1 Introduction

Injury is an internationally recognised public health problem affecting all age groups. Across Australia, injuries account for approximately 7800 deaths annually (Schmertmann and Williamson, 2002). In 1998, 33% of all Australian injury deaths occurred in New South Wales (Schmertmann and Williamson, 2002).

This report presents a demographic profile of injury mortality in NSW using currently available data. Injury mortality data were obtained from the Australian Bureau of Statistics and all injury mechanisms that resulted in more than 20 deaths during 1998–2002 were analysed. Both unintentional and intentional injury mechanisms were included.

Recommendations for improvements in data collection and directions for future research are also included in Section 19. These findings will be used to update current injury death statistics and identify target areas for further research.

1.1 DEFINITIONS

The following sections present the case definitions of injury, injury death and injury mechanism used in this report.

1.1.1 Injury and injury death

According to Robertson (1998), "An injury results when too much or too little energy (in the case of asphyxiation) is transferred to the human body, at rates or amounts that are above or below the tolerance of human tissues, resulting in damage". The World Health Organization (WHO) defines an injury similarly as "a bodily lesion at the organic level resulting from acute exposure to energy (this energy can be mechanical, thermal, electrical, chemical or radiant) interacting with the body in amounts or rates that exceed the threshold of physiological tolerance" (WHO Injury Report 2001).

In order to recognise the physical nature of an injury (e.g. broken leg) and the external cause of the injury (e.g. a fall), two separate sets of codes were developed by WHO for its International Classification of Diseases (ICD) coding structure (WHO 1977, WHO 1996). One set, known as diagnostic codes (Ncodes), describes the physical nature of an injury and provides important information from a clinical standpoint. The other set, known as external cause codes (Ecodes), provides important information for prevention purposes, by identifying the type of energy that caused the physical injury.

Injury mortality is defined in terms of the underlying cause of death. For this analysis, cases were included where the underlying cause of death was determined to be an external cause of injury (injury mechanism or Ecode) and the state of residence of the deceased person was NSW.

1.1.2 Injury mechanism

Injuries are usually classified in terms of their external cause and intent. An injury mechanism (represented by an Ecode) is defined as the external object or circumstance that caused the injury, such as motor vehicle transport or drowning. The intent could be unintentional, intentional or undetermined.

Injury mechanisms that are intentional are either self-inflicted or inflicted by another person or persons. All injury mechanisms that are intentionally self-inflicted are grouped together under a separate injury mechanism called suicide. For example, a poisoning that is self-inflicted would be considered suicide and would be classified separately from poisonings that had occurred unintentionally. All injury mechanisms that are intentionally inflicted by another person or persons are grouped under a separate injury mechanism called interpersonal violence. Death caused by the intentional use of a firearm would be considered interpersonal violence and would be classified separately from unintentional firearms deaths.

Fifteen injury mechanisms are included in this report. These account for all of the injury mechanisms that resulted in more than 20 deaths during 1998–2002. They are as follows (in alphabetical order):

- air transport
- complications of care
- drowning
- falls
- fire/burns
- firearms
- interpersonal violence
- machinery
- motor vehicle transport
- natural/environmental factors
- poisonings
- rail transport
- struck by/struck against
- suffocation
- suicide.

The burn subcategory of the fire/burn mechanism group refers to injuries received from hot objects or substances and not burns sustained from a fire. The firearms injury mechanism only includes unintentional deaths due to use of a firearm. Firearms used intentionally on oneself or another person are included in the injury mechanisms of suicide and interpersonal violence respectively.

The two ICD revisions covered in this report are the ICD 9th Revision (ICD-9) and the ICD 10th Revision (ICD-10). The ICD-9 and ICD-10 Ecodes for the injury mechanisms included in this report are listed in Appendix 1.

1.2 INJURY DATA SOURCES AND CODING ISSUES

1.2.1 Mortality (numerator) data

Data were obtained for NSW for 1986–1998 from the Australian Bureau of Statistics (ABS) for all Ecoded death records. Records for these years were coded using ICD-9. All death records for 1999–2002 were also obtained from the ABS, with data being coded according to ICD-10.

Injury death records were selected and analysed according to the year of occurrence and not the year the death was registered with the ABS. Injury deaths that occurred during 1986–2002, which were not registered with the ABS, are not included in this report. Of the deaths registered in 2001, for example, 94% actually occurred in 2001, 5% occurred in 2000 and the remaining 1% occurred prior to 2000. In the following year (2002), deaths occurring in 2002 accounted for 94% of all the registered deaths and deaths occurring in 2001 accounted for 6% of all registered deaths.

Deaths attributed to the late effects of an injury are not included in this report.

1.2.2 Population (denominator) data

Annual data were obtained from the ABS for the estimated resident population of NSW in each year from 1986 to 2002. The source was the ABS time series spreadsheet 3201.0 Population by Age and Sex, Australian States and Territories which contained population estimates for June 1971 to June 2003.

1.2.3 Injury data coding issues

As mentioned above, the data used in this report span a change in the ICD coding scheme used to classify injury. This coding scheme was initially formalised in 1893. Since 1948, it has been revised in its entirety approximately every 10 years by WHO. The two ICD revisions covered in this report are the ICD 9th Revision (ICD-9) which was in use from 1979 to 1998 and the ICD 10th Revision (ICD-10) used from 1999 onward.

In ICD-10 alphanumeric codes were introduced (e.g. A37, R10) to represent injury or disease, superseding the numeric codes (e.g. 125, 802) used in ICD-9. The external cause of injury codes have been included within the alphanumeric structure of ICD-10, as opposed to the separate scheme in ICD-9 (i.e., use of E800-E999).

When a person dies as a result of an injury, a consequence or 'nature of injury' code is assigned using the death certificate. In ICD-9, there was a specific Ncode for each injury (i.e., 800–999) and the codes were organised by the type of injury (e.g. fracture, dislocation). In ICD-10, a unique Ncode still exists, but the codes are organised by the location of the body part injured (e.g. head) instead of the type of injury.

For each injury Ncode and a few other disease Ncodes, an external cause of injury code (Ecode) must also be supplied to identify the cause or mechanism of the injury (e.g. drowning, fall, burn). Two major changes regarding Ecodes occurred between ICD-9 and ICD-10. In ICD-9, the person injured in a transport event (e.g. motor vehicle) was secondary to the type of event (e.g. collision with other motor vehicle); however, in ICD-10, the coding structure focuses on the person injured first and then the type of event. The second change in ICD-10 was the introduction of codes for the place where the injury occurred (e.g. home) and the activity at the time of the injury (i.e., playing sport).

Specific rules for coding injury mortality are part of each ICD revision and all injury deaths are coded using the guidelines established by WHO.

In coding the causes of death for the purposes of national statistics, the ABS assumes that children under the age of 10 years are not capable of forming the intent to commit suicide. This convention has been followed in this report.

1.3 ANALYSIS APPROACH

Description of the injury data presented in this report is limited to demographic analysis by age and sex. Injury data for place of occurrence and activity at the time of the injury (e.g. at work) were not analysed as these variables were available only from 1999 forward and the quality of the data is unknown. Also, injury data were not analysed by ethnic status (such as aboriginality) as the quality of population data for ethnic groups is questionable due to under-reporting.

Each of the following sections briefly describes the types of analysis undertaken with the death data. Three types of epidemiological calculations were performed:

- frequency of death
- age-specific rate
- age-adjusted rates.

The frequency of death was calculated as the number of times such a death occurred in a given time period (e.g. number of drownings in 1992). The frequency of death was subdivided into categories (e.g. age and gender groups) so that comparisons between the different categories were possible.

An age-specific rate was calculated by dividing the frequency of death for a particular age group (e.g. under five years) by the total estimated population in that age group. Once this was done, the resulting

value was multiplied by 100,000 to give the number of deaths for that age group per 100,000 population. For example, suppose that one under five-year-old drowned in Place X in 1992. The total population of under-five-year-old children in Place X in 1992 was estimated as 4000. The resulting age-specific rate for drowning in under five-year-old children in Place X in 1992 would therefore be 25/100,000 population.

An age-adjusted rate is the weighted sum of individual age-specific rates. Each age-specific rate was multiplied by a standard population weight for that age group. The standard population weight was calculated by dividing the frequency in an age group by the total population for the year chosen to represent the standard year. The standard population used was the 2001 Australian population census.

Once all of the age groups had been weighted, the new age-specific values were added together to produce one age-adjusted rate. This method of age-adjustment is called direct standardisation. When the same age-specific population weights are used, standardisation allows for comparison between different states and territories that may have different age structures.

For the purposes of this report, age-adjusted rates were calculated both annually and for the block of years during 1998–2002. Age-specific rates and frequencies were calculated for the block of years during 1998–2002.

1.3.1 Top 10 causes of death in NSW

All death cases occurring in 2002 were grouped into disease and injury categories, using the cause of death. The disease categories were based on the disease chapter headings and the injury category was based on the external cause chapter in the ICD-10 coding manual. The list of disease and injury categories used is presented in Appendix 2. The top 10 causes of death tables were generated by ranking the frequencies of the disease and injury categories by age group.

The following age groups were used to present frequencies for the top 10 leading causes of death tables: under 1, 1–4, 5–9, 10–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65+ years.

1.3.2 Top 10 causes of injury death in NSW

All injury death cases occurring during 1998–2002 were grouped into injury mechanism categories, using the cause of death and principle Ecode respectively. The injury mechanism categories were based on a recommended framework for Ecode groupings for injury mortality developed by the Centres for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control (NCIPC) and National Centre for Health Statistics (NCHS) in collaboration with members of the American Public Health Association's Injury Control and Emergency Health Services Section (ICEHS) (Anonymous 1997) and the National Data Standards for Injury Surveillance (AIHW 1998). The list of injury mechanism categories used is presented in Appendix 3. The top 10 causes of injury death tables were generated by ranking the frequencies of the injury mechanism categories by age group.

The following age groups were used to present frequencies for the top 10 leading causes of injury death tables: under 1, 1–4, 5–9, 10–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65+ years.

1.3.3 Trend analyses

Age-adjusted rates for each injury mechanism were calculated annually from 1986 to 2002 for deaths and presented as a time trend. For each trend, Poisson regression analyses were performed to determine the statistical significance of changes in the trend from 1986 to 2002.

Age- and sex-specific rates for five-year age groups were calculated for each injury mechanism for 1998–2002 and presented as trends by age group. For each age- and sex-specific rate, 95% confidence intervals were calculated to examine the statistical significance of differences between age groups.

1.3.4 Injury mechanism subcategory-specific frequencies and rates

The total frequencies for each injury mechanism for 1998–2002 were divided into subcategories specific to each injury mechanism. The list of injury mechanism subcategories by Ecode is presented in Appendix 4.

Frequencies for the injury mechanism subcategories were also ranked by age group and presented in a 'Top 10' table format. The following age groups were used to present frequencies for the top 10 leading causes of injury death tables: under 1, 1–4, 5–9, 10–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65+ years.

Frequencies and rates for all persons, males and females, were also calculated for each injury mechanism. This information was presented in a table and the subcategories were ranked by the number of deaths per subcategory. For each sex-specific rate, 95% confidence intervals were calculated to examine the statistical significance of differences in rates between males and females. Also, a male/female mortality rate ratio was calculated to determine the magnitude of the difference between male and female rates for the subcategories of each injury mechanism.

1.4 SPECIAL NOTATIONS

Injury mechanism subcategories

Each injury mechanism consists of a number of individual ICD-9 and ICD-10 Ecodes. In each injury mechanism chapter, the individual Ecodes that comprise that mechanism are discussed as subcategories of that injury mechanism (e.g. different methods of suicide).

The text of the subcategories is derived from the actual text from the individual ICD-9 and ICD-10 Ecodes for each injury mechanism. In order to differentiate the subcategories from the injury mechanism itself, all subcategories are italicised whenever they are used in the text.

Small cell sizes

Caution should be used when interpreting cells with small numbers. Although an effort has been made to reduce the occurrence of small cell sizes by using five years of death data in this report, cells with counts less than five do occur in some of the tables and figures. Cells with values less than five for either an injury mechanism or injury mechanism subclass will be represented by a # symbol.

Null values

Although an effort has been made to reduce the occurrence of null values by using five years of death data in this report, cells with null values do occur in some of the tables and figures. Cells with values of zero for either an injury mechanism or injury mechanism subclass have been left blank.

For example, in tables where injury mechanism subclasses are compared, blank cells in an age group column represent null values for one or more injury mechanism subclasses.

Comparison with previous data

Where applicable, the death data presented in this report has been compared to injury death data presented in a previous report by Schmertmann and Williamson (2002). Although injury death data for the years 1998 and 1999 are included in both reports, comparison with the previous report still provides valuable information. Comparison of age- and sex-specific rates for the time periods 1995–1999 and 1998–2002 shows both continuing and changing patterns in the risk for injury death.