

THE UNIVERSITY OF
NEW SOUTH WALES

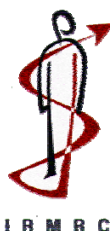


NSW Injury Risk Management Research Centre,
University of New South Wales

**Methodological issues in
using routinely collected
electronic population mortality
data: Guidelines for using the
National Coroners Information
System for fatal injury
surveillance in NSW**

Melissa Irwin, Andrew Hayen, Caroline Finch

July 2008



UNSW, SYDNEY NSW 2052, AUSTRALIA
Telephone: +61 (2) 9385 4207, Facsimile: +61 (2) 9385 6040,
<http://www.irmrc.unsw.edu.au>

ISBN 978-0-9804866-2-9

TABLE OF CONTENTS

LIST OF TABLES	i
ACKNOWLEDGEMENTS	ii
ABBREVIATIONS	iii
EXECUTIVE SUMMARY	1
PART 1: INTRODUCTION AND OBJECTIVES	4
PART 2: BACKGROUND	7
2.1 THE CORONIAL AND DEATH REGISTRATION PROCESSES IN NSW	7
2.2 SOURCES OF ROUTINELY COLLECTED ELECTRONIC MORTALITY DATA.....	9
2.2.1 <i>Australian Bureau of Statistics (ABS) mortality data</i>	9
2.2.2 <i>The National Coroners Information System (NCIS)</i>	10
2.3 DEFINING AND CATEGORISING FATAL INJURIES	12
PART 3: METHODS	13
3.1 DESCRIPTIVE EPIDEMIOLOGY OF FATAL INJURIES IN NSW	13
3.2 EVALUATION OF THE NCIS.....	14
PART 4: RESULTS	16
4.1 THE DESCRIPTIVE EPIDEMIOLOGY OF FATAL INJURIES IN NSW	16
4.1.1 <i>Characteristics of all-cause deaths and fatal injuries by residential status</i>	16
4.1.2 <i>Leading fatal injuries by mechanism</i>	19
4.1.3 <i>NSW age-standardised rates by fatal injury mechanism</i>	22
4.2 THE EVALUATION OF THE NCIS AS A TOOL FOR FATAL INJURY SURVEILLANCE IN NSW	24
4.2.1 <i>Coroner-certification of deaths by fatal injury mechanism</i>	24
4.2.2 <i>Coroner-certification by sub-mechanism of fatal injury</i>	25
4.2.3 <i>A comparison of NSW deaths in the NCIS and the ABS mortality data</i>	31
4.3 TIME TO CASE CLOSURE OF ALL-CAUSE DEATHS AND FATAL INJURIES CONTAINED IN THE NCIS DATASET	36
4.3 DOCUMENTS ATTACHED TO NCIS CASE RECORDS FOR ALL-CAUSE DEATHS AND FATAL INJURIES.....	38
PART 5: DISCUSSION AND RECOMMENDATIONS	40
5.1 NCIS COVERAGE OF CORONER-CERTIFIED DEATHS	40
5.2 THE CAPTURE OF CASES AGED 65+ YEARS	41
5.3 TIMELINESS OF COMPLETE DATA IN THE NCIS	42
5.4 USING THE NCIS TO IMPROVE THE QUALITY OF CODING UNDERLYING CAUSE OF DEATH.....	43
REFERENCES	44
APPENDIX 1: SECTION 12B OF THE NSW CORONERS ACT 1980	46
APPENDIX 2: ICD-10 CODING FOR FATAL INJURY MECHANISMS AND SUB- MECHANISMS.....	47
APPENDIX 3 IMPACT OF CASE SELECTION METHODS ON DEATHS REPORTED FOR NSW	51

LIST OF TABLES

Table 1. Characteristics of NSW all-cause deaths registered between 2000 and 2003 by residential status.....	17
Table 2. Characteristics of NSW fatal injuries registered between 2000 and 2003 by residential status.....	18
Table 3. Leading types of fatal injury by sex and resident status in deaths registered between 2000 and 2003.....	21
Table 4. NSW age-standardised death rates/100,000 persons by fatal injury mechanism registered between 2000 and 2003.....	23
Table 5. Proportion of deaths certified by a coroner in NSW deaths registered between 2000 and 2003, by age group and mechanism of death.....	24
Table 6. Level of coroner-certification of suicide deaths.....	26
Table 7. Level of coroner-certification of motor vehicle transport deaths.....	26
Table 8. Level of coroner-certification of drowning deaths.....	27
Table 9. Level of coroner-certification of struck by/against deaths.....	27
Table 10. Level of coroner-certification of rail transport deaths.....	27
Table 11. Level of coroner-certification within poisoning deaths.....	28
Table 12. Level of coroner-certification of fire/burn deaths.....	28
Table 13. Level of coroner-certification of natural/environmental deaths.....	29
Table 14. Level of coroner-certification of suffocation deaths.....	29
Table 15. Level of coroner-certification of falls deaths.....	30
Table 16. Level of coroner-certification of complications of care deaths.....	30
Table 17. Level of coroner-certification of accidental exposure to other and unspecified factor deaths.....	31
Table 18. Comparing ABS mortality data and the NCIS data by year of registration from July 2000 to December 2003.....	32
Table 19. Coverage of NSW ABS mortality data by mechanism of death in the NCIS data registered between July 2000 and December 2003.....	35
Table 20. Months to close death cases contained in the NCIS dataset by cause of death.....	37
Table 21. Proportion of death records (by cause of death) in the NCIS dataset with police, autopsy and coroner's findings attached.....	39
Table A3.1 Year of death for NSW fatal injuries registered between 2000 and 2003.....	52
Table A3.2. State of registration of NSW fatal injuries registered between 2000 and 2003.....	53
Table A3.3. NSW fatal injuries reported for 2002.....	54

ACKNOWLEDGEMENTS

The project was undertaken as part of the core research program of the New South Wales (NSW) Injury Risk Management Research Centre (IRMRC). The IRMRC is funded by the NSW Department of Health (NSW Health), the NSW Roads and Traffic Authority (RTA) and the Motor Accidents Authority (MAA).

This report was produced whilst Melissa Irwin was a Public Health Officer Trainee placed at the IRMRC from December 2005 to December 2006. Funding was received from the Centre for Health Advancement, NSW Health, to support this placement.

Dr Andrew Hayen was supported by IRMRC Core Funding and Professor Caroline Finch was supported by a National Health and Medical Research Council Principal Research Fellowship. Part of this work was completed while she was employed by the School of Human Movement and Sport Sciences at the University of Ballarat.

The NSW population and ABS mortality data used in this report were obtained through the Health Outcomes Information and Statistical Toolkit (HOIST), a data warehouse maintained by the Centre for Epidemiology and Research, NSW Health.

The mortality data from the National Coroners Information System was supplied through an access agreement between the Victorian Institute of Forensic Medicine and the IRMRC. The staff of the National Coroners Information System at the Victorian Institute of Forensic Medicine – particularly Jessica Pearse, Marde Hoy, Megan Bohensky and Leanne Daking – are thanked for their valuable assistance with accessing and downloading the NCIS data.

The following are also thanked for providing valuable comments on the draft report: A/Prof Ann Williamson (IRMRC) and Ms Jessica Pearse (NCIS).

ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ASCO	Australian Standard Classification of Occupations
ASGC	Australian Standard Geographical Classification
CDC	Centers for Disease Control and Prevention (US)
HOIST	Health Outcomes Information and Statistical Toolkit
ICD-10-AM	International Classification of Diseases and Related Health Problems, 10 th Revision
IRMRC	NSW Injury Risk Management Research Centre
IPV	Interpersonal Violence
NCIS	National Coroners Information System
NISU	National Injury Surveillance Unit (Flinders University)
NSW	New South Wales
UCOD	Underlying cause of death
VIFM	Victorian Institute of Forensic Medicine

EXECUTIVE SUMMARY

The National Coroners Information System (NCIS) is the world's first electronic national collection of coronial information. It is operated by the Victorian Institute of Forensic Medicine as an initiative of the Australian Coroners' Association. The NCIS is a collection of coded data and textual reports on all deaths reported to Australian coroners since July 2000. This report presents an evaluation of the NCIS as a tool to support fatal injury surveillance in New South Wales (NSW). Its findings are important for informing injury prevention researchers, practitioners and policy makers of the strengths and weaknesses of using the NCIS in the NSW context.

The method of selecting deaths affects the final numbers reported from different routinely collected population mortality data, such as the Australian Bureau of Statistics (ABS) mortality data and the NCIS dataset. This report considers the impact of case selection by time and place and makes recommendations about case selection methods depending on the purpose of data interrogation.

The report also provides a snapshot of the descriptive epidemiology of fatal injuries in NSW residents for the period 2000-2003. Fatal injuries were categorised using the World Health Organization (WHO) International Classification of Diseases and Related Health Problems, 10th Revision (ICD-10).

The NCIS was assessed as a tool for surveillance using recognised guidelines for the evaluation of surveillance systems as developed by the US Centers for Disease Control and Prevention (CDC) and the World Health Organization. Specifically, the NCIS was evaluated against the desirable surveillance system attributes of reliability and timeliness. In this context, a reliable surveillance system is one where the users have confidence that it fully records all injury events, excludes non-injury events and detects all injury events within the relevant population. A timely surveillance system should be able to generate up-to-date information whenever it is required.

The evaluation presented in this report shows that the NCIS reliably captures most fatal injuries in NSW residents that are referred to, and certified by, a coroner rather than all fatal injuries that are recorded in the ABS mortality data. Some types of fatal injury are not reliably captured in the NCIS dataset as doctors frequently certify them, rather than reporting them to a coroner for investigation. Often, deaths of people aged 65+ years are not referred to a coroner if they die from fatal injuries that may be related to their age, or do not die in a hospital or institution. This is in accordance with the interpretation of criteria outlined in the *NSW Coroners Act 1980*.

Case closure is defined as the time between the date of notification and the case closed date on the NCIS. The state of NSW experiences the longest median time to closure of coroners' cases of any jurisdiction in Australia. In addition, investigation of fatal injuries takes significantly longer than that of deaths from natural causes. This, in turn, influences the quality of cause of death coding, with 'unspecified' codes being commonly used when insufficient information is available. The NCIS does not reliably capture many 'unspecified' fatal injuries.

However, there is still an important role for the NCIS in understanding the mechanisms that may be allocated an 'unspecified' code and for providing strategies to reduce the use of 'unspecified' cause of death codes in NSW, therefore improving the quality of cause of death coding.

To get the most out of fatal injury surveillance, the ABS mortality data should be used to observe trends in fatal injuries. Concurrently, NCIS data can be useful for explaining the observed trends, as it holds more detail on the time, place and mechanism of the incident that caused the fatal injury, as well as the circumstances surrounding the incident. Therefore, the ABS mortality and NCIS data should be used to complement each another and to build a more detailed understanding of the patterns and risks for fatal injuries, rather than each being used in isolation.

Guidelines and recommendations

Guidelines for NCIS users

1. The NCIS dataset reliably captures fatal injuries in NSW residents across most injury types except for:
 - accidental exposure to unspecified factors;
 - suffocations due to non-food objects causing obstruction; and
 - other and unspecified falls.
2. The only type of complication of care that is reliably captured in the NCIS dataset in NSW is 'misadventure to patient during surgical or medical care'. All other complications of care are rarely referred to a coroner for investigation in NSW.
3. There is a direct relationship between the frequency with which a particular fatal injury category is referred to, and certified by, a coroner (as noted in the ABS mortality data), and how reliably the NCIS will capture those fatal injuries.
4. The median time to case closure for each type of fatal injury can indicate the minimum period required to access enough cases from the NCIS for studies that aim to explore injury risk factors.
5. The NCIS could be used to obtain data on fatal injuries associated with a specific geographical location and would be the best routinely collected mortality data source to map the occurrence of fatal injuries.

Recommendations for ongoing data quality

- Consideration should be given towards developing and including a unique identifier in both ABS mortality data and the NCIS death records to aid the process of adding ICD-10 underlying cause of death codes to the NCIS death records.

- Given the importance of accurate external cause of death information on death certificates, particularly in people aged 65+ years who are less likely to have their death investigated by a coroner, consideration should be given to improving the reporting of information in the *Medical Certificate of Cause of Death* section of death certificates.
- It would be useful for the ABS and coroners to continue to monitor the median time to case closure to identify particular fatal injury mechanisms that may be subject to cause of death quality issues due to longer coronial investigations.
- A detailed investigation of the NCIS data should be undertaken to explore the large category of 'unspecified' fatal injury mechanisms in NSW. Particular analyses could focus on the reasons why these deaths are coded as such and potential strategies to reduce the use of 'unspecified' cause of death codes.

PART 1: INTRODUCTION AND OBJECTIVES

Fatal injuries represent a significant public health issue for the residents of New South Wales (NSW). Injury and poisoning were the fourth leading cause of death in 2002 and, in people, aged 10–44 years it was the leading cause of death. Between the years 1986 and 2002, about 2500 people died each year in NSW due to an injury or poisoning (Schmertmann et al, 2004). In 1998, about one-third of all Australian fatal injuries occurred in NSW (Schmertmann and Williamson, 2002).

The Australian Bureau of Statistics (ABS) mortality data are the primary source for reporting on causes of death, including fatal injuries, in Australia. The ABS mortality data capture all deaths reported to the Registrars of Births, Deaths and Marriages in all states and territories. Although these data provide the consistency required for injury surveillance, they generally lack enough detail on the circumstances and contributing factors leading to the death, to explore risk factors in depth.

The National Coroners Information System (NCIS) is the world's first electronic national collection of coronial information. Information on all deaths referred to Australian coroners since July 2000 (with the exception of Queensland, where data collection commenced on 1 January 2001) has been captured by NCIS in both coded and narrative text format. The NCIS was set up to assist coroners to identify, and make recommendations to prevent deaths that occurred in similar settings or by similar mechanisms. Although not originally set up for the purpose of injury surveillance, the NCIS has the potential to complement the ABS mortality data by providing richer contextual information on fatal injuries.

The NCIS contains information on the time, mechanism and geographical location of the incident that led to the fatal injury. The NCIS also contains detailed information on the mechanism, objects involved and the activity that was occurring at the time of injurious incident. The NCIS is therefore likely to be a useful resource for enriching traditional injury surveillance.

To date, the use of NSW data from the NCIS has been limited. One reason for this is that the NCIS has not been evaluated as a surveillance tool for fatal injuries in NSW. Consequently, the reliability of the NCIS to capture fatal injuries and the timeliness with which complete data become available is unclear. A recent report (Driscoll et al, 2003) suggested that the NCIS provides good coverage of fatal injuries. According to that report, the NCIS identified 28 additional fatal injuries compared with the ABS mortality data, in deaths registered in NSW for the period July 2000 to June 2001. The report also showed that NSW had the longest median time for closure of cases referred to the coroner for investigation across all Australian states and territories. The NSW median was 20.3 months (or approximately 1.7 years), compared with the national median of 17.1 months (or 1.4 years).

Closed coronial cases are important for injury surveillance and research as they are the cases where the coronial investigation is complete and all the required coded and textual information has been entered onto the NCIS.

While most open cases on the NCIS did not have specific information on the mechanism or object involved in the death, they did have information on the location, activity at the time of injury and the cause of death (Driscoll et al, 2003).

The time taken to close cases referred to the coroner can influence the quality of cause of death coding in the ABS mortality data. The longer it takes to close a case, particularly if it takes more than two years, the more likely it is for the cause of death coding to be less specific or have a higher proportion of 'unspecified' codes. For deaths reported to a coroner, the ABS uses the NCIS to obtain information to allow coding of the UCOD. As the ABS codes UCOD at the end of the calendar year following the year in which the death is registered, deaths are typically coded 12-24 months following the registration of the death. If a coronial case remains open at the time the ABS is coding the UCOD, only the available information in the open record can be used. This can lead to the death being coded with an ICD-10 code such as X59 'accidental exposure to unspecified factors' or another non-specific category, such as W19 'unspecified fall'. Currently, the ABS does not update its coding of death records, including its coding of UCOD, once a case is closed. The NCIS could therefore provide further insight into the mechanisms that contribute to unspecified fatal injuries.

In 2005, all death records on the NCIS for all deaths registered before or in 2003 had the ABS mortality data added. These data included ICD-10 codes for UCOD and contributing causes of death and other ABS data, such as the Australian Standard Geographical Classification (ASGO) codes and the Australian Standard Classification of Occupations (ASCO) codes. No comprehensive evaluation of the NCIS data across the most common fatal injuries in NSW has been undertaken, but the addition of ICD-10 codes to the NCIS dataset now makes this possible.

The US Centers for Disease Control (CDC) guidelines for the evaluation of surveillance systems (Klauke et al, 1998) have been adapted for injury surveillance systems (Holder et al, 2001). The guidelines suggest the following positive attributes of an injury surveillance system:

Simplicity: The system should produce all the data needed, but in the most simple and straightforward way. Simplicity is closely related to timeliness and affects the amount of resources required to operate the system.

Flexibility: The system should be easy to change, especially when ongoing evaluation shows that change is necessary or desirable. Flexibility is probably best judged retrospectively, by observing how a system responds to a new demand.

Acceptability: The system should reflect the willingness of individuals and organisations to participate in the surveillance system.

Reliability: Anyone using the data produced by the surveillance system should have confidence in the accuracy of the data. Therefore, the system should:

- fully record injury events
- exclude non-injury events
- detect all injury events within the relevant population, or be able to detect a representative sample of injury events that can be shown to reflect the distribution of events in the population.

Utility: The system should be practical and affordable.

Sustainability: The system should function with the minimum effort and be easy to maintain and update, so that it continues to serve its purposes well after it has been established.

Timeliness: The system should be able to generate up-to-date information whenever that information is required.

In this report, we evaluate two of these attributes, reliability and timeliness, of the NCIS system.

The main objectives of this report are to:

1. provide background epidemiological information on rates of death from injury in NSW, by describing the most frequent types of fatal injury for NSW for the period 2000-2003 by sex and by residential status
2. evaluate the NCIS as a tool to support fatal injury surveillance in NSW against the surveillance system attributes of reliability and timeliness.

PART 2: BACKGROUND

2.1 The coronial and death registration processes in NSW

The coronial process

When a death occurs in Australia, a doctor completes a 'Medical Certificate Cause of Death' unless the death meets the criteria for referral to a coroner. In NSW, a coroner is a magistrate who has the jurisdiction to investigate deaths, suspected deaths, fires and explosions. The roles of the coroner include:

- legally determining whether a death has occurred, or determining whether a death is likely to have occurred (e.g. if the person was missing and their body has not been found);
- identification of the deceased;
- determining the manner and cause of the death (including circumstances); and
- investigating the reasons why the death occurred in order to prevent similar occurrences in future (Bills, 1998).

Section 12B of the NSW *Coroners Act 1980* (Appendix 1) outlines the circumstances when the death of a person should be referred to a coroner for investigation. Usually this is when deaths are deemed 'unnatural' or if there are suspicious circumstances surrounding the death. This may include situations where:

- the person died unexpectedly and the cause of death is unknown;
- the person died in a violent or unnatural manner;
- the person died as a result of an anaesthetic;
- the person was 'held in care' or in custody immediately before they died;
- a doctor had been unable to sign a death certificate giving the cause of death; or
- where the identity of the person who died is unknown (ABS, 2007).

The exception to these criteria is when an 'accidental death' in a person aged 65+ years could have been attributed to the age of that person. If, however, the 'accidental death' of the person aged 65+ years occurred in a hospital or nursing home, the death should be reported to a coroner for investigation.

If the death meets any of the criteria outlined in the NSW Coroners Act, the NSW Police attend the scene and formally refer the case to the coroner. The police investigation determines whether the death is suspicious and gathers information necessary for the coroner to investigate (Bills, 1998). A 'coroner's order' is then issued allowing the family to arrange for the disposal of the body.

A death requiring coronial investigation is usually referred to a coroner in the state or territory in which the death occurred, even if the person usually resides in another state or territory. Overseas visitors are also referred to the coroner in the state or territory where they died. Occasionally, a case may be referred from one state coroner to another, when the death occurs in a state and territory border regions.

Deaths registered in NSW therefore represent people who died within the NSW boundaries, and not necessarily those of NSW residents.

A coroner may request a forensic pathologist to perform an autopsy to assist in determining the mechanism of death and medical cause, prior to the disposal of the body. This medico-legal process is called a 'forensic autopsy'. A forensic autopsy has the goal of determining the cause of death in a coroner's case, and specific consent from the family is not required. Requests that a forensic autopsy not take place are only granted in exceptional circumstances (Ranson, 1998).

Although central to the death investigation, the forensic autopsy should complement the investigation rather than be its entirety. The physical autopsy procedure usually only takes a few hours to complete; however, the entire autopsy process may take months to finalise, because of the range of histological and toxicological examinations required. A provisional report on the autopsy is usually available within two to six weeks (Ranson, 1998).

Once the forensic pathologist provides information on the medical cause of death, the coroner can decide on the scope and form the death investigation should take. A coroner may decide to examine the information gathered (known as a stand-alone sitting) or may request that a formal inquest take place. When an inquest is held, witnesses can be called to the Coroner's Court. In NSW, formal findings and recommendations are only offered by the coroner if an inquest is held. However, all cases referred to the coroner will have the cause of death determined, allowing a full death certificate to be provided. In the ABS mortality data, the certifier of the death is always noted as being either a doctor or a coroner.

Registering the death

A death is usually registered with the Births, Deaths and Marriages Registry in the state or territory in which the death occurs. In NSW, Section 41 of the *Births, Deaths and Marriages Registration Act 1995* dictates that registration must occur within seven days of the burial or cremation. The next of kin registers the death by presenting the 'Medical Certificate Cause of Death' or the 'coroner's order' advising on disposal of the body and the following demographic information about the deceased:

- all given names and surnames;
- the sex of the deceased;
- the date of death and date of birth;
- the place of death;
- the usual address of the deceased;
- usual occupation during working life;
- the deceased's marriage particulars (place, age, full name of spouse);
- all children of the deceased (names and ages); and
- the full name of both parents (including mother's maiden name).

Once lodged, the Registry processes the death record and issues a full death certificate for the next of kin. The date of registration and state or territory of registration of the death is noted and a unique case identifier is added to the death record. It is then sent to the ABS for collation and coding of the underlying and contributing causes of death. The coding of the causes of death uses information on the 'Medical Certificate Cause of Death' or information provided by the coroner on the NCIS.

2.2 Sources of routinely collected electronic mortality data

2.2.1 Australian Bureau of Statistics (ABS) mortality data

The ABS mortality data provide the most comprehensive collection of NSW fatal injuries due to the legislative requirement to report all deaths to the Registry of Births, Deaths and Marriages. The ABS mortality data are the primary source of reporting of fatal injuries and are considered the current standard for injury mortality reporting and the best source for reporting trends in fatal injuries.

Method of Collection

The ABS mortality data are collected from the registries of births, deaths and marriages in the states or territories of death occurrence and registration. Deaths are usually reported by the ABS in their 'Death' and 'Causes of Death' reports by the state or territory of usual residence.

Description

The ABS mortality data primarily report demographic data and the causes of death according to the ICD-10 (Australian Bureau of Statistics, 2002b). The ABS mortality data include:

- the underlying and contributing causes of death in ICD-10 coded format (for deaths registered in 1999 or later);
- a unique arbitrary sequence number;
- the year, month and state in which the death was registered;
- the date and year the death occurred;
- the age, five-year age group and ABS file age at death;
- the years of residence in Australia;
- the sex of the deceased;
- the marital status, date of marriage and age at first marriage of the deceased;
- the place of residence of the deceased by state, statistical division, statistical local area and postcode;
- the country of birth of the deceased;
- the occupation of the deceased;
- the type of certifier of the death (doctor or coroner);

- the Aboriginal or Torres Strait Islander status of the deceased; and
- the various other flags, including post-mortem, drowning, cancer as contributing cause of death, maternal death, tuberculosis as contributing cause of death, leukaemia, alcohol-related, other drug-related, diabetes (from 1994), previous pregnancy more than 20 weeks' duration, and asbestosis.

Limitations

Misclassification or non-specific classification of fatal injuries can occur if there is inadequate information available for coding fatal injuries or a prolonged passing of time until this information is available. There is also the risk of misclassification of the ICD-10 cause of death codes for fatal injuries, particularly in mechanisms such as poisoning, drowning or suffocation where the intent may initially be unclear.

The ABS mortality data may not always be the optimal dataset for exploring risk factors for the injurious incident because of the risk of misclassification and because they lack detailed information about the incident causing the fatal injury.

2.2.2 The National Coroners Information System (NCIS)

The NCIS is the world's first electronic national collection of coronial information. It is an initiative of the Australian Coroners' Society, and is based at and operated by the Victorian Institute of Forensic Medicine in Melbourne, Victoria (NCIS, 2005). The NCIS is governed by a Board of Management, which comprises representatives from each of the core funding agencies. These core funding agencies are the Justice Departments in each State and Territory and several Commonwealth agencies including the Department of Health and Ageing.

The NCIS holds a collection of data concerning all deaths reported to Australian coroners since July 2000 (except for Queensland where implementation occurred on 1 January 2001). In theory, it should include all deaths certified by any Australian coroner from 1 July 2000.

Method of collection

When a death is registered with a coroner, it is entered onto the NCIS, creating a 'date of death notification'. All demographic and circumstantial details that are available are entered onto the NCIS and the case status is marked 'Open'. Once the coronial process is complete, and all the required coded information entered onto the NCIS, the case can then be marked 'Closed' (Driscoll et al, 2003). The NCIS coders at the Coroner's Court or the NCIS staff themselves can reopen the case if corrections need to be made. This makes it difficult to determine the true number of coroner's cases that have ever been closed. For the purposes of this report, case closure is determined on the basis of a recorded date of case closure, rather than the current status on the NCIS being noted as 'Closed'.

Description

The NCIS dataset contains coded variables and full text reports covering case demographics, incident and death information, contextual information and the medical cause of death for each case. Each case also has attached textual information containing the coronial findings, autopsy report, toxicology and police findings. In NSW, for the period 2000-2003 separate toxicology reports were rarely attached as separate documents, but toxicology findings are often included within the autopsy report. Taken together, these variables provide a rich source of data on both the injurious incident and death.

Much of the detail on each case is only determined towards the end of the coronial process and is often only available when the case is closed. The time for cases to be closed varies considerably across states and territories (Driscoll et al, 2003) and also varies across injury death categories.

For each death record on the NCIS, the following coded variables are included:

- demographic details:
 - full name, date of birth, sex, full residential address, marital status, employment status, country of birth, years in Australia; and
 - date of death and age at death;
- coroner details:
 - date and time of notification of death;
 - case/coroner closed date;
 - Coroner's Court; and
 - inquest held.
- case details:
 - case type at notification and completion;
 - intent at notification and completion;
 - product related;
 - work related;
 - usual occupation; and
 - documents attached.
- time and location details for the injurious incident, body found, death and/or last time seen alive, if relevant:
 - location codes (levels 1 and 2);
 - activity at the time (levels 1 and 2);
 - full address; and
 - date (or range of possible dates).
- procedure list;
- medical cause of death (1a, 1b, 1c, 1d, 2, 3);
- mechanism and objects involved in the injurious incident:
 - three descriptor levels for each of the primary and two secondary mechanisms of injury;
 - vehicle details (mode of transport, counterpart, context and user).

- linking numbers:
 - local case number (as completed by the coroners staff);
 - police case number;
 - death registration number (as provide by the ABS upon provision of the other codes);
 - hospital record number;
 - WorkCover number; and
 - psychiatric services database number.
- ABS data:
 - ASGC code (geographical location code for residence of deceased);and
 - ICD-10 cause of death codes with underlying cause of death identified.

For each death record on the NCIS, the narrative text reports include (when available):

- a police report;
- an autopsy report (usually including toxicology results; and
- a report of coronial findings if an inquest is held.

The ABS data including ICD-10 and ASGC codes have only been allocated to the NCIS death records since 2005. In 2005, all NCIS records from 2000 to 2003 had the ABS data applied. Since 2005, as each ABS Cause of Death Report is released the ABS codes are added to the NCIS death records. As no common unique identifier is available on either dataset to link cases, a probabilistic matching process is required. The NCIS death records that do not have a matching record in the ABS data do not have the ABS codes (including ICD-10 codes) added to the death record. This results in an underestimation of the number of cases of a particular type of fatal injury if they are searched for by ICD-10 UCOD.

Limitations

All deaths contained in the NCIS data are reported in the ABS deaths data. However, deaths certified by doctors are not included in the NCIS dataset.

2.3 Defining and categorising fatal injuries

The ICD-10 outlines the physical nature of an injury in chapter XIX 'Injury, poisoning and certain other consequences of external causes' and the external cause in chapter XX 'External causes of morbidity and mortality' (WHO, 1992). Following ICD-10 rules, deaths due to external causes are firstly classified by intent, i.e. whether or not they are deliberately inflicted (ABS, 2007). They are then classified by the external cause of death (e.g. suffocation, drowning or transport). Injury deaths are categorised by the underlying cause of death ICD-10 code (Schmertmann et al, 2004). If an injury is determined to be the underlying cause of death, an external cause code of injury or poisoning, not the physical nature of the injury, is recorded (ABS, 2004).

PART 3: METHODS

3.1 Descriptive epidemiology of fatal injuries in NSW

Data source

The ABS mortality data were used to describe the epidemiology of fatal injuries in NSW. Estimated mid-year NSW and Australian population data were also used for calculating crude and age-standardised mortality rates. For age-standardised rates, the Australian standard population as of 30 June 2001 was used.

Case selection method

For this report, deaths meeting the following criteria were selected:

- deaths of usual NSW residents;
- deaths of overseas residents whose deaths were registered in NSW; and
- deaths registered in the years 2000 to 2003.

This corresponds to the way in which the ABS reports its deaths. (More details on the impact of case selection methods are in Appendix 3 of this report.) We term these deaths “NSW deaths” in this report. Deaths from any cause (natural or external) are called “all cause deaths” in this report.

Fatal injuries were identified using external cause ICD-10 codes for underlying cause of death, i.e. codes in the ICD-10 range ‘V00 to Y98’. The categorisation into mechanism and sub-mechanisms of fatal injury used the same matrix as that used by Schmertmann et al, 2004. In addition to those categories, we also considered the category ‘accidental exposure to unspecified factors’ (ICD-10 code X59).

Method of analysis

Each fatal injury category was ranked for ‘all NSW deaths’, according to sex and according to residential status (usual NSW resident or overseas resident). The estimated resident mid-year population for NSW for each year of 2000 to 2003 was used as the denominator data for the calculation of crude incidence. The 2001 mid-year resident Australian population was used as the standard for calculating directly age-adjusted rates for each mechanism of death.

3.2 Evaluation of the NCIS

Data source

National Coroners Information System and ABS mortality data.

Case selection method

The NCIS contains deaths registered from July 2000. Therefore, when comparing the ABS mortality data and the NCIS, deaths meeting the criteria in Section 3.1 but registered after 1 July 2000 were used.

Method of analysis

To evaluate the reliability of the NCIS, for each NSW all-cause deaths, fatal injuries and fatal injury mechanisms the following were determined:

- the proportion of deaths reported to and certified by a coroner in the ABS mortality data;
- the proportion of coroner-certified deaths in the ABS mortality data that could be found in the NCIS dataset;
- the proportion of fatal injuries in those aged 65+ years in the ABS mortality data that could be found in the NCIS dataset; and
- the proportion of death records in the NCIS with textual documents attached (police reports, autopsy reports and coroner's findings).

The number and proportion of each fatal injury category that were certified by a coroner were reported, as was the proportion of NCIS cases in each fatal injury that had police reports attached, autopsy reports attached or finding of a coronial inquest attached.

The reporting of how reliably the ABS cases were captured in the NCIS dataset across each fatal injury category had two components:

- the number and proportion of ABS cases that were certified by a coroner as being intentional (i.e. deliberate); and
- the number of cases on NCIS and the proportion of coroner certified and total ABS deaths.

To evaluate the timeliness of the NCIS, for each of NSW all-cause deaths, fatal injuries and fatal injury mechanisms the following were determined using the NCIS data:

- the median time it takes to close the coroners' cases; and
- the proportion remaining open two years after the registration of the death.

Case closure is defined as the time between the date of notification and the case closed data on the NCIS. It is recognised that this can be included by factors other than the length of coroners processing, such as a backlog of data in the coroners' office. To describe the time to case closure (in months) across the fatal injury categories, a survival analysis was used. Cases without a date of closure were censored (giving a time to case closure as that between the date of notification and the date the NCIS data were extracted), so that a good estimate of the median time to case closure could be obtained.

The proportion of cases remaining open two years following the case being notified to the NCIS was also determined across external cause mechanisms of death. This was obtained to determine a conservative estimate of the proportion of cases that remained open when the ABS would have had to allocate cause of death ICD-10 coding. This way of representing time to case closure was chosen to be consistent with previous reports (Driscoll et al, 2003).

PART 4: RESULTS

4.1 The descriptive epidemiology of fatal injuries in NSW

This section describes fatal injuries in NSW residents who had their deaths registered between January 2000 and December 2003. Data sources and methods used in this section are described in Section 3.1.

4.1.1 Characteristics of all-cause deaths and fatal injuries by residential status

Tables 1 and 2 describe the characteristics of NSW deaths due to all causes and fatal injuries, respectively. Deaths registered in the period 2000 to 2003 and reported in the ABS mortality data for NSW were used for these tables. Each table describes the demographic details for all NSW deaths, deaths of usual NSW residents and deaths of overseas residents.

Sixty-nine per cent of fatal injuries occurred in males compared with 52% of all-cause deaths. There were also a higher proportion of males among deaths of overseas residents compared with NSW residents in both all-cause deaths and fatal injuries. A coroner certified 13% of all-cause deaths and 82% of fatal injuries. Of overseas residents who had their death registered in NSW, a coroner certified 50% of all-cause deaths and 96% of fatal injuries.

Almost all of the 182,445 all-cause deaths and the 10,113 fatal injuries in NSW residents registered between 2000 and 2003 occurred in the calendar year in which the death was registered or in the previous calendar year. In fact, only 76 (<0.1%) all-cause deaths and 25 (0.2%) injury deaths occurred earlier than this. Of those who died earlier, the maximum time from death to registration of death for all-cause deaths was 33 years (in cases registered in 2003) and 24 years for injury deaths (in cases registered in 2002). For both all-cause and injury deaths, 100% of the overseas residents died in the calendar year of the death registration or the year before.

Fewer than 2% of NSW all-cause deaths and 4% of NSW fatal injuries were registered outside of NSW. Of those registered outside of NSW, deaths were most often registered in Queensland, the Australian Capital Territory (ACT) and Victoria.

Table 1. Characteristics of NSW all-cause deaths registered between 2000 and 2003 by residential status

Year death was registered	2000			2001			2002			2003			TOTAL		
	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS
Resident status*															
Total deaths	45,409	45,282	127	44,552	44,438	114	46,384	46,245	139	46,110	46,010	100	182,445	181,975	480
Males (% column total)	23,445 (51.6)	23,359 (51.6)	86 (67.7)	23,192 (52.1)	23,118 (52.0)	74 (64.9)	23,953 (51.6)	23,862 (51.6)	91 (65.5)	23,531 (51.0)	23,465 (51.0)	66 (66.0)	94,121 (51.5)	93,804 (51.6)	317 (66.0)
Females (% column total)	21,964 (48.4)	21,923 (48.4)	41 (32.3)	21,360 (47.9)	21,320 (48.0)	40 (35.4)	22,431 (48.4)	22,383 (48.4)	48 (34.5)	22,579 (49.0)	22,545 (49.0)	34 (34.0)	88,334 (48.4)	88,171 (48.4)	163 (34.0)
Coroner certified (% column total)	5,961 (13.1)	5,892 (13.0)	69 (54.3)	5,714 (12.8)	5,654 (12.7)	60 (52.6)	5,583 (12.0)	5,517 (11.9)	66 (47.5)	5,607 (12.1)	5,563 (12.1)	44 (44.0)	22,865 (12.5)	22,626 (12.4)	239 (49.8)
% who died in the calendar year in which the death was registered	96.8	96.8	93.7		96.1	96.5		96.0	97.8		96.3	97.0	96.3	96.3	96.3
No. (%) who died ≥ 2 calendar years before the year the death was registered	17 (0.04)	17 (0.04)	0	16 (0.04)	16 (0.04)	0	24 (0.05)	24 (0.05)	0	19 (0.04)	19 (0.04)	0	76 (0.04)	76 (0.04)	0
Max. years between death and registration	19	19	1	29	29	1	29	29	1	33	33	1	33	33	1
% of deaths registered outside NSW	1.9	1.9	0	1.9	1.9	0	2.0	2.0	0	2.0	2.0	0			

Resident status:*

Total = all 'usual NSW residents' who had their deaths registered in any Australian state or territory and all overseas visitors who had their deaths registered in NSW with an underlying cause of death of all ICD-10 codes

NSW = all 'usual NSW residents' who had their deaths registered in any Australian state or territory with an underlying cause of death of all ICD-10 codes

OS = overseas residents who had their deaths registered in NSW with an underlying cause of death of all ICD-10 codes

Data extracted from HOIST on 20 April 2006 from the ABS Australian deaths dataset and restricted to NSW as state of residence and from the ABS overseas resident deaths dataset restricted to NSW by state of registration to match the ABS cause of death reports

Table 2. Characteristics of NSW fatal injuries registered between 2000 and 2003 by residential status

Year death was registered	2000			2001			2002			2003			TOTAL		
	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS	TOTAL	NSW	OS
Total deaths	2,486	2,455	31	2,556	2,534	22	2,569	2,538	31	2,502	2,488	14	10,113	10,015	98
Males (% column total)	1,733 (69.7)	1,709 (69.6)	24 (77.4)	1,768 (69.2)	1,756 (69.3)	12 (54.5)	1,773 (69.0)	1,749 (68.9)	24 (77.4)	1,686 (67.4)	1,675 (67.3)	11 (78.6)	6,960 (68.8)	6,889 (68.8)	71 (72.4)
Females (% column total)	753 (30.3)	746 (30.4)	7 (22.6)	788 (30.8)	778 (30.7)	10 (45.5)	796 (31.0%))	789 (31.1)	7 (22.6)	816 (32.6)	813 (32.7)	3 (21.4)	3,153 (31.2)	3,126 (31.2)	27 (27.6)
Coroner certified (% column total)	2,107 (84.8)	2,076 (84.6)	31 (100)	2,133 (83.5)	2,111 (83.3)	22 (100)	2,068 (80.5)	2,038 (80.3)	30 (96.8)	1,942 (77.6)	1,930 (77.6)	12 (85.8)	8,250 (81.6)	8,155 (81.4)	95 (96.9)
% who died in the calendar year the death was registered	95.4	95.4	93.6	94.2	94.2	95.5	93.6	93.6	96.8	94.8	94.7	100	94.5	94.6	95.9
N (%) who died ≥2 calendar years before the year the death was registered	6 (0.2)	6 (0.2)	0	5 (0.2)	5 (0.2)	0	8 (0.3)	8 (0.3)	0	6 (0.2)	6 (0.2)	0	25 (0.2)	25 (0.2)	0
Max. years between death and registration	19	19	1	14	14	1	24	24	1	9	9	1	24	24	1
% of deaths registered outside NSW	3.9	3.9	0	3.0	3.0	0	3.0	3.0	0	4.3	4.3	0	3.5	3.6	0

Resident status:*

Total = all 'usual NSW residents' who had their deaths registered in any Australian state or territory and all overseas visitors who had their deaths registered in NSW with an underlying cause of death ICD-10 code of V01–Y98

NSW = all 'usual NSW residents' who had their deaths registered in any Australian state or territory with an underlying cause of death ICD-10 code of V01–Y98

OS = all overseas visitors who had their deaths were registered in NSW with an underlying cause of death ICD-10 code of V01–Y98

Data extracted from HOIST on 20 April 2006 from the ABS Australian deaths dataset and restricted to NSW as state of residence and from the ABS overseas resident deaths dataset restricted to NSW by state of registration to match the ABS cause of death reports

4.1.2 Leading fatal injuries by mechanism

This section describes the leading mechanisms of fatal injury in NSW residents for the period January 2000 to December 2003. The ten leading mechanisms of fatal injury for males, females, NSW residents and overseas residents are described. The deaths are described by intent, i.e. intentional, unintentional and undetermined. Table 3 provides the rankings of all fatal injuries for each of the populations of interest.

Overall, the leading ten groups of fatal injury mechanisms account for 94% of NSW fatal injuries and the top five mechanisms account for 80% of NSW fatal injuries.

Intentional deaths

Suicide. Suicide describes intentional self-inflicted injury resulting in death. Suicide can be broken into sub-mechanisms by the method used, including hanging, strangulation or suffocation, poisoning by overdose or shooting by firearm. Suicide was the leading cause of fatal injury in NSW and is the leading cause of fatal injury for males. It was the third leading cause of fatal injury in females and overseas residents, accounting for 19% fatal injuries among females and 13% of fatal injuries among overseas residents.

Interpersonal violence. Interpersonal violence (IPV) is the term used to describe injury purposely inflicted by one or more persons on another person and is classified by the method used to inflict the injury. This was the sixth leading cause of fatal injury in NSW. It accounted for 4% of fatal injuries among males and 4% of fatal injuries among females, but only 1% of fatal injuries among overseas residents.

Unintentional deaths

Motor vehicle transport. Unintentional motor vehicle transport deaths were the second leading cause of fatal injury in NSW. Twenty-three per cent of fatal injuries among males and 19% of fatal injuries among females were due to motor vehicle transport. However, 37% of fatal injuries among overseas residents were due to motor vehicle transport, making this the leading cause of fatal injury in overseas residents.

Falls. Unintentional fall related deaths are classified by the circumstances in which the fall occurred. Sub-categories include falls on the same level, falls from one level to another, falls from ladders or scaffolding, falls from buildings or other structures, falls on stairs or steps, or other and unspecified falls. Unintentional falls were the fourth leading cause of fatal injury in NSW. Thirteen per cent of fatal injuries among females, 10% of fatal injuries among overseas residents and 8% of fatal injuries among males were due to unintentional falls.

Poisoning. Unintentional deaths due to poisoning are classified according to the substance causing the poisoning. An intentional self-inflicted poisoning is usually coded as a suicide and an intentional poisoning inflicted by another person as usually coded as

IPV. Unintentional poisonings were the fifth leading cause of fatal injury in NSW. Eight per cent of fatal injuries among males, 8% fatal injuries among females and 6% of fatal injuries among overseas residents were due to unintentional poisoning.

Drowning. Unintentional deaths due to drowning are classified by the location in which the drowning occurs. Intentional drowning is recorded under the suicide or interpersonal violence categories. Unintentional drowning was the seventh leading cause of fatal injury in NSW. Four per cent of fatal injuries among males and 4% of fatal injuries among females were due to unintentional drowning. However, 18% of fatal injuries among overseas residents were due to drowning, making this the second leading cause of injury death in this group.

Suffocation. Unintentional deaths due to suffocation are classified by the objects or circumstances that inhibit a person's ability to breathe (other than drowning). Intentional suffocation is included in suicide if self-inflicted or in IPV if inflicted by another person. Unintentional suffocation was the eighth leading cause of fatal injury in NSW. Four per cent of fatal injuries among females, 3% of fatal injuries among males and 1% of fatal injuries among overseas residents were due to unintentional suffocation or threats to breathing.

Complications of care. Complications of care are unintentional complications related to healthcare treatments or procedures. Complications of care were the ninth leading cause of fatal injury in NSW. About 3% of fatal injuries among females, 2% of fatal injuries among males and 2% of fatal injuries among overseas residents were due to complications of care.

Fire/burn. Fire-related and burn-related deaths are unintentional and are classified by the location or circumstances in which the fire or burn took place. They include exposure to fire, smoke and flames, and contact with heat or hot substances. Fire/burn related deaths were the tenth leading cause of fatal injury in NSW. Only 1% of fatal injuries among males and 1% of fatal injuries among females are due to exposure to fire, smoke, flames or contact with heat or hot substances.

Unspecified deaths

Accidental exposure to other and unspecified factors. Exposure to other and unspecified factors was the largest unspecified categorisation of fatal injury. This group includes all deaths thought to be injury related but unable to be further classified. Exposure to other and unspecified factors was the third largest fatal injury category in NSW, accounting for 12% of fatal injury in NSW. This category accounts for 7% of fatal injuries among males, and 1% of fatal injuries among overseas residents. With 22% of fatal injuries among females being classified 'Accidental exposure to other and unspecified factors', this was the leading fatal injury category for NSW females.

Table 3. Leading types of fatal injury by sex and resident status in deaths registered between 2000 and 2003

Rank	Total NSW N (% column)	Total NSW by sex N (% column)		Total NSW by resident status N (% column)	
		Male	Female	NSW residents	Overseas residents
1	Suicide 2,847 (28.2%)	Suicide 2,263 (32.5%)	Other & unspecified factors 696 (22.1%)	Suicide 2,834 (28.3%)	Motor vehicle transport 36 (36.7%)
2	Motor vehicle transport 2,212 (21.9%)	Motor vehicle transport 1,611 (23.1%)	Motor vehicle transport 601 (19.1%)	Motor vehicle transport 2,176 (21.7%)	Drowning 18 (18.3%)
3	Other & unspecified factors 1,213 (12.0%)	Poisoning 576 (8.3%)	Suicide 584 (18.5%)	Other & unspecified factors 1,212 (12.1%)	Suicide 13 (13.3%)
4	Falls 982 (9.7%)	Falls 565 (8.1%)	Falls 417 (13.2%)	Falls 972 (9.7%)	Falls 10 (10.2%)
5	Poisoning 815 (6.1%)	Other & unspecified factors 517 (7.4%)	Poisoning 239 (7.6%)	Poisoning 809 (8.1%)	Poisoning 6 (6.1%)
6	Interpersonal violence 408 (4.0%)	Drowning 299 (4.3%)	Interpersonal violence 127 (4.0%)	Interpersonal violence 407 (4.1%)	Natural/environmental #
7	Drowning 381 (3.8%)	Interpersonal violence 281 (4.0%)	Suffocation 109 (3.5%)	Drowning 363 (3.6%)	Complications of care #
8	Suffocation 316 (3.1%)	Suffocation 207 (3.0%)	Complications of care 108 (3.4%)	Suffocation 315 (3.2%)	Fire/burn #
9	Complications of care 231 (2.3%)	Complications of care 123 (1.8%)	Drowning 82 (2.6%)	Complications of care 229 (2.3%)	Interpersonal violence #
10	Fire/burn 131 (1.3%)	Fire/burn 84 (1.2%)	Fire/burn 47 (1.5%)	Fire/burn 130 (1.3%)	Machinery #
11	Struck by/against 77 (0.8%)	Struck by/against 64 (0.9%)	Natural/environmental 20 (0.6%)	Struck by/against 76 (0.8%)	Struck by/against #
12	Rail transport 58 (0.6%)	Rail transport 47 (0.7%)	Struck by/against 13 (0.4%)	Rail transport 58 (0.6%)	Suffocation #
13	Natural/environmental 56 (0.6%)	Firearm 38 (0.5%)	Rail transport 11 (0.3%)	Natural/environmental 52 (0.5%)	Water transport #
14	Air transport 47 (0.5%)	Air transport 37 (0.5%)	Air transport 10 (0.3%)	Air transport 47 (0.5%)	Other & unspecified factors #
15	Firearm 40 (0.4%)	Natural/environmental 36 (0.5%)	Firearm #	Firearm 40 (0.4%)	-
16	Machinery 24 (0.2%)	Machinery 24 (0.3%)	Water transport #	Machinery 23 (0.2%)	-
17	Water transport 16 (0.2%)	Water transport 14 (0.2%)	-	Water transport 15 (0.2%)	-
18	All other specified injuries 259 (2.6%)	All other specified injuries 174 (2.5%)	All other specified injuries 85 (2.7%)	All other specified injuries 257 (2.6%)	All other specified injuries #
Total injury	10 113	6960	3153	10 015	98

Fatal injuries = all deaths with an ICD-10 code of V01–Y98

Total NSW = NSW residents whose deaths were registered in any state or territory of Australia and overseas residents whose deaths were registered in NSW

NSW residents = NSW residents whose deaths were registered in any state or territory of Australia

Overseas residents = overseas residents whose deaths were registered in NSW

suppressed to prevent identification of cell counts less than five

ABS mortality data extracted from HOIST 20 April 2006

4.1.3 NSW age-standardised rates by fatal injury mechanism

Table 4 describes the age-standardised rates for males and females in each injury mechanism and the standardised mortality ratio for males compared to females. The ranking of age-standardised rates for injury mechanisms remains the same as the ranking by frequency for all NSW residents. 'Accidental exposure to other and unspecified factors' in females drops to the third leading mechanism of fatal injury when age-standardised rates are used to rank causes of death. For all fatal injury mechanisms, males are more likely to have died than females, as reflected by the standardised mortality ratios shown. This is most pronounced for deaths related to firearms, water transport, struck/by and against, rail transport and suicide.

Table 4. NSW age-standardised death rates/100,000 persons by fatal injury mechanism registered between 2000 and 2003

Injury mechanism	N	Rate [‡]	N	Males Rate [‡] (95% CI) ^{‡‡}	N	Females Rate [‡] (95% CI) ^{‡‡}	SMR** (95% CI)
Specified fatal injury categories							
Suicide§	2,845	10.76	2,261	17.47 (16.76–18.21)	584	4.34 (4.00–4.71)	4.00 (3.83–4.16)
Motor vehicle transport	2,212	8.36	1,611	12.46 (11.85–13.08)	601	4.40 (4.05–4.77)	2.84 (2.70–2.98)
Falls	982	3.59	565	5.00 (4.59–5.44)	417	2.47 (2.23–2.72)	2.15 (1.97–2.33)
Poisoning §	814	3.09	575	4.40 (4.05–4.78)	239	1.76 (1.55–2.00)	2.52 (2.32–2.74)
Interpersonal violence§	407	1.55	280	2.13 (1.89–2.40)	127	0.97 (0.81–1.15)	2.20 (1.95–2.47)
Drowning§	379	1.43	297	2.27 (2.02–2.55)	82	0.61 (0.49–0.76)	3.71 (3.30–4.15)
Suffocation§	315	1.17	206	1.71 (1.48–1.96)	109	0.73 (0.60–0.89)	2.32 (2.02–2.66)
Complications of care	231	0.84	123	1.09 (0.90–1.30)	108	0.68 (0.55–0.82)	1.58 (1.32–1.89)
Fire/burn	131	0.49	84	0.70 (0.56–0.87)	47	0.32 (0.23–0.42)	2.19 (1.74–2.71)
Struck by/against	77	0.29	64	0.49 (0.38–0.63)	13	0.10 (0.05–0.17)	5.15 (3.97–6.58)
Rail transport	58	0.22	47	0.36 (0.26–0.48)	11	0.08 (0.04–0.14)	4.70 (3.46–6.25)
Natural/environmental	56	0.21	36	0.30 (0.21–0.42)	20	0.13 (0.08–0.20)	2.30 (1.61–3.81)
Air transport	47	0.18	37	0.28 (0.20–0.38)	10	0.08 (0.04–0.14)	3.60 (2.53–4.96)
Firearm	40	0.15	#	0.29 (0.20–0.40)	#	0.02 (0.00–0.06)	18.54 (13.12–25.45)
Machinery	24	0.09	24	0.18 (0.12–0.27)	0	–	–
Water transport	16	0.06	#	0.11 (0.06–0.18)	#	0.02 (0.00–0.06)	6.87 (3.76–11.53)
Unspecified fatal injury category							
Accidental exposure to other and unspecified factors§	1 211	4.38	515	5.06 (4.62–5.52)	698	3.94 (3.65–4.24)	1.31 (1.20–1.42)
All injury §	10,104	37.82	6,951	55.68 (54.36–57.02)	3,153	21.19 (20.44–21.95)	2.98 (2.90–3.05)
Natural causes§	172,322	625.82	87,143	767.04 (761.87–772.23)	85,179	516.98 (513.47–520.49)	1.52 (1.51–1.53)

Death rates have been age-standardised using the 2001 mid-year Australian census population
NSW = NSW residents whose deaths were registered in any state or territory of Australia and overseas residents whose deaths were registered in NSW

Fatal injuries = deaths with an underlying cause of death ICD-10 code of V01–Y98

Natural causes = deaths with an underlying cause of death ICD-10 code of A00–R99

[‡]Rate = age-standardised rate/100,000 persons

^{‡‡}CI = 95% confidence interval (CI)

**SMR = standardised mortality ratio for male/female

Suppressed to prevent identification of cell counts less than five

§ Number of deaths records missing age: suicide (2); poisoning (1); interpersonal violence (1); drowning (2); suffocation (1); exposure to other and unspecified factors (2); all injury (9); and natural causes (20);

4.2 The evaluation of the NCIS as a tool for fatal injury surveillance in NSW

4.2.1 Coroner-certification of deaths by fatal injury mechanism

Table 5 lists the leading fatal injury mechanisms in NSW by the proportion of deaths in the injury mechanism that were certified by a coroner. All deaths certified by a coroner should appear on the NCIS. The level of coroner-certification of fatal injuries in the ABS mortality data can be used to predict how reliably the NCIS captures deaths in each fatal injury mechanism. Because 'accidental' deaths in those aged 65+ years that can be attributed to the person's age do not need to be referred to the coroner, we examined levels of coroner certification according to the age group of the person (<65 years or 65+ years of age).

Table 5. Proportion of deaths certified by a coroner in NSW deaths registered between 2000 and 2003, by age group and mechanism of death

Injury mechanism	Deaths		Deaths in those aged <65 years		Deaths in those aged 65+ years	
	N	% coroner-certified	N	% coroner-certified	N	% coroner-certified
Specified injury categories						
Air transport	47	100	39	100	8	100
Firearm	40	100	#	100	#	100
Interpersonal violence	408	100	384	100	24	100
Machinery	24	100	#	100	#	100
Water transport	16	100	#	100	#	100
Suicide	2,847	99.7	2,433	99.8	414	99.5
Motor vehicle transport	2,212	98.8	1,788	99.1	424	97.4
Drowning	381	98.7	326	99.1	55	96.4
Struck by/against	77	97.4	66	97	11	100
Rail transport	58	96.6	#	96.3	#	100
Poisoning	815	94.8	742	98.4	73	58.9
Fire/burn	131	93.9	60	100	71	88.7
Natural/ environmental	56	83.9	25	92	31	77.4
Suffocation	316	67.1	181	90.6	135	35.6
Fall	982	59.2	277	92.4	705	46.1
Complications of care	231	13.4	38	21.1	193	11.9
Unspecified injury categories						
Accidental exposure to other and unspecified factors	1,213	21.8	131	81.7	1,082	14.5
Total injury	10,113	81.6	6,787	97.5	3,326	49.1
Natural causes	172,342	8.5	30,466	22.4	141,876	5.5
Total deaths	182,455	12.5	37,253	36.1	145,202	6.5

NSW = NSW residents whose deaths were registered in any state or territory of Australia and overseas residents whose deaths were registered in NSW

Fatal injuries = deaths with an underlying cause of death ICD-10 code of V01–Y98

Natural causes = deaths with an underlying cause of death ICD-10 code of A00–R99

Suppressed to prevent identification of cell counts less than five

A coroner certified about 1 in 8 of all NSW deaths registered between 2000 and 2003 (Table 5). As expected, fatal injuries were more likely to be coroner-certified (82%) than natural cause deaths (9%). The proportion of deaths certified by a coroner also varied by the mechanism of fatal injury. Deaths related to air transport, firearm, interpersonal violence, machinery and water transport were coroner-certified 100% of the time. Other categories, such as complications of care (13%) and falls (59%) had much lower levels of coroner certification.

Seven other fatal injury mechanisms were coroner-certified more than 90% of the time. These were deaths related to suicide, motor vehicle transport, drowning, struck by/against, rail transport, poisoning and fire/burn-related deaths. The 12 fatal injury mechanisms that were coroner-certified more than 90% of the time accounted for 70% of all fatal injuries in NSW. These mechanisms are therefore likely to be reliably captured in the NCIS dataset.

The fatal injury categories less likely to be certified by a coroner included suffocation, falls, accidental exposure to unspecified factors and complications of care. Only 13–68% of deaths in these fatal injury categories were coroner-certified. These mechanisms are therefore unlikely to be reliably captured in the NCIS dataset.

There was also variation for some injury mechanisms in the level of coroner-certification by age group (Table 5). For deaths related to poisoning, the level of coroner certification was 98% in those aged < 65 years but 59% in those aged 65+ years. For falls, the level of coroner certification was 92% in those aged < 65 years but 46% in those aged 65+ years. For suffocation, the level of coroner certification was 91% in those aged < 65 years but 36% in those aged 65+ years. However, for most mechanisms of fatal injury there was over 90% coroner-certification in both those aged < 65 years and those aged 65+ years.

4.2.2 Coroner-certification by sub-mechanism of fatal injury

The proportion of deaths referred to a coroner varies within fatal injury mechanisms. To determine the extent of this variation the proportion of deaths in each sub-mechanism that were coroner-certified was examined for the mechanisms of fatal injury where less than 100% of deaths were coroner-certified.

Suicide

A coroner certified almost 100% of the 2,847 suicide deaths. Table 6 describes the proportion of deaths in each sub-mechanism of suicide that were certified by a coroner. The lowest level of coroner certification was in firearm related suicides (99%). A coroner certified all other sub-mechanisms of suicide 100% of the time except poisoning and suffocation. Therefore, it is likely that all sub-mechanisms of suicide are well represented in the NCIS.

Table 6. Level of coroner-certification of suicide deaths

Suicide sub-mechanisms Intentional self-harm (X60–X84)	Total in sub-mechanism	% coroner-certified
Jumping from a high building or structure	175	100
Other and unspecified means	94	100
Jumping or lying in front of a moving object	92	100
Sharp or blunt objects	66	100
Drowning	60	100
Suffocation	1,282	99.9
Poisoning	816	99.3
Firearm	262	98.9
Total	2,847	99.7

Motor vehicle transport

A coroner certified 99% of the 2,212 motor vehicle transport deaths. Table 7 describes the proportion of deaths in each motor vehicle transport sub-mechanism that were certified by a coroner. The lowest level of coroner certification was in deaths related to 'other and unspecified traffic' motor vehicle transport (92%) and approximately 25% of this sub-category was aged 65+ years. Motor vehicle transport related deaths in a non-traffic situation including motorcyclist, pedal cyclist and pedestrian deaths were coroner certified 100% of the time. A coroner certified all other sub-mechanisms of motor vehicle transport deaths more than 95% of the time. Therefore, it is likely that all sub-mechanisms of motor vehicle transport deaths are well represented in the NCIS.

Table 7. Level of coroner-certification of motor vehicle transport deaths

Motor vehicle sub-mechanisms V02–V04, V09 (not .0, .2), V12–V14, V19	Number in sub-mechanism	% coroner-certified
Pedestrian – non-traffic	33	100
Motorcyclist – non-traffic	26	100
Pedal cyclist – non-traffic	#	100
Motorcyclist – traffic	230	99.6
Pedestrian – traffic	379	99.5
Occupant – traffic	1,317	99.2
Occupant – non-traffic	70	98.6
Pedal cyclist – traffic	30	96.7
Other and unspecified – traffic	126	92.1
Other and unspecified – non-traffic	0	–
Total	2,212	98.8

Suppressed to prevent identification of cell counts less than five

Drowning

A coroner certified 99% of the 381 drowning deaths. Table 8 describes the proportion of deaths in each drowning sub-mechanism that were certified by a coroner. Boat-related drowning deaths had the lowest level of coroner certification level at 96%. A coroner certified drowning deaths occurring in bathtubs and pools 100% of the time. All sub-mechanisms of drowning deaths should be well represented in the NCIS.

Table 8. Level of coroner-certification of drowning deaths

Drowning sub-mechanisms (V90, V92, W65–70, W73–74)	Number in sub- mechanism	% coroner- certified
Pools	57	100
Bath tub	34	100
Natural water	174	99.4
Other and unspecified	70	97.1
Boat-related	46	95.7
Total	381	98.7

Struck by/against

A coroner certified 97% of the 77 struck by or against deaths. Table 9 describes the proportion of deaths in each struck by and against sub-mechanism that were certified by a coroner. People who died from being struck by or against a person or object had the lowest level of coroner-certification (97%). A coroner certified 'other and unspecified' struck by or against deaths 100% of the time. Most sub-mechanisms of struck/by and against deaths should be well represented in the NCIS.

Table 9. Level of coroner-certification of struck by/against deaths

Struck by/against sub-mechanisms (W20–23, W50–52)	Number in sub- mechanism	% coroner- certified
Other and unspecified	17	100
A person or object	60	96.7
Caught between two objects	0	0
Total	77	97.4

Rail transport

A coroner certified 97% of the 58 rail transport deaths. Table 10 describes the proportion of deaths in each rail transport sub-mechanism that were certified by a coroner. People who died as a result of being an occupant of rail transport had the lowest level of coroner-certification (93%). Most sub-mechanisms of rail transport deaths should be well represented in the NCIS.

Table 10. Level of coroner-certification of rail transport deaths

Rail transport sub-mechanisms (V05, V15, V80.6, V81(.2–.9))	Number in sub- mechanism	% coroner- certified
Pedestrian	44	97.7
Occupant	14	92.9
Pedal cyclist	0	0.0
Other and unspecified	0	0.0
Total	58	96.6

Poisoning

A coroner certified 95% of the 815 poisoning deaths. Table 11 describes the proportion of deaths in each poisoning sub-mechanism that were certified by a coroner. Unintentional poisoning by 'other and unspecified drugs or substances' had the lowest level of coroner-certification (74%). Unintentional poisoning by 'gases or vapours' was coroner-certified 100% of the time. All other categories of unintentional poisoning were coroner-certified more than 90% of the time. Most sub-mechanisms of poisoning deaths should be well represented in the NCIS, with the exception of unintentional poisoning by 'other and unspecified drugs or substances'.

Table 11. Level of coroner-certification within poisoning deaths

Poisoning sub-mechanisms (X40–49)	Number in sub- mechanism	% coroner- certified
Gases and vapours	36	100
Narcotics and hallucinogens	292	99.0
Antidepressants, barbiturates and tranquillisers	106	97.2
Alcohol	27	96.3
Other pharmaceuticals	331	91.2
Other and unspecified drugs or substances	23	73.9
Total	815	94.9

Fire/burn (exposure to fire, smoke and flames and contact with heat and hot substances)

A coroner certified 94% of the 131 fire/burn deaths. Table 12 describes the proportion of deaths in each fire or burn sub-mechanism that were certified by a coroner. Deaths related to burns from contact with heat or hot substances had the lowest level of coroner-certification (73%). Deaths related to fire 'not in buildings' were all coroner-certified. The other sub-categories of fire/burn death were coroner-certified more than 90% of the time. Most categories of fire and burn related deaths should be well represented in the NCIS, with the exception of deaths related to burns from contact with heat or hot substances.

Table 12. Level of coroner-certification of fire/burn deaths

Fire/burn sub-mechanisms (X00–19)	Number in sub- mechanism	% coroner- certified
Fire – not in a building	8	100
Fire – in private a private dwelling or other building	77	98.7
Other and unspecified means	31	90.3
Burn – contact with heat and hot substances	15	73.3
Total	131	93.9

Natural/environmental

A coroner certified 84% of the 56 natural/environmental deaths. Table 13 describes the proportion of deaths in each natural or environmental sub-mechanism that were certified by a coroner. Deaths related to 'excess temperatures' had the lowest level of coroner-certification (79%). Natural or environmental deaths related to 'natural events' were coroner-certified 100% of the time. The other categories of natural environmental deaths were coroner-certified more than 80% of the time. Most categories of natural environmental deaths should be well represented in the NCIS. The second largest category of natural or environmental deaths was 'other and unspecified'. As this category had a high proportion of cases coroner-certified, the NCIS may be useful to describe the types of fatal injuries that are coded in this way.

Table 13. Level of coroner-certification of natural/environmental deaths

Natural/environmental sub-mechanisms (W42–43, W53–64, W92–99, X20–39, X51–57)	Number in sub- mechanism	% coroner- certified
Natural events	5	100
Other and unspecified	12	91.7
Venomous plants or animals	5	80.0
Excess temperatures (hot or cold)	34	79.4
Dog bites	0	#
Total	56	83.9

Suppressed to prevent identification of cell counts less than five

Suffocation

A coroner certified 67% of the 316 unintentional suffocation deaths. Table 14 describes the proportion of deaths in each suffocation sub-mechanism that were certified by a coroner. Suffocation due to non-food causing obstruction had the lowest proportion of deaths coroner-certified (11%). All other categories were coroner-certified more than 70% of the time. Most categories of death related to suffocation should be well represented in the NCIS, with the exception of those caused by obstruction. The largest category of deaths related to suffocation was 'other and unspecified'. As this category had a high level of coroner-certification (96%), the NCIS may be useful to describe the types of fatal injuries that are coded in this way.

Table 14. Level of coroner-certification of suffocation deaths

Suffocation sub-mechanisms	Number in sub- mechanism	% coroner- certified
In bed	12	100
Other and unspecified	140	95.7
Due to food causing obstruction	80	71.3
Due to non-food object causing obstruction	84	10.7
Cave in	0	-
Total	316	67.1

Falls

A coroner certified only 59% of the 982 deaths coded as fall-related. Table 15 describes the proportion of deaths in each fall sub-mechanism that were certified by a coroner. Other and unspecified falls made up 54% of all falls reported but only 32% of these were coroner-certified. This category is the reason that overall fall-related deaths have a relatively low level of coroner-certification. All other falls sub-categories were coroner-certified over 85% of the time, and are well represented in the NCIS. Despite a low level of coroner-certification, the NCIS may still be useful in describing fatal injuries that are coded as 'other and unspecified falls' as 169 of these deaths were coroner-certified, providing a reasonable number of cases that could be reviewed.

Table 15. Level of coroner-certification of falls deaths

Falls sub-categories	Number in sub-mechanism	% coroner-certified
Building or other structure	78	97.4
Ladder or scaffolding	32	96.9
Stairs/steps	78	92.3
One level to another	109	91.7
Same level	156	85.3
Other and unspecified	529	32.0
Total	982	59.2

Complications of care

A coroner certified only 13% of complications of care. Table 16 describes the proportion of deaths in each complications of care sub-mechanism that were certified by a coroner. The only sub-mechanism of complications of care that had a reasonable level of coroner-certification was 'misadventure to patient during surgical or medical care'. These are mostly due to unintentional cut, puncture, perforation or haemorrhages during surgical or medical care but they still predominantly occur in older people, with 67% being aged 65+ years. Most categories of death related complications of care are not well represented in the NCIS, with the exception of deaths caused by 'misadventure to patient during surgical or medical care'.

Table 16. Level of coroner-certification of complications of care deaths

Complications of care sub-mechanisms	Number in sub-mechanism	% Coroner-certified
Misadventure to patient during surgical or medical care	9	77.8
Surgical and other medical procedures as the cause of abnormal reaction of the patient, or later complication, without mention of misadventure at the time of the procedure	162	11.1
Drugs medicaments and biological substances in therapeutic care	59	10.2
Medical devices associated with adverse incidents in diagnostic and therapeutic use	#	0
Total	231	13.4

Suppressed to prevent identification of cell counts less than five

Accidental exposure to other and unspecified factors

A coroner certified only 22% of deaths due to accidental exposure to other and unspecified factors. Table 17 describes the proportion of deaths in each sub-category of other and unspecified deaths that were certified by a coroner. A coroner certified 22% of all deaths coded as X59. A doctor certified the majority of deaths coded as X59, so the ABS only had the information contained on the medical cause of death code underlying cause of death. The medical cause of death probably suggested a fatal injury but did not have enough specific information to confirm the external cause of death.

Table 17. Level of coroner-certification of accidental exposure to other and unspecified factor deaths

Accidental exposure to other and unspecified sub-categories	Number in sub-category	% coroner-certified
X58: Accidental exposure to other specified factors	#	100
X58 and X59: Accidental exposure to other and unspecified factors	#	21.8
Total	1,213	21.8

Suppressed to prevent identification of cell counts less than five. The number of deaths due to (X58: Accidental exposure to other specified factors) was <5.

4.2.3 A comparison of NSW deaths in the NCIS and the ABS mortality data

This section describes the reliability of the NCIS to capture all deaths the NSW ABS mortality data and coroner-certified deaths. The ABS mortality data and the NCIS dataset were compared. All deaths of NSW residents registered in any state or territory and all overseas visitors who had their deaths registered between 1 July 2000 and 31 December 2003 were included in this comparison. This section also describes how timely complete information becomes available on the NCIS for each fatal injury mechanism.

The NCIS coverage of all-cause deaths and fatal injuries by year of death registration

A total of 161,894 NSW all-cause deaths and 8 847 NSW fatal injuries were registered and in the ABS mortality data for the period 1 July 2000 to 31 December 2003 (Table 18). Of these 12% of all-cause deaths, and 81% of fatal injuries, were coroner-certified. This is almost the same as the coroner-certification levels for the period 1 January 2000 to 31 December 2003 described in Section 4.1.1.

Table 18. Comparing ABS mortality data and the NCIS data by year of registration from July 2000 to December 2003

NSW deaths in the NCIS and ABS mortality data	2000	2001	2002	2003	Total
NSW deaths in ABS mortality data	Jul-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jul 00-Dec03
All-cause deaths in ABS	24,848	44,552	46,384	46,110	161,894
Coroner-certified deaths	3,058	5,714	5,583	5,607	19,962
Fatal injuries	1,220	2,556	2,569	2,502	8,847
Coroner-certified fatal injuries	1,019	2,133	2,068	1,942	7,162
NSW deaths in the NCIS	Jul -Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jul 00-Dec03
All-cause deaths in the NCIS with ICD-10	2,684	5,307	5,028	5,000	18,019
All-cause deaths in the NCIS without ICD-10	401	541	619	555	2,176
All-cause deaths in NCIS with and without ICD-10	3,085	5,848	5,647	5,555	20,195
Proportion of coroner-certified deaths in NCIS with ICD-10	87.8%	92.9%	90.1%	89.2%	90.3%
Proportion of coroner certified deaths in NCIS with or without ICD-10	100.9%	102.3%	101.1%	99.1%	101.2%
Fatal injuries with ICD-10	857	1,926	1,826	1,749	6,358
Proportion of coroner-certified fatal injuries in NCIS with ICD-10	84.1%	90.3%	88.3%	90.1%	88.8%

NSW deaths = NSW residents who had their death registered in any state or territory of Australia and overseas residents who had their death registered in NSW, reported in ABS mortality data for the period 1 July 2000 to 31 December 2003

Fatal injuries = deaths with an underlying cause of death ICD-10 code of V01-Y98

ABS mortality data extracted 20 April 2006

NCIS deaths extracted 15 September 2006

In the NCIS dataset 2, 195 NSW all-cause deaths and 6,358 NSW fatal injuries could be identified for the period 1 July 2000 to 31 December 2003 (Table 18). There were 233 additional all-cause deaths identified in the NCIS data (20,165 deaths) than were coroner-certified in the ABS mortality data (19,962 deaths). Of the 20,195 all-cause deaths identified in the NCIS data, 11% (2 176) did not have an ICD-10 underlying cause of death code. This is most likely because a matching ABS death record was not identified by the probabilistic matching process. The NCIS death records without ICD-10 codes can only be identified by the NCIS staff, rather than through the NCIS web interface. No further information on these cases could be obtained from the NCIS during the period when this report was being written. It is understood, that such information is now available and could be useful in validating some of the comments about possible cases not being included.

In NSW, 90% of all-cause deaths and 89% of fatal injuries referred to a coroner between 1 July 2000 and 31 December 2003 were identified in the NCIS dataset. This is an underestimation of how reliably deaths are captured in the NCIS, as the deaths without ICD-10 codes could not be included in the analysis.

The NCIS coverage of fatal injuries

The reliability with which NCIS captures deaths in each mechanism of fatal injury depends on the level of coroner-certification of the mechanism and the proportion of these coroner-certified deaths that can then be identified in the NCIS dataset.

Table 19 lists for each fatal injury mechanism the number and proportion of NSW deaths and coroner-certified deaths that were identified in the NCIS dataset for the period 1 July 2000 to 31 December 2003.

The ten most frequent fatal injury mechanisms in NSW ABS data for the period 1 July 2000 to 31 December 2003 were, in decreasing order: suicides; motor vehicle transport; accidental exposure to other and unspecified factors; falls; unintentional poisonings; interpersonal violence; drowning; suffocations; complications of care and fire/burn. This was the same ranking as for the period 1 January 2000 to 31 December 2003, in Section 4.1.2.

The ten fatal injury mechanisms in NSW for the period 1 July 2000 to 31 December 2003 with the highest level of coroner-certification were, in decreasing order: interpersonal violence (100%); air transport (100%); firearm (100%); machinery (100%); water transport (100%); suicide (100%); motor vehicle transport (99%); drowning (99%); rail transport (98%) and struck by/against (97%). This was almost the same ranking as for the period 1 January 2000 to 31 December 2003, in Section 4.2.1. However, it should also be noted that in some cases, e.g. for water transport injuries, that the absolute number of cases is small. Of the ten most frequent fatal injury mechanisms, accidental exposure to other and unspecified factors, falls, suffocations and complications of care were not frequently referred to a coroner.

The ten most frequent fatal injury mechanisms in the NSW NCIS data for the period 1 July 2000 to 31 December 2003 in descending order were: suicides; motor vehicle transport; unintentional poisonings; falls; interpersonal violence; drowning; suffocations; fire/burn and struck by/against. The level of coroner-certification and number of deaths in each fatal injury mechanisms will influence this ranking.

The NCIS captures 89% of coroner-certified fatal injuries and 91% of coroner-certified natural cause deaths in the ABS mortality data. The NCIS most reliably captures the coroner-certified deaths in the following ten fatal injury mechanisms: suffocation (93%); falls (92%); rail transport (90%); suicide (90%); accidental exposure to other and unspecified factors (90%); poisoning (89%); air transport (89%); motor vehicle transport (89%); struck by/against (88%) and firearm (87%). The fatal injury mechanism with the lowest proportion of coroner-certified deaths on the NCIS was water transport (71%). Therefore, coroner-certified deaths are usually contained in the NCIS dataset.

The NCIS captures 72% of all NSW fatal injuries but only 8% of all NSW natural cause deaths contained in the ABS mortality data. The NCIS most reliably captures all NSW deaths in the following ten fatal injury mechanisms: suicide (90%); air transport (89%); rail transport (89%); motor vehicle transport (88%); firearm (87%); struck by/against

(86%); poisoning (84%); interpersonal violence (82%); machinery (81%) and fire/burn (78%). The least reliably captured fatal injury mechanism when considering all NSW deaths is complications of care with only 11% of deaths on the NCIS.

The true reliability in which the NCIS captures coroner-certified and all deaths was underestimated as 11% of all-cause deaths on the NCIS did not have an underlying cause of death ICD-10 code, so could not be included in the analysis. The NCIS reliably captures coroner-certified fatal injuries in NSW. However, when considering all NSW fatal injuries, the NCIS does not reliably capture fatal injury mechanisms with low levels of coroner-certification as was predicted in Section 4.2.1.

Table 19. Coverage of NSW ABS mortality data by mechanism of death in the NCIS data registered between July 2000 and December 2003

Mechanism of death	NSW deaths in ABS mortality data		% NSW deaths coroner-certified			NSW deaths in the NCIS		% of NSW coroner-certified deaths in the NCIS		% of NSW deaths in the NCIS	
	Rank	N	N	Rank	%	Rank	N	Rank	%	Rank	%
Natural causes	1	15,3047	12,800	18	8.4	1	11,661	3	91.1	18	7.6
Fatal injury mechanisms											
Suicide	2	2,447	2,438	6	99.6	2	2,197	5	90.1	1	89.8
Motor vehicle transport	3	1,885	1,861	7	98.7	3	1,656	9	89.0	4	87.9
Exposure to other & unspecified factors	4	1,085	239	16	22.0	8	214	6	89.5	16	19.7
Falls	5	869	510	15	58.7	5	467	2	91.6	15	58.7
Poisoning	6	739	699	11	94.6	4	624	7	89.3	7	84.4
Interpersonal violence	7	352	352	1	100	6	289	13	82.1	8	82.1
Drowning	8	341	336	8	98.6	7	263	16	78.3	11	77.1
Suffocation	9	290	190	14	65.5	9	176	1	92.6	14	60.7
Complications of care	10	220	29	17	13.2	16	23	15	79.3	17	10.5
Fire/burn	11	117	109	12	93.2	10	91	12	83.5	10	77.8
Struck by/ against	12	69	67	10	97.1	11	59	10	88.1	6	85.5
Rail transport	13	53	52	9	98.1	12	47	4	90.4	3	88.7
Natural/environmental	14	50	41	13	82.0	15	31	17	75.6	13	62.0
Air transport	15	46	46	1	100	13	41	8	89.1	2	89.1
Firearm	16	37	37	1	100	14	32	11	86.5	5	86.5
Machinery	17	21	21	1	100	17	17	14	81.0	9	81.0
Water transport	18	14	14	1	100	18	10	18	71.4	12	71.4
All others		212	129		57.1		121		100		57.1
NSW fatal injuries		8,847			81.0		6,358		88.8		71.9
NCIS deaths with ICD-10 missing							2,176				
All-cause NSW deaths		161,894			12.3		20,195		101.2		12.5

NSW deaths = NSW residents who had their death registered in any state or territory of Australia and overseas residents who had their death registered in NSW, reported in ABS mortality data for the period 1 July 2000 to 31 December 2003

Fatal injuries = deaths with an underlying cause of death ICD-10 code of V01–Y98

NCIS deaths = deaths of coroner-certified NSW residents and overseas residents that appear in the NCIS dataset

All-cause deaths = deaths with an underlying cause of death ICD-10 code of A00–R99

ABS mortality data extracted 20 April 2006, NCIS deaths extracted 15 September 2006

4.3 Time to case closure of all-cause deaths and fatal injuries contained in the NCIS dataset

The timeliness in which coroners' cases are closed and data are complete and available on the NCIS will affect how the NCIS can be used for injury prevention research. Timeliness of closing cases will also affect the information that is available to code underlying cause of death in coroner-certified deaths.

Table 20 describes the time in months to have 25%, 50% and 75% of cases on NCIS closed in each mechanism of death. The time to case closure is the time between the date the NCIS is notified of the death and the date the NCIS is notified that a case is closed. The median time to case closure for all NSW fatal injuries on the NCIS was significantly higher at 17.4 months (95% CI: 16.9–17.9 months) than natural cause deaths at 12.0 months (95% CI = 11.7–12.4 months), (log-rank test $\chi^2_1 = 201.7$, $p < 0.0001$).

Across fatal injury mechanisms variation existed in the median time to case closure. Machinery-related deaths had the shortest median time to case closure at 11.9 months (95% CI: 9.5–15.5 months) and air transport related deaths the longest at 34.1 months (95% CI: 25.4–40.1 months). As a result, only 6% of machinery cases, but over 70% of air transport cases, remained open two years after the NCIS was notified of the death. It is likely that the complexity of the coronial inquiry required significantly influences the time to case closure across fatal injury mechanisms. The Australian Transport Safety Bureau, for example, may become involved in investigating air, rail, marine or road transport deaths depending on the severity of the incident, the number of people involved and the potential for the investigation to reduce further deaths in the transport industry.

All fatal injury mechanisms had a significant portion of cases remaining open two years after the notification of the death. This two-year time period was chosen as this is the longest likely time from NCIS case notification until the ABS would have to code underlying cause of death. Therefore, using this conservative estimate at least 31% of fatal injury cases would have remained open at the time the ABS coded underlying cause of death. Minimal information would have been available on the NCIS to assist coding. Therefore, the information contained on the interim death certificate would be used, so deaths would be more likely to be coded less specifically or even as unspecified deaths.

Therefore, for many fatal injury mechanisms the NCIS is unable to provide timely and complete information for underlying cause of death coding and fatal injury prevention research in NSW. For some fatal injury mechanisms, a prolonged period would need to lapse before adequate case numbers are available for injury prevention research using the NCIS in NSW. This is due to the complex and lengthy coronial inquiry required to investigate these types of fatal injuries. The NCIS itself has little scope for reducing these times.

Table 20. Months to close death cases contained in the NCIS dataset by cause of death

Mechanism of death	N	Months until 25% of all cases are closed (95% CI)	Months until 50% of all cases are closed (95% CI)	Months until 75% of all cases are closed (95% CI)	% remaining open 2 years following notification
Natural causes	11,660*	4.2 (4.1–4.3)	12.0 (11.7–12.4)	22.8 (22.4–23.3)	23.2%
Fatal injury mechanisms					
Machinery	17	9.5 (5.9–11.9)	11.9 (9.5–15.5)	15.5 (11.9–23.7)	5.9%
Fire/burn	91	6.2 (4.2–10.2)	13.6 (11.6–17.8)	24.7 (18.9–33.3)	26.4%
Falls	467	7.6 (6.8–8.9)	14.6 (12.9–16.8)	23.9 (22.2–24.7)	24.2%
Poisoning	624	7.1 (6.5–7.9)	15.4 (13.7–17.0)	23.0 (21.8–24.2)	22.4%
Suicide	2,197	7.2 (6.7–7.7)	15.6 (14.8–16.4)	24.6 (23.9–25.5)	26.5%
Natural/environmental	31	6.9 (2.9–16.2)	17.4 (11.4–22.6)	25.8 (17.9–29.6)	29.0%
Exposure to other and unspecified factors	214	7.9 (6.5–9.9)	17.0 (14.1–21.1)	27.6 (25.7–33.2)	35.5%
Complications of care	23	12.0 (3.6–17.4)	17.5 (12.4–28.4)	30.7 (17.8–49.8)	39.1%
Water transport	10	13.1 (1.7–18.0)	18.0 (13.1–22.6)	22.6 (18.0–24.9)	10.0%
Rail transport	47	9.7 (6.5–15.5)	19.4 (14.0–22.2)	25.9 (21.5–37.1)	34.0%
Suffocation	176	9.7 (7.6–11.7)	19.1 (17.3–20.8)	27.1 (24.5–32.0)	33.0%
Motor vehicle transport	1,656	10.4 (9.5–11.0)	19.1 (18.4–19.8)	28.9 (27.6–30.3)	34.5%
Drowning	263	9.3 (7.3–11.2)	19.5 (17.3–21.5)	30.4 (27.5–42.0)	36.5%
Interpersonal violence	289	10.0 (8.5–12.5)	22.0 (18.9–23.9)	42.6 (34.4–47.3)	43.9%
Struck by/against	59	11.0 (6.0–15.6)	23.5 (15.6–28.6)	34.9 (28.6–#)	47.4%
Firearm	32	16.3 (11.3–21.7)	23.9 (18.1–30.4)	36.1 (25.4–47.7)	50.0%
Air transport	41	22.8 (21.6–28.2)	34.1 (25.4–40.1)	##	70.7%
Fatal injuries in the NCIS	6,358	8.5 (8.1–8.8)	17.4 (16.9–17.9)	26.4 (25.9–27.1)	30.5%
All-cause deaths in the NCIS	18,018	5.4 (5.3–5.6)	13.9 (13.6–14.4)	24.4 (24.1–24.7)	25.8%

N = number of open and closed cases on NCIS with ICD-10 code allocated

**One case missing from analysis*

NCIS cases = deaths of coroner-certified NSW residents and overseas residents that appear in the NCIS dataset and were registered between 1 July 2000 and 31 December 2003

Fatal injuries = deaths with an underlying cause of death ICD-10 code of V01–Y98

All-cause deaths = deaths with an underlying cause of death ICD-10 code of A00–R99

NCIS deaths extracted 15 September 2006

#Upper confidence interval unable to be calculated

##Time to case closure and confidence intervals unable to be calculated

4.3 Documents attached to NCIS case records for all-cause deaths and fatal injuries

The textual documents attached to the NCIS death record provide additional information about the death. Police reports often include important information regarding the setting and mechanism of the injurious incident; however, they provide information from an early stage of the death investigation. Autopsy reports provide very detailed information on the pathological cause of death and the contribution drugs or alcohol may have had on the fatal injury, as the toxicology reports are included within the body of the autopsy report in NSW. In NSW, the coroner's finding document is usually the final summation from the court transcript of the inquiry. For these documents to be consistently useful, they need to be reliably attached to the NCIS death record.

Table 21 describes the proportion of cases in each fatal injury mechanism on the NCIS dataset that have each of the key NSW textual documents attached. This analysis included open and closed cases that had an ICD-10 code attached. In NSW, police reports should be attached to all cases on the NCIS, as it is the police who officially refer the death to the coroner. Police reports are likely to be one of the most useful textual documents for injury prevention researchers; however, care should be taken with interpretation of intent as the police report describes the beginning of the death investigation rather than the conclusions reached. Police reports were attached to 84% of all NCIS case records. Similarly, 82% of fatal injury cases on the NCIS had police reports attached. The fatal injury category with the largest proportion (96%) of cases on the NCIS with police reports attached was IPV. The police investigation of deaths related to interpersonal violence is a necessary part of the criminal investigation. Rail transport deaths also had police reports attached almost all of the time (96%). The fatal injury category with the lowest proportion of cases on the NCIS with police reports attached (72%) was 'accidental exposure to other and unspecified factors'. Not having a police report attached at the time the ABS allocated UCOD ICD-10 codes may also increase the likelihood that deaths are coded to this non-specific code.

Autopsy reports will only be attached when a forensic autopsy has been done. Not all deaths referred to the coroner will require a forensic autopsy; however, some fatal injuries mechanisms are more likely to require an autopsy to determine the cause of death. Forty-four per cent of all-cause deaths and 45% of injury deaths had autopsy reports attached. Across injury mechanisms, the proportion of cases with autopsy reports attached varied from 70% for interpersonal violence to 35% for motor vehicle transport related deaths. Variable amounts of information on the setting and mechanism of the injurious incident are included in the autopsy report. There were more autopsy reports attached than were stated to have occurred therefore, only the proportion of cases with autopsy reports attached have been reported.

In NSW, coroner's findings are only attached when an inquest is held. This is in contrast to the practice in other states where other coronial documents, including a statement of the cause of death, may be attached and referred to as findings. Only 6% of fatal injury cases had coroner's findings attached; however, fewer all-cause deaths (4%) had findings attached. Rail transport had the highest proportion of cases with coroner's findings attached at 25% and suicide the lowest at 3%.

Table 21. Proportion of death records (by cause of death) in the NCIS dataset with police, autopsy and coroner's findings attached

Mechanism of death	NSW deaths from the ABS mortality data contained in the NCIS dataset	Number and % of death records in the NCIS dataset with police reports attached		Number and % of death records in the NCIS dataset with autopsy report attached		Number and % of death records in the NCIS dataset with coroner's finding attached	
	N	N	%	N	%	N	%
Natural causes	11,661	9,775	83.8	5,007	42.9	278	2.4
Fatal injury mechanisms							
Suicide	2,197	1,885	85.8	976	44.4	64	2.9
Motor vehicle transport	1,656	1,331	80.4	585	35.3	112	6.8
Exposure to other and unspecified factors	214	153	71.5	77	36.0	10	4.7
Falls	467	413	88.4	278	59.5	19	4.0
Poisoning	624	551	88.3	384	61.5	24	3.8
Interpersonal violence	289	277	95.8	203	70.2	41	14.2
Drowning	263	212	80.6	106	40.3	20	7.6
Suffocation	176	145	82.3	87	49.4	11	6.3
Complications of care	23	17	73.9	10	43.5	#	4.3
Fire/burn	91	81	89.0	52	57.1	6	6.6
Struck by/against	59	53	89.8	26	44.1	10	16.9
Rail transport	47	45	95.7	31	66.0	12	25.5
Natural/environmental	31	26	83.9	18	58.1	#	6.5
Air transport	41	35	85.4	19	46.3	#	9.8
Firearm	32	22	68.8	13	40.6	#	12.5
Machinery	17	14	82.4	9	52.9	#	17.6
Water transport	10	8	80.0	#	40.0	0	0.0
All other fatal injuries	121	98	81.0	57	47.1	18	14.9
Fatal injuries in the NCIS	6,538	5,366	82.1	2,935	44.9	361	5.5
All-cause deaths in the NCIS	18,019	15,141	84.0	7,942	44.1	639	3.5

Suppressed to prevent identification of cell counts less than five

N rank = ranking of mechanism of death from highest to lowest frequency

% rank = ranking of mechanism of death from highest to lowest proportion

Fatal injuries = ICD-10 codes V01–Y98

All-cause deaths = all ICD-10 codes

NCIS deaths = deaths of coroner-certified NSW residents and overseas residents that appear in the NCIS dataset

NCIS deaths and number of documents attached extracted 15 September 2006

PART 5: DISCUSSION AND RECOMMENDATIONS

5.1 NCIS coverage of coroner-certified deaths

During the period July 2000 to December 2003, NSW fatal injuries that were intentional or of uncertain intent (such as suicide, interpersonal violence and poisonings) were generally reported to a coroner. Fatal injury mechanisms related to transport or machinery were always referred to a coroner in NSW.

This report has demonstrated that the NCIS reliably captured most coroner-certified injury fatalities in NSW. In fact, 89% of coroner-certified fatal injuries of NSW residents registered between July 2000 and December 2003 were identified in the NCIS dataset. There was some variability in the level of captured of coroner-certified deaths across fatal injury mechanisms, ranging from 71% of coroner-certified water transport related deaths to 93% of coroner-certified suffocations. It should be noted that these figures are an underestimation of how reliably the NCIS captures coroner-certified deaths because some NCIS case records (approx 11%) did not have an ICD-10 underlying cause of death code and so could not be included in the comparison. The ICD-10 codes have been added to records in the NCIS to provide some additional information, sourced from the ABS, but are not the only manner in which all external cause deaths can be identified. It would be useful if both the NCIS and the ABS had a common unique identifier in their electronic records that could facilitate the linking of these records and ensuring that all injury deaths can be identified. Currently, the only option is to adopt a probabilistic matching process that results in some NCIS case records not having ICD-10 codes for underlying and contributing causes attached.

Our analysis has shown that the NCIS does not reliably record all fatal injury events in some sub-mechanisms. This is because fatal injury sub-mechanisms that are infrequently reported to a coroner for investigation will not be captured in the NCIS dataset. This is particularly relevant to some complications of care categories such as 'drugs, medicaments and biological substances used in therapeutic care' and 'surgical and other medical procedures causing abnormal reaction or later complication, without misadventure at the time of the procedure' which were only reported to a coroner 10% and 11% of the time, respectively.

In summary, most coroner-certified injuries should be identifiable in the NCIS dataset if all NCIS death records have an ICD-10 code and the mechanism of injury is usually reported to a coroner for investigation. However, it may be possible that some cases flagged as coroner-certified by the ABS could be removed from the NCIS if they end up being certified by a doctor after being reported to a coroner. This could account for some of the discrepancy in the numbers of coroner-certified cases in the NCIS and ABS. The NCIS therefore is a useful tool to support the surveillance of coroner-certified deaths in NSW but may have some limitations in coverage for all deaths. There is a direct relationship between how reliably the NCIS captures a particular fatal injury mechanism and the level of coroner-certification of that fatal injury mechanism. Given the wealth of information available in the NCIS, the NCIS dataset is most useful for understanding the risk factors for injury, especially for particular mechanisms and age groups.

Recommendations

Consideration should be given towards developing and including a unique identifier in both ABS mortality data and the NCIS death records to aid the process of adding ICD-10 underlying and contributing cause of death codes to the NCIS death record.

The NCIS can reliably be used for surveillance of fatal injuries and identification of key risk factors, in NSW residents in all injury sub-mechanisms except:

- complications of care due to drugs, medicaments and biological substances used in therapeutic care (Y40-Y59)
- complications of care due to surgical and other medical procedures causing abnormal reaction or later complication, without misadventure at the time of the procedure (Y83-Y84)
- accidental exposure to unspecified factors (X59)
- suffocations due to non-food objects causing obstruction (W80)
- other and unspecified falls (W04, W16, W19).

5.2 The capture of cases aged 65+ years

This report has shown that the NCIS is unlikely to capture the fatal injuries of people aged 65+ years reliably, particularly if the nature of the injury is related to the age of the person and the death does not occur in a hospital or nursing home. This is because of the criteria outlined in sub-Section 2 of Section 12B of the NSW *Coroners Act 1980*. For the mechanisms suffocation, falls and complications of care, less than 50% of deaths of people aged 65+ years were coroner-certified. For deaths due to exposure to other and unspecified factors, the proportion in people aged 65+ years was about 15%.

One solution to improving NCIS capture of older people would be to refer more injury-related deaths of people aged 65+ years to a coroner in NSW. However, this increasing workload could have the adverse effect of increasing the overall time to case closure in NSW and, with it, decrease the quality of mortality coding. A preferred solution with a likely bigger impact on improving fatal injury surveillance for older people would be to improve the quality of external cause reporting on the medical cause of death, thus reducing the use of unspecified codes. There is, however, an example from another jurisdiction where increased coronial involvement has improved the quality of cause of death coding in older people for particular injury mechanisms. In Victoria, coronial involvement in investigating fall-related deaths in hospitals has increased the mechanism 'fall' being noted on the *Medical Certificate of Cause of Death*, rather than just the injury details, such as fractured neck of femur (ABS, 2007).

Recommendations

Given the importance of accurate external cause of death information on death certificates, particularly in people aged 65+ years who are less likely to have their death investigated by a coroner, consideration should be given to improving the reporting of information in the *Medical Certificate of Cause of Death* section of death certificates.

5.3 Timeliness of complete data in the NCIS

Unlike natural cause deaths, external causes of death are manually coded through a time-consuming process (ABS, 2007). The NCIS is only able to close their death record once the coronial process is complete and they do not have any control over the timing of this. The more complex the coronial investigation is, or if an inquiry is needed, the longer the time required to complete the coronial investigation and hence the NCIS death record. This lack of timeliness has implications for the use of NCIS as a routine injury surveillance tool.

The state of NSW has the longest median time to closure of coronial cases across all jurisdictions in Australia. Although coronial cases do not have to be closed when causes of death are allocated, the closer to the investigation is to being completed, the more accurate the information available to inform the cause of death codes will be. If insufficient information is available on the NCIS at the time of cause of death coding, a query process is instigated by the ABS. For coroner-certified deaths, this might involve accessing the paper files available at that time at the coroner's office, but this audit process does not continue beyond the end of the administration period. The prolonged time to coronial case closure in NSW is therefore likely to impact on the quality of cause of death coding, at least in cases requiring a long coronial investigation. In recent years, the ABS has increased the administration period for mortality statistics from 12 to 15 months and has continued to work with the NCIS and the various NSW coroners' offices to address this issue.

Recommendations

It would be useful for the ABS and coroners to continue to monitor the median time to case closure to identify particular fatal injury mechanisms that may be subject to cause of death quality issues due to longer coronial investigations.

Those wishing to use and report on NCIS death records should consider the time taken to close coronial cases and finalisation of the NCIS death record details. The median time to case closure for each fatal injury mechanism in this report should be used to guide the period required to access the required number of cases for injury prevention studies using the NCIS.

5.4 Using the NCIS to improve the quality of coding underlying cause of death

Deaths coded as X59 'accidental exposure to unspecified factors' were referred to the coroner in only 22% of cases in NSW. Despite this, given that there are a large number of cases, the information available in the NCIS is still likely to provide valuable insight into the reasons why so many deaths are coded as X59 in NSW and what fatal injury mechanisms these cases correspond to. One analysis of interest would be to compare deaths coded as X59 in the ABS data that are certified by a coroner with those certified by a doctor.

Other mechanisms of fatal injury that are assigned 'unspecified underlying cause of death' codes could be similarly explored using the NCIS (e.g. 'other and unspecified' suicides, poisoning and falls). Even though the NCIS does not reliably capture many unspecified fatal injuries, there is still a role for the NCIS in monitoring the quality of cause of death coding and providing strategies to reduce the use of unspecified 'dump' codes.

Recommendations

A detailed investigation of the NCIS data should be undertaken to explore the large category of 'unspecified' fatal injury mechanisms in NSW. Particular analyses could focus on the reasons why these deaths are coded as such and potential strategies to reduce the use of 'unspecified' cause of death codes.

REFERENCES

- Australian Bureau of Statistics. (2002a). *Death* cat. no. 3302.0, Canberra: ABS.
- Australian Bureau of Statistics. (2002b). *Causes of Death* cat. no. 3303.0, Canberra: ABS.
- Australian Bureau of Statistics. (2004). *Causes of Death* cat. no. 3303.0, Canberra: ABS.
- Australian Bureau of Statistics. (2007). *Information Paper: External Causes of Death, Data Quality, 2005* cat. no. 3317.0.55.001, Canberra: ABS.
- Baker SP, O’Niell B, Ginsburg MJ, Guohua Li. (1992). *The Injury Fact Book*, 2nd edn. New York: Oxford University Press.
- Bills S. (1998) The police role in coronial inquiries. In Selby H (ed.). *The Inquest Handbook*. Sydney: Federation Press.
- Births, Deaths and Marriages Registration Act 1995* (NSW).
<http://www.legislation.nsw.gov.au/>
- Coroners Act 1980* (NSW).
<http://www.legislation.nsw.gov.au/fullhtml/inforce/act+27+1980+FIRST+0+N/#pt.2a-sec.12b>, (downloaded 12/01/2006).
- Driscoll T, Henley G, Harrison JE. (2003). The National Coroners Information System as an information tool for injury surveillance. Injury Research and Statistics Series Number 21. Adelaide: Australian Institute of Health and Welfare (AIWH cat. no. INJCAT 60).
- Holder Y, Peden M, Krug E, Lund J, Gururaj G, Kobusingye O (eds). (2001). *Injury surveillance guidelines*. Geneva, World Health Organisation.
http://www.who.int/violence_injury_prevention/index.html
- Klauke DN, Buehler JW, Thacker SB, Parrish RG, Trowbridge, FL, Berkelman RL. (1988). *Guidelines for evaluating surveillance systems*. Morbidity and Mortality Weekly Report, Series 5, 37:1–18.
- Kriesfeld R, Newson R, Harrison J. (2004). Injury deaths, Australia 2002. Injury Research and Statistics Series Number 23. Adelaide: Australian Institute of Health and Welfare (AIWH cat. no. INJCAT 65).
- National Coroners Information System. National Coroners Information System Coding Manual and User Guide. Version 2.5, September 2005. Melbourne: Victorian Institute of Forensic Medicine.

Ranson, D. (1998). The autopsy. In Selby H (ed.). *The Inquest Handbook*. Sydney: Federation Press.

SAS. (2003). SAS system for Windows, version 9.1. Cary, North Carolina: SAS Institute.

Schmertmann M and Williamson A. (2002). *NSW Injury Profile: A Review of Injury Data from During 1995–1999*. Sydney: NSW Injury Risk Management Research Centre.

Schmertmann M, Finch C, Williamson A. (2004). *NSW Injury Profile: A Review of Injury Deaths During 1998–2002*. Sydney: NSW Injury Risk Management Research Centre.

World Health Organisation. International classification of diseases and related health problems 10th revision. Geneva: WHO, 1992.

Anonymous. Recommended framework for presenting injury mortality data. *Morbidity & Mortality Weekly Report. Recommendations & Reports*. 46(RR–14): 1–30, Aug. 29 1997.

APPENDIX 1: SECTION 12B OF THE NSW CORONERS ACT 1980

1. A medical practitioner must not give a certificate as to the cause of death of a person for the purposes of notification of the cause of death under the *Births, Deaths and Marriages Registration Act 1995* if the medical practitioner is of the opinion that the person died in any of the following circumstances:
 - a. the person died a violent or unnatural death,
 - b. the person died a sudden death the cause of which is unknown,
 - c. the person died under suspicious or unusual circumstances,
 - d. the person died having not been attended by a medical practitioner within the period of 3 months immediately preceding his or her death,
 - e. the person died while under, or as a result of, or within 24 hours after the administration of, an anaesthetic administered in the course of a medical, surgical or dental operation or procedure or an operation or procedure of a like nature, other than a local anaesthetic administered solely for the purpose of facilitating a procedure of resuscitation from apparent or impending death,
 - f. the person died within a year and a day after the date of any accident to which the cause of his or her death is or may be attributable,
 - g. the person died while in, or temporarily absent from, a hospital within the meaning of the *Mental Health Act 1990* and while the person was a resident at the hospital for the purpose of receiving care, treatment or assistance,
 - h. the person died in circumstances that are examinable as referred to in section 13A (Deaths in custody etc. examinable only by State Coroner or Deputy State Coroner),
 - i. the person died in circumstances that are examinable as referred to in section 13AB (Child or disability deaths examinable only by State Coroner or Deputy State Coroner).
2. Despite subsection (1), a medical practitioner may give a certificate as to the cause of death of a person if the medical practitioner is of the opinion that the person:
 - a. was 65 years of age or older, and
 - b. died in circumstances other than those referred to in subsection (1) (b), (c), (d), (e), (g), (h) or (i), and
 - c. died after sustaining an injury from an accident, being an accident that was attributable to the age of that person, contributed substantially to the death of the person and was not caused by an act or omission by any other person.
3. Subsection (2) does not apply if the accident concerned occurred in a hospital or nursing home.
4. If a medical practitioner certifies the cause of death of a person in pursuance of subsection (2), the certificate must state that it is given in pursuance of that subsection.
5. A medical practitioner who is prevented from certifying the cause of death of a person because of this section must, as soon as practicable after the death, report that death to a police officer.

APPENDIX 2: ICD-10 CODING FOR FATAL INJURY MECHANISMS AND SUB-MECHANISMS

Intent	ICD-10 mechanism name	ICD-10 codes	ICD-10 sub-mechanism name	ICD-10 codes	
Intentional	Suicide	X60– X84	Firearm	X72–X74	
			Poisoning	X60–X69	
			Suffocation	X70	
			Drowning	X71	
			Sharp or blunt object	X78	
			Jump from building or high structure	X80	
			Jump or lie in front of moving object	X81	
			Other and unspecified means	X75–X77, X82–X84	
	Interpersonal violence	X85–Y09	Firearm	X93–X95	
			Bodily force	Y04–Y05, Y07	
			Poisoning	X85, X87–X90	
			Suffocation	X91	
			Sharp or blunt object	X99, Y00	
			Other and unspecified	X86, X92, X96–X98, Y01–Y03, Y06, Y08, Y09	
Unintentional	Motor vehicle transport	V02–V04	Occupant–traffic	V30–V38 (.4, .5, .6, .7, .9)	
		V09 (.0, .2)		V40–48 (.4, .5, .6, .7, .9),	
		V12–V14		V50–58 (.4, .5, .6, .7, .9)	
		V19 (.0–.2, .4–.6)		V60–V68 (.4, .5, .6, .7, .9)	
		V20–V79		V70–V78 (.4, .5, .6, .7, .9),	
		V80.3–V80.5		V39 (.4, .5, .6, .8, .9),	
		V81.0–V81.1		V49 (.4, .5, .6, .8, .9),	
		V82.0–V82.1		V59 (.4, .5, .6, .8, .9),	
		V83–V86		V69 (.4, .5, .6, .8, .9),	
		V87–V88 (.0–.8)		V79 (.4, .5, .6, .8, .9),	
V89 (.0, .2)	V80 (.3–.5),				
		V83–V86 (.0–.4)	Occupant–non-traffic	V30–V79 (.0–.3),	
				V83–V86 (.5, .6, .7, .9)	
				Motorcyclist–traffic	V20–V28 (.3, .4, .5, .9),
					V29 (.4, .5, .6, .8, .9)
				Motorcyclist–non-traffic	V20–V28 (.0–.2),
					V29 (.0–.3)
				Pedal cyclist – traffic	V12–V14 (.3, .4, .5, .9),
					V19 (.4–.6))

Intent	ICD-10 mechanism name	ICD-10 codes	ICD-10 sub-mechanism name	ICD-10 codes
Unintentional (continued)	Motor vehicle transport (continued)		Pedal cyclist—non-traffic	V12–V14 (.0–.2), V19 (.0–.2)
			Pedestrian—traffic	V02–V04 .1, .9), V09 (.2)
			Pedestrian—non-traffic	V02–V04 (.0), V09 (.0)
			Other and unspecified—traffic	All other traffic codes
			Other and unspecified—non-traffic	All other non-traffic codes
	Falls	W00–W19	Same level	W01–W03, W18
			One level to another	W05–W09, W14, W15, W17
			Ladder or scaffolding	W11, W12
			Building or other structure	W13
			Stairs/steps	W10
			Other and unspecified type	All other fall codes
	Poisoning	X40–X49	Narcotics and hallucinogens	X42
			Antidepressants, barbiturates and tranquillisers	X41
			Other pharmaceuticals	X40, X43, X44
			Alcohol	X45
			Gases and vapours	X47
			Other and unspecified	X46, X48, X49
	Drowning	V90, V92, W65–W74	Boat related	V90 (0–.9), V92 (.0–.9)
			Natural water	W69, W70
			Bathtub	W65, W66
			Pools	W67, W68
			Other and unspecified location	W71–W74
	Suffocation Threats to breathing	W75–W84	Due to food	W78, W79
			Non-food	W80
			In bed	W75
			Cave in	W77
			Other and unspecified	W76, W81–84

Intent	ICD-10 mechanism name	ICD-10 codes	ICD-10 sub-mechanism name	ICD-10 codes
Unintentional (continued)	Complications of care Complications of medical and surgical care	Y40–Y84	Drugs, medicaments and biological substances in therapeutic care	Y40–Y59
			Misadventure to patient during surgical or medical care	Y60–Y69
			Surgical and other medical procedures as the cause of abnormal reaction of the patient, or later complication, without mention of misadventure at the time of the procedure	Y83–Y84
			Medical devices associated with adverse incidents in diagnostic and therapeutic use	Y70–Y82
	Fire/burn Exposure to fire, smoke and flames and contact with heat and hot substances	X00–X19	Fire—in private dwelling	X00, X02
			Fire—not in building	X01, X03
			Burn—contact with heat and hot substances	X10–X19
			Other and unspecified type	X04–X09
	Struck by/against	W20–W23, W50–W52	A person or object	W20–W22, W50–W52
			Caught between two objects	W23
	Rail transport	V05, V15, V80.6, V81 (.2–.9)	Occupant	V81 (.2–.9)
			Pedestrian	V05
			Pedal cyclist	V15
			Other and unspecified	V80.6
	Natural/ environmental	W42–W43, W53–W64, W92–W99, X20–X39, X51–X57	Excessive temperature	W92, W93, X30, X31
			Venomous plants or animals	X20–X29
			Dog bites	W54
			Natural events	X33–X38
			Other and unspecified	W42–43, W53, W55–W65, W94–W99, X32, X39, X51–X57
	Air transport	V95–V97	Powered	V95
			Non-powered	V96
			Other and unspecified	V97

Intent	ICD-10 mechanism name	ICD-10 codes	ICD-10 sub-mechanism name	ICD-10 codes
Unintentional (continued)	Firearm	W32–W34	Handguns	W32
			Larger firearms	W33
			Other and unspecified	W34
	Machinery	W24, W30, W31	Agricultural	W30
			Lifting and transmission	W24
			Other and unspecified	W31
	Water transport	V91, V93, V94		
Unspecified	Exposure to other and unspecified factors	X58, X59	Exposure to other specified factors	X58
			Exposure to unspecified factors	X59
All injury		V01–Y98		
Natural causes		A00–R99		

1

APPENDIX 3 IMPACT OF CASE SELECTION METHODS ON DEATHS REPORTED FOR NSW

In this appendix, we examine a number of different ways of reporting deaths. We consider the effect on the number of deaths of reporting by year of registration versus year of death, and by state of residence versus state of registration. ABS mortality data are used throughout this appendix.

Case selection methods

Deaths that were registered in NSW in the period January 2000 to December 2003, or deaths for which the date of death was in the period January 2000 to December 2003 were selected.

Deaths were also selected by the state in which the death was registered and the state in which the deceased usually resided.

Method of analysis

For all descriptive analyses, frequencies and proportions were calculated and the effect of using the different case selection methods on numbers of deaths explored.

Impact of case selection methods on deaths reported for NSW

Reporting of deaths by year of registration or year of death

Deaths are usually reported in time by either the year in which they occurred (year of death) or the year in which the death was registered with a Births, Deaths and Marriages Registry (year of registration). For some deaths, the registration of the death is delayed either because of administrative issues or because of the time taken to confirm a suspected death, as in the case of a missing person. The choice of year of death or year of registration affects the number of deaths reported for the year of interest. Year of registration does not change over time, but the numbers reported by year of death change as the deaths occurring in the year of interest are registered in later years.

Table A3.1 shows the relationship between year of death and year of registration for NSW fatal injuries registered between 2000 and 2003. As shown in Table A3.1 the year of death and the year of registration of that death may not be the same. As a small proportion of deaths occurring in past years continue to be registered as each year of data becomes available. For the period 2000–2003, 94% of NSW fatal injuries occurred in the year the death was registered, 5% occurred in the year before registration and 1% occurred in the years prior to this. The longest time between death and registration of the death was more than 20 years. The fatal injury cases with prolonged periods

between the death and registration of the death most frequently had an ICD-10 UCOD code of unspecified assault (Y09) or exposure to unspecified factors (X59).

Table A3.1 Year of death for NSW fatal injuries registered between 2000 and 2003

Year of death	Year of registration			
	2003 N (%)	2002 N (%)	2001 N (%)	2000 N (%)
2003	2,371 (94.8%)	–	–	–
2002	125 (5.0%)	2,405 (93.7%)	–	–
2001	# (0.1%)	155 (6.0%)	2,407 (94.2%)	–
2000	0	# (0.1%)	144 (5.6%)	2,371 (95.4%)
1999	#	0	#	109 (4.4%)
1998	0	0	0	5 (0.2%)
1997	#	0	#	0
1996	0	0	0	0
1995	0	0	0	0
Before 1995	#	6	#	#
TOTAL*	2,502	2,568	2,556	2,486

NSW fatal injuries = all 'usual NSW residents' who had their deaths registered in any Australian state or territory and all overseas visitors who had their deaths registered in NSW with an underlying cause of death ICD-10 code of V01–Y98

*N = number of deaths registered in the column year that died in each calendar year
% = percentage of deaths registered in the column year that died in each calendar year*

**One case had year of death missing; therefore, NSW fatal injuries = 10,112*

Suppressed to prevent identification of cell counts less than five

Data extracted from HOIST 20 April 2006

Using the year of death to report deaths underestimates the true number of fatal injuries by approximately 6%, if the data on deaths registered in the year following the study period were not available. Reporting by year of registration is more stable. For a small proportion of deaths, especially of persons who have been missing for many years, the death may have occurred many years before it is registered.

In this report, deaths were selected by the date of registration to best reflect the reporting structure of both the ABS and the NCIS.

Reporting of deaths by place

Deaths are usually reported according to either the place where the person resides or by the state or territory in which the death was registered. Overseas visitors who die while in Australia have their death registered in the state or territory in which they die. The ABS defines NSW deaths as all 'usual NSW residents' who had their deaths registered in any Australian state or territory and all overseas visitors who had their deaths registered in NSW (ABS, 2002b). In contrast, the NCIS usually reports deaths by state of registration rather than state of usual residence; however, there is information in each death record that describes the state of usual residence. Table A3.2 describes the number and proportion of NSW fatal injuries (reported in the ABS mortality data) registered in each state or territory of Australia.

Table A3.2. State of registration of NSW fatal injuries registered between 2000 and 2003

State/territory where the death is registered	Number of NSW fatal injuries registered in each state/territory	Proportion (%) of NSW fatal injuries registered in each state/territory
NSW	9,754	96.5
Queensland	153	1.5
Victoria	103	1.0
ACT	75	0.7
South Australia	14	0.1
All other states or territories	14	0.1
AUSTRALIA-wide	10,113	100

NSW fatal injuries = all 'usual NSW residents' who had their deaths registered in any Australian state or territory and all overseas visitors who had their deaths registered in NSW with an underlying cause of death ICD-10 code of V01–Y98

All other states and territories includes Western Australia, Northern Territory and Tasmania

Data extracted from HOIST 20 April 2006

Almost 97% of NSW fatal injuries were registered in NSW. Most of the fatal injuries registered outside NSW were registered in Queensland, Victoria and the ACT. This is not surprising as these states share geographical borders with NSW.

The population denominators for state of residence are easily obtained from ABS population data. However, it is more difficult to obtain denominator data for overseas visitors when the state of registration is used. As the coronial system functions on a state of registration basis, extracting data from the NCIS on a state of residence basis for comparison with the ABS data is more difficult and can only be done by the NCIS staff. In addition, ethical approval must be obtained from the Victorian Department of Justice and the Western Australian Department of Justice to access case details of NSW residents whose deaths are registered in all other states.

Impact of case selection on fatal injuries reported in 2002

Table A3.3 describes the impact of case selection by time (date of registration or death) and place (place of registration or residence) has on the number of NSW fatal injuries that are reported for 2002 in three Australian reports. The year 2002 was chosen to highlight the impact that case selection has as there were reports available from numerous sources. All deaths reported had an ICD-10 underlying cause of death of injury or poisoning.

Table A3.3. NSW fatal injuries reported for 2002

Time	Place	
	State of 'usual residence'	State where death registered
Date of death	IRMRC report n=2357	
Date death registered	ABS 'Death' and 'Causes of Death' reports n=2569	NISU report n=2580

Schmertmann et al (2004) included 2,357 fatal injuries of people who usually resided in NSW and which had occurred in the calendar year of 2002. To be included in this report, these deaths had to be reported in the ABS 2002 dataset released on 2 December 2003, so they had to have been registered before 31 December 2002. Reporting by year of occurrence most closely reflects the true incidence of fatal injuries and is important when considering trends in fatal injury mechanisms that may have been influenced by public health policy. However, underreporting of deaths that occurred in the 2002 calendar year is likely to be in the order of 5–6%. The numbers reported by date of occurrence will change when further years of ABS data become available.

The National Injury Surveillance Unit (NISU) report (Kriesfeld et al, 2004) included 2,580 deaths registered in NSW in 2002, including 2,547 deaths of Australian residents, 31 deaths of overseas residents and two deaths of Australian residents where the state of residence was missing. It is likely that most of these deaths occurred in NSW, except for the small number of cases that may have been transferred from one coronial jurisdiction to another. This case selection criterion would be the easiest to compare with the NCIS data as it reflects the state and year of registration structure adopted by the Australian coronial system. The numbers reported would remain stable over time but would even more inaccurately reflect the true incidence for the year and state.

The choice of case selection criteria will depend on the aims of the injury research and careful consideration should be given as to which case selection method is most appropriate to answer the research question. A nationally consistent case selection approach would ensure that reporting of fatal injury trends across Australia is more comparable.

Discussion and recommendations

In practice, the method used to select fatal injury cases in time (e.g. date of death versus date of registration of the death) and by place (e.g. state of registration of death versus state of usually residence) will alter the numbers reported for any given period. Careful consideration should be given as to the best-case selection method to use depending on the question being addressed. Notwithstanding what case selection choice is made, it is imperative that this is clearly documented so that reports can be accurately compared.

Using the year of death provides the most accurate description of the number of people who have died in a period of interest. However, the final year of death reported is usually underestimated by a factor in the order of 5–6%. The number of deaths reported per given year, changed as late registrations occur in subsequent years. For this

reason, some method of adjusting the more recent years for late registrations should be considered. As long as the final year reported is adjusted for potential underreporting, using a population denominator would give the most accurate reflection of incidence.

Using the year of registration of the death (rather than year of death per se) is a stable method of reporting, as there are legislative requirements to register a death within seven days of burial. This is how the ABS reports deaths. The number of deaths reported will not change in subsequent reports, although they will include a small portion of deaths that occurred in previous years (particularly for deaths around the end of a calendar year).

Both the ABS and NCIS data sets include both date of death and date of registration fields. However, as both datasets are collected based on the year of registration, this is usually the most accurate case selection criterion when comparing datasets. Deaths can be extracted relatively easily from the ABS data on a date of death basis. To extract deaths from the NCIS by date of death requires a specific data download request to NCIS staff because this cannot be done using the NCIS Internet interface.

When reporting deaths according to place, using state of residence as the case selection method is the most appropriate if population denominator data are to be used for the calculation of rates. However, the state of registration may be a better proxy for some fatal injuries, such as motor vehicle transport deaths and drowning deaths, as a death is usually registered in the state in which it occurs. The NCIS dataset has details of the time and location of the injurious incident, and thus may be the most accurate mortality source for geographical mapping of fatal injury events.

The NCIS and ABS both collect mortality data on a state of registration basis; however, the ABS reports by state of residence. To state of usual residence cannot be readily obtained through the NCIS Internet interface, particularly if numbers are required on both open and closed cases. If cases need to be extracted from the NCIS dataset on a state of residence basis then a data download should be requested from the NCIS team. When cleaning the extracted data, care will need to ensure that the residential postcodes match the state of residence variable. The state of residence variable has recently been added to the NCIS quality assurance program after coding errors were observed within the NSW data.

Recommendations

The date of registration of death is the best-case selection method for comparing the ABS and NCIS data or when the stability of data over time is important.

The date of occurrence of the death is the best-case selection method when researching the incidence of a particular fatal injury mechanism. However, some adjustment for potential underreporting of true numbers of fatal cases should be considered.

If date of death is to be used, this data can only be extracted from the NCIS by the NCIS staff conducting a data download.

The state of residence is the best-case place selection method for calculating the incidence of fatal injuries.

The state of registration may be the best-case selection method when exploring the risk factors associated with the place of occurrence of a fatal injury event.

The NCIS specifically records the place of fatal injury event and so would be the best mortality data source for mapping various fatal injury mechanisms.

When the state of residence is used as the case selection method, data needs to be extracted from the NCIS dataset by the NCIS staff through a data download. Users should then ensure the state of residence postcodes match the state of residence variable in their subset of NCIS data.