3.0 METHODS

3.1 Definitions

The following three sections present the case definitions of injury mechanism, mortality and morbidity used for the purposes of this report.

3.1.1 Injury Mechanism

Injuries are usually classified in terms of their cause and intent. An injury mechanism (represented by an Ecode) is defined as the external object or circumstance that caused the injury, such as a motor vehicle accident. The intent can be accidental, intentional or undetermined. Intentional injuries are grouped together on the basis that they were either self-inflicted or inflicted by another person or persons.

Eight major injury mechanisms are analysed for this report- drowning, falls, fire/burns, interpersonal violence, motor vehicle crashes, poisonings, suicide and complications of care. The burn subcategory of the fire/burn mechanism group refers to injuries received from hot objects or substances and is separate from burns received in a fire. All intentionally self-inflicted injuries were grouped into the suicide injury mechanism and all injuries intentionally inflicted by another were grouped into the interpersonal violence mechanism. The ICD-9, ICD-9-AM, ICD-10, and ICD-10-AM Ecodes for the injury mechanisms analysed in this report are listed in Appendix 1.

3.1.2 Injury Mortality

Injury mortality is defined in terms of a single 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 was New South Wales. In some cases, the identified injury mechanism was a complication of care and was linked to a nature of injury code or Ncode that is not injury-related. In these cases, the patient was probably being treated at hospital for a medical condition (e.g., heart attack) and suffered a complication of care that resulted in death

3.1.3 Injury Morbidity

Hospital separations were identified as cases if:

- a diagnosis code (N-code) was injury/ poisoning. This included ICD9-AM N-codes 800-999, ICD10- AM codes S00-T99. Up to 21 ICD10-AM, ICD9-AM codes were included in total.
- the first mechanism/external cause of injury was assigned (see appendix 1 for corresponding codes).

Hospital separations were included only where they did not result in death and where the state of residence was New South Wales. In some cases, the identified injury mechanism may be a complication of care which was linked to a N code/ primary diagnosis that is not injury-related (e.g. heart attack).

3.2 Data Sources

Two types of information were used in this report- death and in-patient (hospitalisation) data. The death record data come from information written on a death certificate by a coroner and the hospitalisation record data (usually) come from notes written in a patient's medical chart. Death data contains coded information that refers to the cause of death and hospitalisation data contains coded information that refers to the principle reason for hospitalisation.

3.2.1 Mortality Data

Data was 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 were also obtained. These data were coded using ICD-10.

3.2.2 Morbidity Data

All in-patient (hospitalisation) records were obtained from the NSW Department of Health for fiscal years 1991/1992 to 1999/2000. Data from fiscal years 1991/1992 to 1997/1998 were coded using ICD-9-CM and data from fiscal years 1998/1999 to 1999/2000 were coded using ICD-10-AM.

3.3 Injury Data Coding Issues

The data used in this report span a change in the coding scheme used to classify injury and disease. This coding scheme is referred to as the International Classification of Disease (ICD) and was initially formalised in 1893. Since 1948, it has been revised in its entirety approximately every ten years by the World Health Organisation (WHO). The two ICD revisions covered in this report are the ICD 9th Revision (ICD-9) and the ICD 10th Revision (ICD-10).
In ICD-10 alphanumeric codes have been introduced (e.g., A37, R01) to represent an 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 or is hospitalised as a result of an injury, a consequence or 'nature of injury' code is assigned using the death certificate and/or notes in the patient's record. In ICD-9, there was a specific Ncode for each injury (i.e., 800 –999) and the codes were organized by the type of injury (e.g., fracture, dislocation). In ICD-10, a unique Ncode still exists, but the codes are organized 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 accident (e.g., motor vehicle) was secondary to the type of accident (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 accident. The second change in ICD-10 was the introduction of a code for the activity at the time of the injury.

Specific rules for coding injury morbidity and mortality are part of each ICD revision; however, the Australia National Centre for Classification in Health (NCCH) made additional changes to ICD-9 and ICD-10 to produce special Australia versions (i.e., ICD-9-CM, ICD-

10-AM) for coding morbidity. These Australian versions are used to code all injury morbidity cases in Australia (e.g., hospitalisations), while all injury mortality cases are coded using the guidelines established in the original WHO ICD versions.

3.4 Other Injury Data Issues

There are a number of issues arising from analysis of death and hospital record data to understand patterns of injury mortality and morbidity. First, to be useful, the injury coding must be reliable and valid. Evaluation studies of the quality of ICD9 diagnosis and mechanism codes reported in hospital discharge data shows that they are a reliable source of information for injury surveillance. A Victorian hospital coding validation study (MacIntyre, Ackland and Chandraraj, 1997) found low percentages of coding error, with only six per cent of principal diagnoses to be in error at the three-character level- (coded to principal diagnoses other than injuries) and 22 per cent at any level. Only 16 per cent of external cause codes were found to contain an error. These findings were supported by a US study (Lemier, Cummings and West, 2001) which examined a sample of 1260 computerized records and found 13% of external cause/mechanism codes contained an error.

A second injury data issue is that in the hospitalisation data set, there may be more than one record for the same individual. For example, a person may be hospitalised for a heart attack in the beginning of the year and have the misfortune to be seriously injured in a motor vehicle transport crash later in the year. The same person may need to be readmitted after the initial hospitalisation stay to receive further treatment for the injuries suffered in the crash. In this example, the same person would have at least three hospitalisation records in one year of hospitalisation data.

Unfortunately, there is no way to identify multiple records for an individual in the hospitalisation data used, so each record was considered to be unique for purposes of this profile. For injury mechanisms that are affected by this decision, frequencies and rates may be slightly elevated.

A third injury data issue involves the absence of an Ecode for 2,134 injury morbidity cases where a nature of injury code was assigned as the primary diagnosis. These cases were hospitalised between January 1995 and June 1998 and were coded under the ICD-9 coding scheme. These cases accounted for only 0.2 percent of all hospitalised cases analysed between 1995 and 1999 and are reported as having an unknown injury mechanism.

3.5 Analysis

Each of the following sections briefly describes the types of analysis done using the death and hospitalisation data. Three types of epidemiological analyses were done:

- Frequency of event;
- Age-specific rate; and
- Age adjusted rates.

The frequency of an event is calculated by counting the number of times the event occurs in a given time period (e.g., number of drownings in 1992). Frequencies are often subdivided into categories (e.g., age and gender groups) so that comparisons between the different categories are possible.

An age-specific rate is calculated by dividing the frequency of an event for a particular age group (e.g., under five) by the total population in that age group that could have experienced the event in that same time frame. Once this is done, the resulting value is multiplied by 100,000 so that the number of events per that age group is given per 100,000 population. For example, one under five years old drowned in Place X in 1992. The total population of under five year old children in Place X in 1992 was 4000. The resulting age-specific rate for drowning in under five year old children in Place X in 1992 is 25/100,000 population.

An age-adjusted rate is the sum of individually standardized age-specific rates. Each age-specific rate is multiplied by a standard population weight for that age group. The standard population weight is 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 currently being used is the 1991 Australia population census.

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

The time period measured can be any length of time. In some cases, it is beneficial to group at least five years of data together. This is done for two reasons:

(i) So enough events can be measured; and

(ii) 'Typical' data is captured, minimising the influence of fluctuations from year to year. For the purposes of this report, age-adjusted rates were calculated both annually and for the block of years from 1995 to 1999. Age-specific rates and frequencies were calculated using data for the block of years from 1995 to 1999

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All of the following analyses were done for both morbidity and mortality data.

3.5.1 Top Ten Causes of Death and Hospitalisation

All death and hospitalisation cases occurring in 1999 were grouped into disease and injury categories, using the cause of death and principle diagnosis, respectively. The disease categories were based on the chapter headings in the ICD-10 and ICD-10-AM coding manuals. For injury deaths, cases were grouped by Ecode and for injury hospitalisations, cases were grouped by Ncode. The top ten causes of death and hospitalisation 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 ten leading causes of death and hospitalisation tablesunder 1, 1-4, 5-9, 10-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65+. An under one year age group was analysed separately from the rest of the under five age group because children under one are likely to exhibit different patterns of injury as compared to the rest of the under five age group.

The list of disease and injury categories used is presented in Appendix 2.

3.5.2 Top Ten Causes of Injury Death and Hospitalisation

All injury death and hospitalisation cases occurring from 1995 to 1999 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 developed by the Centers for Disease Control in the United States. Thetop ten causes of injury death and hospitalisation 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 ten leading causes of injury death and hospitalisation tables- under 1, 1-4, 5-9, 10-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65+. An under one year age group was analysed separately from the rest of the under five age group because children under one are likely to exhibit different patterns of injury as compared to the rest of the under five age group:

The list of injury mechanisms categories used is presented in Appendix 3.

3.5.3 Time Trends

Age-adjusted rates for each injury mechanism were calculated annually from 1986 to 1999 for deaths and 1992 to 1999 for hospitalisations and presented as a time trend. For each rate, 95% confidence intervals were calculated in order to examine the statistical significance of changes in rates over the time period.

3.5.4 Age- and Gender-specific Rates

Age and gender-specific rates for five-year age groups were calculated for each injury mechanism for 1995 to 1999 and presented as trends by age group. For each age and gender-specific rate, 95% confidence intervals were calculated to examine the statistical significance of differences between age groups

3.5.5 Injury Mechanism Subcategory-specific Frequencies

The total frequencies for each injury mechanism for 1995 to 1999 were divided into subcategories specific to each injury mechanism. For example, the total number of drownings was broken down into the frequencies for the different locations where drownings occurred (e.g., bathtubs, swimming pools). The frequencies for these injury mechanism subcategories were plotted as percentages on a pie chart. The list of injury mechanism subcategories by Ecode is presented in Appendix 1.

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