The cost and compensability of trauma patients

Kate Curtis, Cara Dickson, Deborah Black and Thomas Nau

Abstract

Injury in Australia was responsible for 400 000 hospitalisations in 2002. This study aimed to examine the direct costs of trauma patients in a Level 1 trauma centre and determine the compensability of those patients. Data on all admitted patients (206) filling trauma criteria were collected prospectively over a 3-month period (November 2006 to January 2007). A 10-question survey was completed on each patient to record mechanism of injury, third party private health insurance or workers compensation, and direct costs were also obtained. 30% of trauma admissions had an injury severity score (ISS)>15 ($n=62$; median ISS=9; range, 1–56). Median length of stay was 3 days (range, 1–126). Almost half (47%) of the patients were involved in road trauma, and 29% in falls. More than half (53.4%) were eligible for compensation (21.8% of patients had full hospital health insurance cover, 21.4% third party insurance and 9.2% workers compensation). The mechanism of injury with the highest median cost per patient was assault, followed by pedal cyclists, pedestrians then motor vehicle collisions.

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What is known about the topic?

Major injury typically results from motor vehicle collisions, falls, assaults or other blunt or penetrating forces. Patients usually require hospital admission and access to specialised resources, and a degree of short or long-term functional disability may result.

What does this paper add?

For the first time in Australia, this paper provides a description of direct cost and compensability of trauma patients in a Level 1 trauma centre.

What are the implications for practitioners?

More accurate and timely patient compensability status determination may occur if relevant financial personnel liaise with the trauma service or use the data collected by the trauma service. The trauma service has accurate information regarding the patient as they interact daily with the trauma patient as a matter of course. Initial investigation suggests the actual costs incurred by the hospital for trauma patients are adequately described by the trauma patient episode.

TRAUMA OR INJURY refers to patients who have sustained minor injuries that can be quickly treated at local emergency services, through to moderate and severe trauma that requires hospital admission and access to specialised resources. The patient often experiences a degree of short or long-term functional disability. Major injury typically results from motor vehicle collisions (MVCs), falls, assaults or other blunt or penetrating forces.[1] For the purposes of this paper, the trauma patient is an injured person who requires timely diagnosis and treatment of actual or potential injuries by a multidisciplinary team of health care professionals, supported by the appropriate resources, to diminish or eliminate the risk of death or permanent disability.

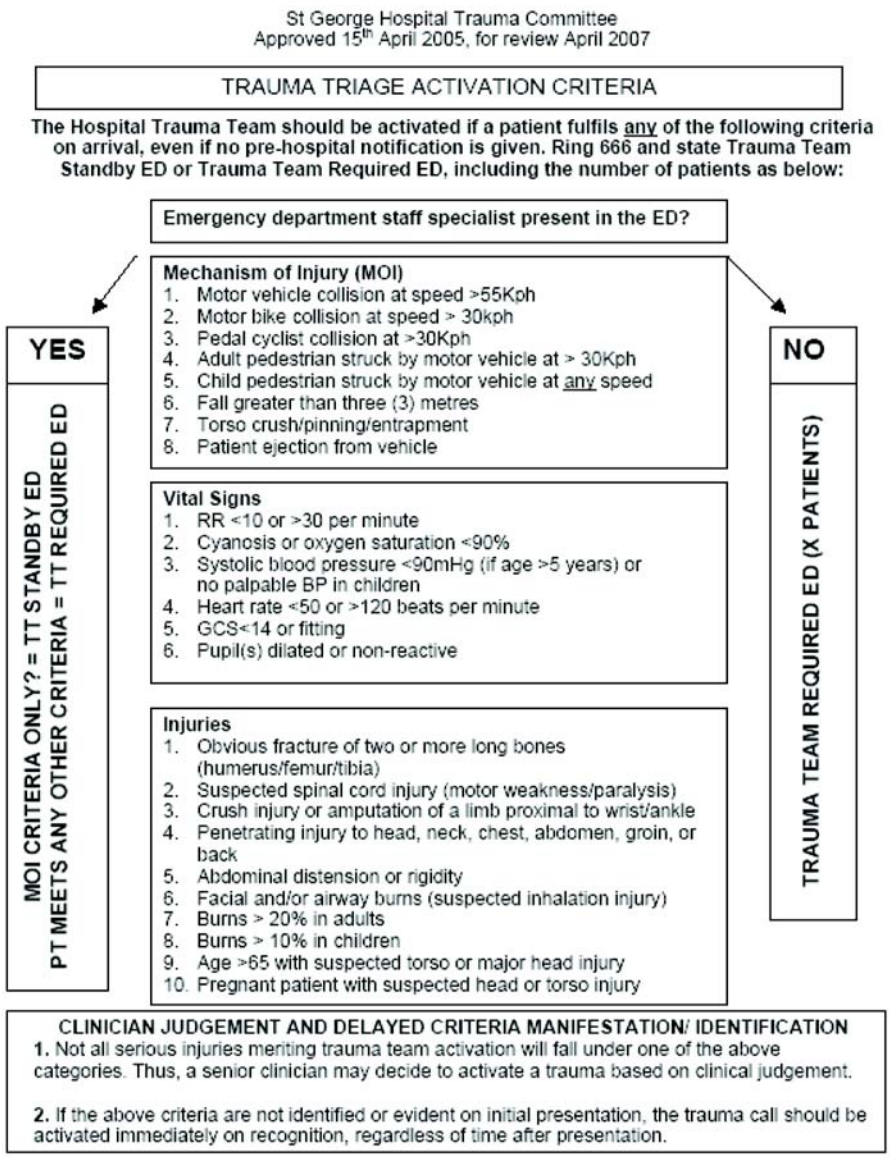
Injury represents the leading cause of death in those less than 45 years of age in Australia and New Zealand[2] and was responsible for 400 000 hospitalisations in 2002.[3] In 2004 inpatient health system costs due to injury were $4.1 billion per annum or around 8.3% of total recurrent health expenditure.[4] Of these hospital admissions, 5837 patients were reported to have an Injury Severity Score (ISS) of greater than 15.[2] This equates to severe and critical injury. Persons aged from 15 to 24 years are more frequently seriously injured than any other age group. Road

Kate Curtis, PhD, Clinical Associate Professor, Faculty of Nursing, University of Sydney; and Trauma Nurse Consultant
Cara Dickson, BSc(Hons), Performance Analyst, Casemix Unit
Thomas Nau, MB BS, Director of Trauma
St George Hospital, Sydney, NSW.

Deborah Black, PhD, Associate Professor
Faculty of Health Sciences, University of Sydney, Sydney, NSW.

Correspondence: Clinical A/Prof Kate Curtis, St George Hospital, Gray St, Kogarah, Sydney, NSW 2217.
kate.curtis@sesiahs.health.nsw.gov.au

1 Trauma call criteria



ED = emergency department. TT = trauma team. MOI = mechanism of injury.

traffic crashes account for 54% of serious injuries, and, of this category, pedestrians are the most likely to die (21%).[2] In Australia and New Zealand 85%–90% of all major trauma is blunt (for example, road traffic crashes, falls, sporting injury) with about 5%–7% penetrating trauma (for example, stabbings or firearm injury) and 5%–6% burns.[5]

A system for trauma care was first proposed in New South Wales in 1988, and since then similar systems have developed throughout Australia.[6] The aim of a trauma system is to facilitate treat-

2 Sex, ISS and mechanism of injury of study group (n=206)

Characteristic	Frequency (%)
Male	152 (73.8%)
ISS < 9	102 (49.5%)
ISS 9–15	42 (20.4%)
ISS > 15	62 (30.1%)
MVC Driver	48 (23.3%)
MVC Passenger	20 (9.7%)
Motor bike crash	16 (7.8%)
Pedestrian	13 (6.3%)
Pedal cyclist	9 (4.4%)
Assault/stabbing/gunshot wounds	17 (8.3%)
Fall < 1m	24 (11.7%)
Fall 1–5m	31 (15%)
Fall > 5m	5 (2.4%)
Sporting	14 (6.8%)
Burns	5 (2.4%)

ISS = injury severity score. MVC = motor vehicle collision.

ment of injured patients at the right hospital or centre, that is, a hospital with the appropriate level of resources, thus resulting in optimal care for all trauma patients. Currently there are four types of trauma centres/services in NSW: major, regional, urban and rural. The major trauma centres are tertiary care facilities, which provide all clinical specialties including trauma rehabilitation services. The major trauma service is also required to demonstrate leadership in trauma education, research, trauma training (locally and in surrounding smaller hospitals) and injury prevention in the community. Patients presenting to rural or urban centres are generally transferred to a major service. (For more information on the NSW trauma system please visit the NSW Institute of Trauma and Injury Management 2006 website at www.itim.nsw.gov.au.)

When in hospital, trauma patients require extensive resource use, often for extended periods of time. The National Trauma Registry Consortium reports that almost 50% of patients with an ISS > 15 are admitted to intensive care for an average of 7 days. The average length of hospital stay for this cohort of seriously injured patients varies from 17 to 18 days, depending on whether the trauma patients were transferred from another hospital or directly from the scene.[4]

In NSW, insurers receive about 15 000 claims each year, which means that about 60% of people who have been injured in an MVC make a claim. Compensation for severe spinal cord injury is the most costly injury group, representing 0.2% of claims and 5% of claim costs. Forty per cent of claims include a claim for whiplash, and account for 28% of total claim costs.[7]

The direct cost of the major trauma patient to the treating hospital has not been previously described in Australasia. This study aims to examine the economic cost of trauma patients in a Level 1 trauma centre and consider the potential sources of financial remuneration for those patients. We propose that if trauma care providers sought payment from insurers, the payments received may cover the costs of the services provided. It is acknowledged that throughout Australia trauma funding methods vary, and discussion of these is beyond the scope of this paper.

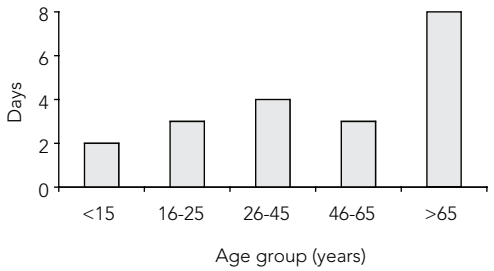
Methods

Patient identification

There were two aspects to the methods of this research (i) computing an estimate of the economic costs of the resources used to treat traumatic injuries in our trauma centre and (ii) considering the various sources of remuneration of those costs.

Data on all admitted patients (n = 206) filling trauma criteria (Box 1) were collected prospectively over a 3-month period (November 2006 to January 2007). Patients were identified by the duty trauma case managers, who are rostered 7 days a week. The case manager assessed every patient admission to the Emergency Department for suitability for inclusion. To identify any inter-hospital transfer patients, the case manager communicated daily with the nurse in charge of each ward.

3 Median length of stay by age group



Once the patient was identified, a 10-question survey was conducted by the duty case manager during the course of their daily patient round and medical record review. Information not documented in the patient record was obtained by asking either the patient, their family, the police attending the Emergency Department or the hospital patient liaison officer. The survey collected data to assist in determining the patients' financial status. This information included mechanism of injury, third party claim potential, private health insurance or workers compensation. If the information could not be obtained, or fault was unable to be determined during the patient's admission, it was noted on the survey and the patient was allocated to the non-compensable category. In addition, basic patient demographic data and injury severity were obtained.

The compensability sources were allocated as follows: a) 3rd party insurance if the patient was in a road accident and deemed not at fault. This was straightforward if the patient was a passenger. However, if the patient was intoxicated, involved in a single vehicle collision, indicated to be at fault by the police attending the ED or circumstances were unclear, this category was not allocated; b) Private insurance if they had full hospital cover; c) Workers compensation if the injury occurred at or on route to work and the patient was not self-employed without insurance; d) Department of Veterans' Affairs (DVA) if the patient was in possession of a "gold DVA card"; e) Medicare if they did not fill any of the above categories. If the patient had more than one potentially compensable source, the source most likely to be used by the hospital was allocated. For example, if the patient had full private health insurance they were allocated into that category.

Casemix costings

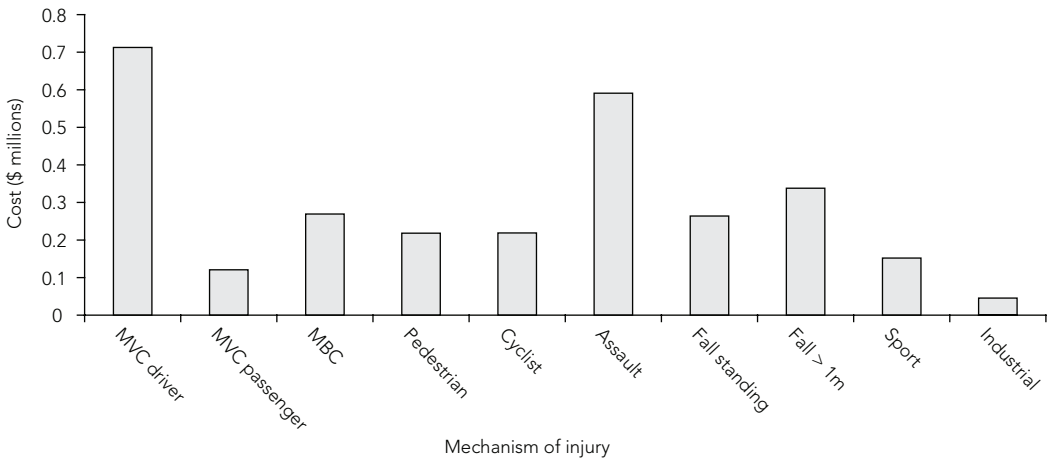
The list of patient medical record numbers was sent to the casemix unit to obtain further financial information in order to calculate the cost of each patient's admission. Patient costing was conducted in accordance with 2006–2007 NSW Program and Product Data Collection (PPDC) Standards.[8]

The costing tool used was Trendstar Decision Support System, which employs both clinical costing and cost modelling methodologies in the cost allocation process. The system has two main components — financial and clinical. Financial information was extracted from the hospital's general ledger. Cost centres need to be identified as either overhead or patient care cost centres (PCCCs). Suitable overhead allocation statistics need to be selected for each overhead cost centre, in accordance with guidelines in the NSW PPDC. Examples of overhead statistics include staffing full-time equivalents, weighted floor space and weighted sterile supply items. Overhead costs need to be allocated to PCCCs and ultimately to the patients utilising the resources of that PCCC. Inpatient fractions are required for each PCCC where total patient utilisation is not available.

The clinical information in Trendstar is based on patient data from the hospital patient administration system, which is accessed via an interface with the Health Information Exchange (HIE). The HIE is NSW Health's network of corporate data warehouses and acts as a repository for a number of data collections. The additional clinical information, such as theatre, prostheses, pharmacy and allied health, is sourced from a variety of interfaced, non-interfaced and paper-based systems.

There are no national standards for auditing clinical coding, and no statewide audit was performed on New South Wales data in 2005–06. NSW hospitals perform formal audits on ICD-10-AM coded data at a local level. Data edits are monitored regularly and consistent errors are

4 Total cost per mechanism of injury



MVC = motor vehicle collision. MBC = motor bike crash.

identified and rectified by individual hospitals.[11] At the study institution, trauma coding is undertaken with the assistance of the trauma database. The trauma database contains data obtained by trauma case managers on their daily rounds and is edited and maintained by a dedicated data manager. This was instigated to improve the accuracy of coding complex trauma patients.[9]

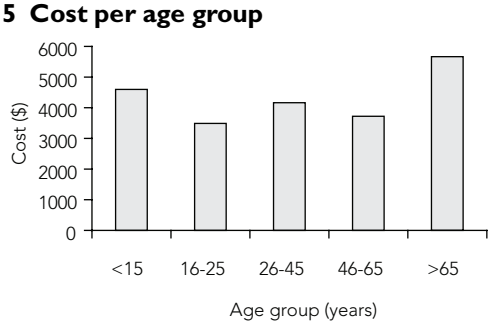
Analysis

The patients' injury severity was coded using the Abbreviated Injury Scale (AIS), the most widely used anatomic injury severity scale in the world.[10] It is used in epidemiological research, trauma centre studies predicting survival probability, patient outcome evaluation and health care systems research. To determine a patient's ISS, the coder allocates a code and score to each of the patient's injuries. The higher the AIS score allocated, the more serious the injury.[10] Patients were grouped according to their ISS in an effort to place patients with similar severity of injury for comparison. An ISS greater than 15 was chosen as the accepted standard of severe injury. An ISS of 9–15 was considered moderate to serious, and less than 9 minor to moderate.[11-13]

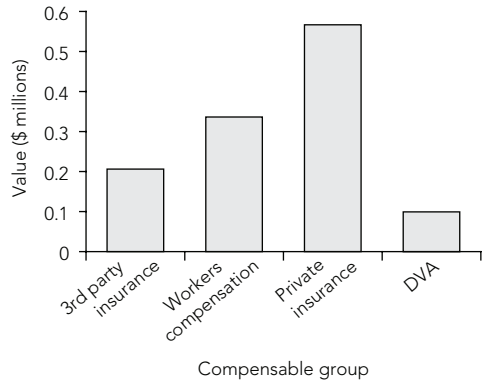
The New Injury Severity Score (NISS) — a simplified variation of the ISS — often increases the apparent severity of injury and provides a more accurate prediction of short-term mortality. However, the ISS remains the most widely used injury severity scoring system, largely because an alternate method has not been found that both increases the accuracy of mortality predication and justifies an industry-wide switch to a new system.[14]

Each patient was allocated a unique identifier to allow de-identification. The two datasets were combined, entered into and analysed with SPSS, version 15 (SPSS Inc, Chicago, Ill, USA). Descriptive statistics were performed on each patient demographic element. Univariate analyses including Spearman's correlations were per-

5 Cost per age group



6 Compensable amount per group



DVA = Department of Veterans' Affairs

formed to evaluate relationships between variants. A 95% confidence interval was used to determine significance.

Results

Patient demographics and injury severity

Males comprised 73.8% of patients; the median age was 40.5 years (range, 0–92 years). The median ISS was 8.5 (range, 1–57). 49.5% of patients had an ISS < 9, 20.4% an ISS of 9–15 and 30.1% an ISS > 15. 48.5% of patients were involved in an MVC either as an occupant of a vehicle, pedestrian or pedal cyclist (Box 2).

The median length of stay (LOS) was 3 days (range 1–126 days). There was some correlation between age of the patient and LOS ($P = 0.01$, Spearman's correlation, 0.285) (Box 3). The median LOS increased significantly with the patient's age ($P = 0.01$). This was reflected in the trend towards increased cost in the age > 65 years age group although this was not statistically significant.

Cost of the trauma patient

The total direct cost for trauma patients in the 3-month study period was $3 020 741. The distribution of cost by mechanism of injury is demonstrated in Box 4. Road injury had the greatest overall cost, but on sub-group analysis, the highest individual median cost was the assault mechanism of injury, followed by MVC passengers, and falls. These patients generally had a longer LOS, although correlations did not find this significant. The median patient cost increased with age and injury severity, but this was not statistically significant (Box 5).

Compensability of the trauma patient

Over half of the cost of the trauma patients in the study period was potentially compensable ($1 600 038). The compensable group representing the highest proportion of patients was the privately insured group, followed by those eligible for workers compensation (Box 6). As expected, there was a significant correlation between the mechanism of injury (MOI) of road trauma and compensability. There was no correlation between compensability and age or other MOI. The potential compensability of the patient was spread evenly across the age groups.

Discussion

The implementation of a trauma system, and thus "trauma centres" is well accepted and indisputably demonstrates improved patient outcomes.[15] Trauma systems are required to provide an organised and coordinated response to injury.[15-18] A standardised trauma management environment provides the potential to ensure effective and coordinated trauma team response (trauma call-out), and defined roles for trauma team members with shared priorities in trauma management. Trauma systems also support evidence-based interventions through trauma clinical practice guidelines, standard timeframes for trauma management (according to resource availability) and a systems approach to managing trauma that extends beyond the primary and secondary surveys.[19]

Health care systems in prosperous societies like Australia deliver increasingly expensive treatment and have an ageing hospital population dominated by chronic disease conditions.[20] Studies conducted in relation to the costing of various

health care services in Australia do not specifically include or describe trauma. However, the financial sustainability of trauma services is of concern. A number of the published articles relating to the financial survival of trauma centres in the United States report that cost recovery is a major problem, primarily because third party reimbursement meets only 40%–60% of the costs of patient care.[21-23] In addition, the diagnosis-related group (DRG) method of describing complex trauma patients' injuries is insufficient and underestimates the true cost of the patients' treatment requirements.[24-26] Furthermore, as has been highlighted by this study, the cost of trauma care for elderly patients will continue to rise with the proportional increase in the ageing population[27-30] — particularly as, by 2020, 18% of the population will be over 65. This has serious implications for trauma. From the age of 60, the rate of injury-related presentation to hospital steadily increases, and in the 85 + age group, the rate of hospital separation for injury is 680% greater than the 45–49-year age group.[31]

This study highlights the need for adequate funding allocation and activity prediction in relation to trauma. Cost containment and effective financial management has become increasingly important for hospitals in recent years.[32-34] Most services seem to be targeted for financial scrutiny and pressured to reduce patient load or improve patient management. These realities have presented continuing challenges to administration and management of a trauma service. As a result, some trauma services have taken the lead in efforts of cost containment and re-engineered support systems. Strategies such as trauma case management,[13] clinical pathways,[35] multidisciplinary rounds[36] and clinical coding auditing[9] have been shown to minimise resource use and improve the efficacy of trauma patient care.

Patient age

In our study, the median LOS increased significantly with the patient's age. This was reflected in the trend towards increased cost in the > 65-years age group and is supported by current literature. Compared with younger patients, the elderly have greater morbidity and mortality, and incur higher costs by using disproportionately more health services, including ambulances for transportation to health and aged care facilities[37,38] In addition, age has a significant influence on physiological response to trauma, and thus morbidity and mortality. Geriatric trauma is gaining increasing recognition as a sub-group requiring specialist attention.[39] People over the age of 55 have a limited ability to compensate for physiological derangements induced by traumatic injury. Loss of peripheral vision, decreased hearing and slowed reaction times increase the risk of elderly pedestrians being struck by vehicles. Polypharmacy, pre-existing illness and poorer vision in dim light predispose the elderly to falls in their home.[12,40-42]

Mechanism of injury

The MOI associated with the highest overall cost was road trauma, as it was the main cause of trauma presentations to the study hospital. This is representative of the high incidence of blunt trauma to Australian and New Zealand trauma centres.[5] Falls in the elderly are the most significant cause of hospitalisation for any aetiology in any age group. The National Injury Prevention Plan identified four priority injury aetiologies that require attention from Australian health authorities: falls in older people (65 + years) were listed as the primary concern.[31]

Compensability

The potential compensability of patients was evenly spread across the age groups. The large proportion of trauma patients that have some form of potential reimbursement should be considered and pursued by each trauma centre. The most severely injured admitted road trauma patients in NSW are now eligible for the Lifetime Care and Support Scheme (implemented for paediatrics 1 October 2006, and adults from 1 October 2007), which provides treatment, rehabilitation and attendant care for people who have a spinal cord injury, a moderate to severe brain injury, multiple amputations, serious burns or blindness from a motor accident in NSW. The

Scheme is funded by a levy collected through compulsory third party insurance.[43]

Recommendations

Most trauma centres in Australia have a comprehensive trauma database containing information regarding patients' hospital episodes and injuries. Perhaps this could be integrated with other hospital information systems to assist in determining potential workload.

On hospital admission, patients are allocated a compensable financial status by clerical staff in the Emergency Department, and once admitted to the ward, by a patient liaison officer. The reliability of this could be queried given that it is often conducted retrospectively. The trauma case manager obtains information directly from the patient and interacts with them daily. The patient liason officer liaising with the trauma service, or using data collected by the trauma service within each centre, may assist with determining a more accurate status in a timely manner.

Initial investigations into the DRG cost weight allocated to the trauma patient compared with the actual costs incurred by the hospital by the trauma patient suggest that the DRG system adequately describes the trauma patient episode. Investigation into this hypothesis is underway at the study institution.

Conclusion

This study examined the direct costs of trauma patients to a Level 1 trauma centre and determined the compensability of those patients. The majority of patients suffered blunt trauma, and there is a correlation between older age and LOS. A large proportion of trauma patients can provide income to the trauma centre. The patient's compensable status should be determined and insurance application pursued in conjunction with the trauma service.

Competing interests

The authors declare that they have no competing interests.

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