (n=5306)

3.6.4 Intensive Care Unit

Fifty-one percent (n=2821) of the total number of patients admitted to hospital with major injuries (ISS>15) were admitted to an intensive care unit (ICU). Of this number 16% (n=461) did not survive to hospital discharge. Similarly 14% (n=369) of the total number of patients (n=2606) admitted to hospital but not admitted to ICU did not survive to hospital discharge (Figure 11). Patients remained an average of six days in ICU (Table 10).

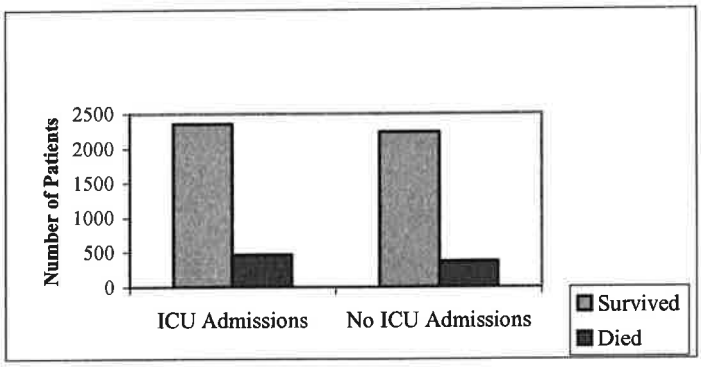

Figure 11: Outcome by admission or no admission to ICU following hospital admission (n=5427; missing data n=11)

Table 10: Average length of stay in ICU (days) and outcome

	All	Survived	Died
Number of patients	2821	2360	461
Average LOS	5.82	6.06	5.04

3.6.5 Operating Procedures

A subset of participating trauma registries provided data on three common surgical procedures performed on patients following major traumatic injuries. Information regarding operating procedures is important for the planning and management of operating theatre resources. However these figures need to be interpreted with caution as the data is limited, for example, some trauma registries provided data for operating procedures performed only during the first 24 hours after hospital admission while others included all time points to discharge.

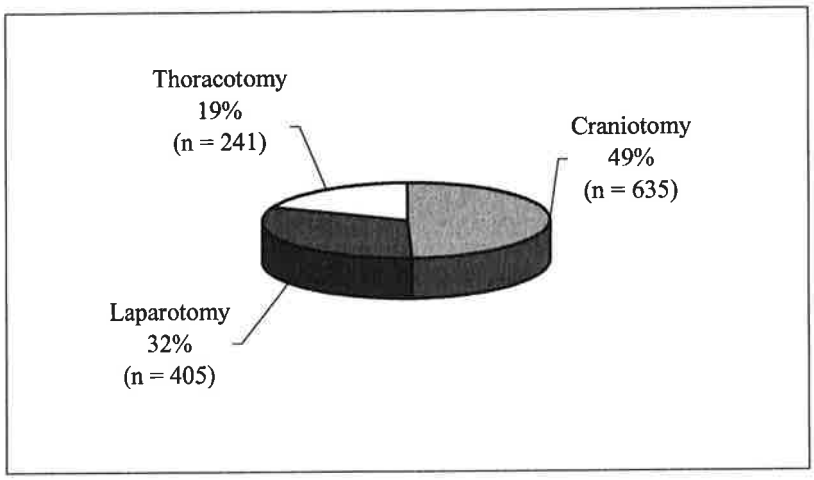

Figure 12: Surgical procedures recorded for a subset of patients (n=1281)

4. Conclusions

The primary purpose of this first national report was to describe the incidence and injury characteristics of major trauma patients within Australia and New Zealand. All trauma registries operating in Australia and New Zealand provided de-identified aggregate data for inclusion in the report; however, it is important to note that the results presented here do not represent the full extent of major trauma within Australia and New Zealand. The previous results section, limited because of the level of data analysis possible, provides an incomplete overview of the extensive burden that major traumatic injuries place on communities within both countries. Nevertheless the significance of this report should not be under estimated in terms of the outstanding achievement it represents in heralding a new national approach to major trauma monitoring.

Another aim of the project was to explore and identify the strengths and barriers to developing a formal National Trauma Registry. One of the most important strengths identified across the trauma registries was the willingness of participating members to negotiate and collaborate with the Consortium. Participants widely support the development of a national approach to quality trauma data collection. In addition the level of expertise within the participating trauma registries was clearly identified and it is anticipated that this factor will significantly enhance the development of a National Trauma Registry.

A number of noteworthy benefits for establishing an ongoing National Trauma Registry were also identified during the project. They included the opportunity to inform national and state policy on trauma management and planning so as to improve patient care, the possibility of developing a national quality assurance standard for trauma care, the ability to improve patient outcomes through collaborative research projects involving large data sets, professional support for resource poor trauma registries and the collective strength and mutual benefits of being part of a national approach.

The production of this report has identified a number of problems with data collection including the ethical issues governing data collection, the limitations of obtaining aggregate level data, the differing inclusion criteria used by trauma registries within Australia and New Zealand and the design of the report protocols. These problems will be addressed in the coming year with negotiations progressing for the collection of de-identified primary data, the development of a national data dictionary to support the minimal data set and the design of software to better manage data collection and security concerns.

At the present time a significant barrier to the future success of the project is the lack of funding available to support the initiative. The resolution of this aspect of the project's development is an urgent priority. A number of practical barriers were also identified during the process although none of them are considered to be insurmountable problems. They included difficulties with (a) incorporating the different definitional rules governing data inclusion at the local trauma registry level so as to obtain meaningful national data, (b) integrating varying definitions and descriptions for external causes of injury, (c) interpreting results because of the restricted analysis of aggregate data, and (d) integrating the various data software packages used by individual trauma registries to facilitate national data collection.

This report demonstrates that it is possible to successfully achieve a national approach to major trauma monitoring. As the National Trauma Registry evolves it will become an essential tool in assisting with the improvement of trauma systems within Australia and New Zealand thereby ensuring enhanced patient outcomes.

5. Recommendations

This report is the first step in the development of a National Trauma Registry (Australia and New Zealand). To ensure the successful development of the next phase of the project and that the data produced at a national level adheres to the highest standards of excellence, the achievement of the following gaols and objectives is recommended.

Goals

1. Successfully establish the National Trauma Registry in order to improve major trauma patient care within Australia and New Zealand
2. Achieve a high standard of collaborative trauma research at a national and international level.

Process Objectives

Data

- Obtain database & software capable of integrating primary data from all Registries
- Continue with de-identified aggregate data transfer and progress towards the implementation of de-identified primary data transfer
- Investigate and implement measures to ensure adequate data protection and security

Governance

- Implement governance procedures to clarify relationships between and within the Consortium membership

Funding

- Obtain funding to support NTRC (Australia & NZ) activities

Stakeholder Relationships

- Continue building collaborative relationships with stakeholders & key contacts within the national & international community

Quality

- Address quality assurance issues

Outcome Objectives

- Define common data fields for the minimum data set
- Compile a national data dictionary to govern national data collection
- Develop a business case for recurrent funding
- Establish a research agenda based on the National Trauma Registry Data
- Disseminate the results of collected data to inform clinical practitioners and policy makers
- Implement benchmarking procedures
- Obtain funding to support research activities
- Address outstanding ethical issues
- Develop policy and procedures for access to data by external bodies and individuals

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