9 Data Issues

9.1 Data sources

All National Hospital Morbidity Database (NHMD) unit records containing injury diagnosis and external cause codes and separating from hospital between 1st July 2004 and 30th June 2005 were provided by the Australian Institute of Health and Welfare (AIHW). All episodes of care separating from an Australian hospital in 2004–05 were coded to the fourth edition of the Australian Modification of the International Classification of Diseases (ICD-10-AM).

Population data by age, sex and state of usual residence was also obtained from the AIHW. Rates of hospitalised injury were calculated using the estimated resident population as at 31st December 2004, the mid-point of the subject year. Rates by state of usual residence were not calculated for the small proportion of injury cases (< 0.3%) involving Australians resident in the Cocos and Keeling Islands, Christmas Island and Jervis Bay.

This report also calculated rates of injury according to the remoteness of the person's usual residence. Remoteness categories were based on the Australian Standard Geographical Classification system for remoteness, but excluded the small proportion of the population classed as residents of Migratory remoteness areas of Australia (which account for those people who are off-shore on oil rigs, drilling platforms and other structures; on board vessels in and between Australian ports; or are in transit on board long distance trains, buses and aircraft on census night, see ABS, 2004). For more information on the various remoteness classifications please refer to the AIHW publication *Rural, regional and remote health: a guide to remoteness classifications* (AIHW 2004). As 31st December estimates of the Australian population by remoteness of usual residence are not a standard ABS product, this report used the average of estimates produced for 30th June 2004 and 30th June 2005 as the denominator for rates of this type (again supplied by the AIHW).

9.2 Selection criteria

Period and scope

While it would be preferable to specify cases in terms of date of injury occurrence, such information is not available in the NHMD. Accordingly, this report was restricted to inpatient episodes that separated from hospital between 1st July 2004 and 30th June 2005 as an estimate of the number of serious injuries newly-occurring in this period.

This report included data from all hospitals that contributed to the NHMD in 2004–05. This included nearly all public and private hospitals in Australia that provide acute care services (AIHW 2006).

Inclusion criteria

This report identified injury separations on the basis of the record's principal diagnosis. Injury diagnoses are those from Chapter XIX, *Injury, poisoning and certain other consequences of external causes*, of the ICD-10-AM, codes S00–T98. Hospital separation records that contained injury codes, but not as the principal diagnosis, were excluded from the analyses in this report. The number of records of this type is shown in Table 9.1. While these episodes of care contribute to the overall burden to the hospital system due to injury (e.g. Bradley & Harrison 2007), the relationship between the injury and the main reason/condition for the episode of care is not well understood and it is considered prudent to omit these records from analysis. In some instances, however, these injuries will have been counted in case estimates on the basis of a previous episode in hospital. In other instances, the injury referred to in the record may have been incidental to the reason for admission and would not, on its own, have prompted admission.

A further selection criterion has been applied for most analyses; the exclusion of injury separations that have a mode of admission of 'transfer from another acute hospital'. This criterion facilitates the estimation of new injurious incidents. An event that results in an injury requiring inpatient hospital care may generate multiple unit records through inter-hospital transfers and subsequent readmissions. As such, the total number of hospital separations identified as being directly attributable to injury overestimates the actual number of events that provoked these hospitalisations. Hence, lacking a date of injury variable or readmission flag in the de-identified NHMD records, the number of discrete injury cases is estimated here by excluding records explicitly categorised as second or subsequent episodes of care (i.e. mode of admission is transfer from another acute hospital). This approach does not account for multiple separations generated by readmissions to hospital after the person had been discharged to their place of usual residence, but unpublished work by NISU with person-linked hospital data suggests that the effect of this is small for most injury cases.

To assess the overall burden of hospital care due to injury (i.e. length of stay), the transfer separations omitted from analyses of cases have been considered, however. While not representing additional incidents of hospitalised injury, these second and subsequent episodes of care to contribute (in some cases substantially) to the time and resources required to treat serious injury in the hospital setting. Accordingly, mean lengths of stay per injury case have been calculated as the total number of patient-days utilised by cases plus the total patient-days utilised by transfer separations, divided by the estimated number of injury cases.

Table 9.1: Selection criteria for hospitalised cases [a] due to injury and poisoning, Australia 2004–05

Selection criteria	Males	Females	Persons [b]
Community injury (principal diagnosis range S00–T75, T79), and			
• lack any external cause code	259	140	399
• have a first reported external cause code of complications of surgical & medical care [c]	949	697	1,646
• have a first reported external cause in the range V01–Y36, Y85–Y87, Y89	206,416	147,794	354,215
Total case numbers for community injury	*207,624*	*148,631*	*356,260*
Cases that do not have a principal diagnosis of community injury, but additional diagnoses codes are in range (S00–T75, T79)	33,945	38,322	72,271
Total case numbers where there is a code for community injury in the principal or additional diagnoses fields	**241,569**	**186,953**	**428,531**
Complications of surgical & medical care (principal diagnosis range T80–T88), and			
• lack any external cause code	40	38	78
• have a first reported external cause code of community injury [d]	162	131	293
• have a first reported external cause in the range Y40–T84, Y88	35,414	33,865	69,279
Total case numbers for complications of surgical & medical care	*35,616*	*34,034*	*69,650*
Cases that do not have a principal diagnosis of complications, but additional diagnoses codes are in range (T80–T88)	39,762	37,417	77,180
Total case numbers where there is a code for complications of surgical & medical care in the principal or additional diagnoses fields	**75,378**	**71,451**	**146,830**
Case numbers where principal diagnosis is in ICD-10-AM Chapter XIX but is not classified as community injury or complications of surgical & medical care (i.e. 'residual groups')			
• Adverse effects, not elsewhere classified (principal diagnosis T78)	2,145	2,434	4,579
• Other complications of trauma not elsewhere classified (principal diagnosis T89)	98	41	139
• Sequelae of injuries, poisoning and of other consequences of external causes (principal diagnosis T90–T98)	*	*	12
Total case numbers for residual groups	*2,251*	*2,479*	*4,730*
All cases with principal diagnosis in the ICD-10-AM range S00–T98	**245,491**	**185,144**	**430,640**

(a) To estimate case numbers and correct for double-counting, 32,914 separations with a mode of admission of 'transfer from another acute care hospital' were omitted here. Without this exclusion, the total numbers of separations for each class of injury diagnosis were; 384,102 for community injury, 74,626 for complications of surgical and medical care and 4,826 for the residual group of Chapter XIX injury and poisoning separations.

(b) Persons may include a small number of separations for which sex was not reported.

(c) 123 (7.5%) of these cases have one or more external cause codes of community injury (external cause of morbidity and mortality fields in the range V01–Y36).

(d) 51 (17.4%) of these cases have one or more external cause codes of complications of surgical and medical care (external cause of morbidity and mortality fields in the range Y40–Y84).

Classes of injury

As outlined in Table 9.1, this report categorises injury hospitalisations into three main groups; community injury, complications of surgical and medical care and residual injury separations.

Community injury

Community injury separations have been defined in this report as unit records with a principal diagnosis in the range S00–T75 or T79. These injuries are thought to be those sustained within the community setting; the home, the workplace, an educational institution, the street, the natural environment etc. Community injuries are further categorised into two main types; unintentional injuries (e.g. motor vehicle crashes, falls) and intentional injuries (e.g. assault, self-harm).

A total of 384,102 community injury separations were identified for the period 1st July 2004 to 30th June 2005. Less than eight per cent of these records were considered to be the second or subsequent separation in a series of admissions relating to the one injury event and excluded from our estimation of community injury incidence.

Complications of surgical and medical care

Complications of surgical and medical care have been defined in this report as unit records with a principal diagnosis in the range T80–T88. These injuries are thought to be the result of adverse events of a health intervention and include post-operative infections, complications associated with prosthetic devices, implants and grafts, and failure or rejection of transplanted organs. While injuries classed as complications of surgical and medical care provide a rudimentary measure of the incidence of adverse events related to hospital care, records with principal diagnosis codes outside the range of T80–T88 may also be related to adverse events (e.g. where external cause codes explicitly describe complications when the diagnoses codes do not). As such, the estimated incidence of adverse events related to surgical and medical care may be lower in this report than stated elsewhere (e.g. AIHW 2006).

A total of 74,626 complications of surgical and medical care separations were identified for the period 1st July 2004 to 30th June 2005. Less than seven per cent of these records were considered to be the second or subsequent separation in a series of admissions relating to the one injury event and excluded from our estimation of complications injury incidence.

There is some potential overlap between these community injury and complications of surgical and medical care cases. For example, an injurious fall sustained by a hospital inpatient can be interpreted as both a community injury (falls) and as an adverse event of surgical and medical care. In this report, such cases were assigned on the basis of the record's principal diagnosis.

Similarly, some records are ambiguous as to whether they should be treated as community injury or complications of surgical and medical care. Such records have a principal diagnosis in the community injury range and a first reported external cause code describing complications of surgical and medical care or a principal diagnosis in the complications of surgical and medical care range and a first reported external cause code indicating community injury. Again, such cases were assigned to an injury group (community or complications) on the basis of the record's principal diagnosis.

Residual groups

Hospital separations coded to T78, T89 or T90–T98 are difficult to classify into injury types and, accordingly, were excluded from the main portions of this report. A diagnosis of T78 describes 'adverse effects, not elsewhere classified' while a diagnosis of T89 describes 'other specified complications of trauma '. Diagnoses in the range T90–T98 describe various sequelae of injury and poisoning, meaning hospital care for a current condition resulting from a previous injury. Such separations have been analysed as a group in this report, and, fortunately, this group is small; only 1.0% of all injury separations in 2004–05 (n = 4,826). Most of these 'residual groups' separations (98.0%, n = 4,730) were considered to be injury cases (i.e. mode of admission was not transfer from another acute hospital).

9.3 Rate calculation

Rates of hospitalised injury were calculated per 100,000 population and standardised to the Australian population as at 30th June 2001 using the direct method. Age-specific rates were calculated in 5-year age groups to 95 years and older when counts were sufficiently large. When small counts were observed for older people, rates were instead calculated in 5-year age groups to 85 years and older.

Confidence intervals

Confidence interval calculations were based on the methods described in Berry and Harrison (2006b). Where cell values were greater or equal to 100, symmetrical 95% confidence intervals were calculated using the formula:

1.96 x age-standardised rate / square root (N)

Where cell values were less than 100, asymmetrical 95% confidence intervals were calculated using the formula:

Upper CI: Rate * upper confidence factor

Lower CI: Rate * lower confidence factor

The confidence factors were taken from page 107 of Berry and Harrison (2006b).

9.4 Small case count issues

Case counts of less than five cases are suppressed in this report to protect patient confidentiality. In some instances, case counts of less than five have been tabulated but cell values have been replace with an asterisk. In the instances where only one cell in a row or column has a count of less than five, some other cells in the same row or column have also been suppressed to prevent back-calculation. In other instances, categories with case counts of less than five have been collapsed into the relevant 'other specified' category.

Efforts have been taken to ensure that as much information remains in the tables when such suppression has had to be made.

9.5 Injury severity

This report utilises the ICD-based Injury Severity Score (ICISS) as a measure of the severity of an injury or set of injuries sustained by each person (Stephenson et al. 2003; Stephenson et al. 2004). Here, cases with an ICISS score of less than 0.941 are considered to represent a high threat to life (see Stephenson et al. 2004). This ICISS score may be interpreted as identifying cases are considered to have less than a six per cent likelihood of survival.

However, when compared to an observed measure, such as the proportion of patients within a predefined group who survive to discharge from hospital, ICISS, in many instances, significantly overestimates mortality. This is largely because the survival rate ratios (SRRs) that underpin the ICISS were calculated using a subset of records that excluded cases where patients were discharged on the same day as their admission, unless discharge was due to death (Stephenson et al. 2003). This exclusion of same-day cases removed a number of low severity cases from the dataset and resulted in a higher estimate of the proportion of cases leading to death. Additionally, the ICISS method, which utilises all injury diagnoses within a record, often assigns a SRR value of less than 1 to injuries which, on their own, would rarely result in death.

Despite these limitations, ICISS serves the intended function of providing a relative measure of threat to life of various injury diagnoses.