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Use of multiple causes of death data for identifying and reporting injury mortality

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FLINDERS UNIVERSITY

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ICD-10	10th Revision of the International Classification of Diseases
NCIS	National Coroners Information System
NISU	National Injury Surveillance Unit
RCIS	Research Centre for Injury Studies
MCoD	Multiple Cause of Death
UCoD	Underlying Cause of Death
STIPDA	State and Territory Injury Prevention Directors Association (United States)

Executive summary

Prior to 1997, Australian mortality data were assigned a single Underlying cause of death (UCoD). This took the form of a code indicating what had caused an injury to occur. From 1997 onward, up to 13, and later up to 20, Multiple causes of death (MCoDs) could be allocated to any death record. These MCoDs represent nearly all of the information about cause of death that appeared on the death certificate. Of particular interest for injury surveillance was the fact that these Multiple causes of death could identify not only the external cause of an injury, but could also provide information about the nature of the injury.

The public health significance of this change is far reaching. Access to MCoDs offers the potential to describe patterns of physiological damage which could support the development of protective interventions. Available evidence suggests that previously inaccessible information about injury diagnoses could enable the development of superior methods of defining injury cases, leading to more accurate estimates of injury incidence. Multiple causes of death information also provides access to greater detail about some types of injury (e.g. the specific types of drugs involved in unintentional poisoning). Many deaths that are currently attributed to *natural* causes have MCoDs that indicate an injury contributed to the death. It is likely that at least some of these could legitimately find a place within routine injury reports, thus providing a more realistic picture of the burden of injury mortality. Finally, injury mortality data is the basis for indicators of some topics given prominence in the *National Injury Prevention and Safety Promotion Plan: 2004–2014* (National Public Health Partnership 2005). More complete identification of injury death offers the potential for improving the validity of these indicators.

The aims of this project were twofold: to analyse aspects of Multiple causes of death data relevant to injury surveillance; and to assess the potential for their use in routine reporting of injury mortality.

Note on terminology: Three terms have been used extensively throughout this report: *Conventional* injury deaths, *Additional* injury deaths, and *Operational Definition of Injury*. *Conventional* injury deaths are those for which the Underlying cause falls within the range of codes from the International Classification of Diseases that refer to External Causes (ICD-10 V01–Y98). The *Conventional* definition has commonly been used by NISU and other agencies in producing reports.

Additional injury deaths are those that have been attributed to natural causes (i.e. their Underlying cause code does not signify an External cause of death), but ICD codes for injury diagnoses or external causes of injury are present among the Multiple causes of death. *Additional* injury deaths are the focus of this report.

An *Operational Definition of Injury* for this study was arrived at by mapping an existing scheme produced by the US Injury Surveillance Workgroup of the State and Territorial Injury Prevention Directors Association (STIPDA) from ICD-9-CM to ICD-10. The chief feature of the scheme is that it excludes cases whose only codes from the 'Injury and Poisoning' chapter of the ICD are for *Complications of Surgical and Medical Care, Sequelae,* and *Adverse reactions to food*. The *Operational Definition of Injury* provided the criteria for selecting cases for this study.

Overview of findings

2,535 *Additional* injury deaths were identified for 2002 in ABS mortality data. These cases differed from *Conventional* injury deaths during 2002 in that they were more highly concentrated among the oldest age groups. There was also a greater similarity between male and female rates among the *Additional* injury cases. Some differences were observed in rates of *Additional* injury deaths by jurisdiction of death registration: rates were low for South Australia and high for the Northern Territory. 80% of the *Additional* injury cases had been certified by a medical practitioner. This contrasted with *Conventional* injury deaths, of which (in 2002) about 80% had been certified by coroners. Very few of the *Additional* injury deaths had been the subject of an autopsy.

The 2,535 *Additional* injury deaths fell into five main categories: unintentional falls; poisoning by drugs; poisoning by other substances; inhalation of gastric contents, food, or some other object; and sequelae of external causes. Two of these categories—unintentional falls and poisoning by drugs—are dealt with in detail in the report, reflecting the number of cases within them. Cases that did not have an External cause as the UCoD but did have a Multiple cause code in the range Y40–Y84 *Complications of surgical and medical care* were also numerous (n=1,384). These cases were, however, not studied in detail because they did not meet the criteria of the *Operational definition of injury* used for this study.

Unintentional falls

Three sources of data were used in investigating this category of *Additional* injury deaths: Australian Bureau of Statistics (ABS) mortality data; the National Coroners Information System (NCIS); and linked hospitalisation and deaths data from Western Australia.

1,518 *Additional* fall-related cases were identified in the ABS data in which a fall had been coded as having contributed to the death. This group of cases includes those that had the presence of the code X59 *Exposure to unspecified factor PLUS* a code indicating that a fracture had occurred. Previous work undertaken by NISU has provided evidence that most deaths coded to a combination of X59 *plus* a fracture were the result of a fall (Kreisfeld & Harrison 2005). The deaths were mainly among the very old. 90% had been certified by a medical practitioner. 73% involved an injury to the hip or thigh—in all but one case the nature of the injury was a fracture of the femur.

136 cases of fall-related deaths from the NCIS were analysed. 71% of these had been designated by coroners as being due to *natural* causes. In a high proportion of the cases, a serious injury had been sustained. For example, 40% involved a femoral fracture, and 30% a head injury. However, in 58% of the 136 cases, the Underlying cause of death was ascribed to a disease of the circulatory or respiratory systems.

The most common scenarios for the fall-related deaths in the NCIS were post-operative deterioration in the patient's condition, deterioration without prior surgical intervention, or being found dead in circumstances that indicated a fall had taken place.

A third source of data used in this report was linked hospitalisation and death records from Western Australia for people who died whilst in hospital. 129 fall related cases were identified from these records. 86.8% of these had been certified by a medical practitioner and, for 70.5% of the records, the death had been attributed to *natural* causes.

The Western Australian data showed poor correlation between the hospital discharge and death records for cases involving falls by elderly people. In particular, the data shed light on two characteristic practices: Death records tended to contain codes for fewer conditions than did hospital discharge records, and codes in death records tended to be less specific (e.g. the appearance of a code in the death record indicating an unspecified head injury, despite more specific information about the injury being available in the hospital discharge record). These characteristics were also evident in a Swedish study by Johansson and Westerling found that adding all of the conditions which appeared in the hospital discharge record to the death certificate, resulted in an increase of 58% in the number of cases that had an accidental fall as the Underlying cause of death (Johansson & Westerling 2002).

Poisoning by drugs

144 *Additional* cases were found in ABS mortality data with a Multiple cause of death code in the range X40–X44 (Accidental poisoning by drugs). Most of these cases were young and middle-aged males. 89% of the cases had been certified by a coroner. For 69% of the 144 cases, a mental and behavioural disorder due to psychoactive substance use (F11–F16, F19) was recorded as the Underlying cause of death. Previous work at NISU has shown that there is no clear demarcation between the ranges X40–X44 and F11–F16, F19 (Kreisfeld & Harrison 2005). NISU therefore took the step, in its 2002 mortality report, of including all deaths due to poisoning by drugs, irrespective of whether they have an *external* or *natural* cause as their Underlying cause of death. The World Health Organization (WHO) has also recommended that deaths due to poisoning should no longer be assigned Underlying cause of death codes from the Mental and Behavioural Disorders chapter of the International Classification of Diseases. This was scheduled to take effect in January 2006 (Walker 2007).

The use of Multiple causes information has an additional advantage for reporting on deaths due to poisoning by drugs. The poisoning codes in the range T36–T50 (which cannot be used as the Underlying cause of death), provide more specificity about the type of drug involved than do the codes in the External Causes chapter and the Mental and Behavioural Disorders chapter of ICD-10.

Poisoning by other substances

105 *Additional* deaths were identified in ABS mortality data with a Multiple cause code in the range T51–T65. Many of these had codes indicating that alcohol had been a contributing factor. A high proportion of the cases involved multiple drug use, suggesting that there is overlap between this category and that of poisoning by drugs.

As was the case for poisoning by drugs, in a substantial proportion of this group of cases, a code from the Mental and Behavioural Disorders chapter of ICD-10 had been selected as the Underlying cause of death. Implementation of changes introduced by the WHO means that the coding of deaths registered from January 2006 should no longer use codes from the mental and behavioural disorders chapter of ICD-10. Until data coded according to this changed rule are available, and thereafter when analysing older data, a strong case exists to include all deaths due to poisoning by other substances for the purposes of injury surveillance. This can be done by including as 'injury' deaths all cases that have multiple cause codes in the range T51–T65 (Kreisfeld & Harrison 2005).

Inhalation of gastric contents, food or other object

Numerous deaths due to this cause were found in 2002 ABS mortality data (n=482). Deaths were concentrated in older age groups: 74% were aged 65 years and over, 56% 75 years and over. Death rates were highest among the very old: 24.9 in the 80–84 year age group; 46.0 in the 85 and over age group.

Although there was variation between the rates for different jurisdictions, only that for South Australia (low) differed significantly from the Australian rate. As for some other categories of death considered in this report, small numbers make it difficult to interpret the variations between states and territories.

Anecdotal information received from the ABS sheds light on this group of cases. In many cases coded to inhalation investigated by the coroner, death was associated with the use of a 'peg' (percutaneous endoscopic gastrostomy) which had been inserted into the patient to assist them with eating. This procedure is common in conditions such as some forms of cancer (ABS 2005). Analysis of coroners' data could provide further information, but doing so for this topic was beyond the scope of the present project.

Sequelae of external causes

80 *Additional* cases of sequelae of external causes were identified. In over half of these, the Underlying cause of death was recorded as a *Disease of the circulatory or respiratory system*.

79% of the cases had been certified by a medical practitioner and an autopsy had been conducted in only 5% of cases.

53 (66%) of the cases were aged 65 years or over. 61% were male. The rate was highest among those aged 85 years and over (7.1 per 100,000 population).

The rates for states and territories did not differ significantly from that for Australia as a whole (0.4 per 100,000 population).

Certification of death and Underlying cause of death

Mortality data are derived from death certificates. Accurate coding of the data is heavily dependent on the information supplied and the language used by the certifying doctor or coroner. The quality of death certificates, and hence of the data, could be affected by a number of factors including:

- Inexperience and lack of familiarity with guidelines for completing death certificates on the part of the certifier. Available literature suggests that this issue is particularly relevant in relation to medical practitioners (Peach & Brumley 1998; Swift & West 2002; Smith & Hutchins 2001). Around 80% of the *Additional* deaths were certified by medical practitioners suggesting a disproportionate susceptibility to defects in certification when compared with the *Conventional* group.
- A lack of clarity on the part of the certifier about how the causal chain is constructed (Goldacre 1993).

- A tendency for a *natural* cause to be chosen over an *external* cause as the Underlying cause of death (Pemberton 1988; Calder et al. 1996; Roberts & Benbow 1996; Maxwell 1986).

Routine cause of death coding focuses on deriving a single 'Underlying cause' for each death. This simplification is useful for summary reporting, but does not capture the reality that most deaths have multiple causes. The addition of Multiple cause codes provides a way to begin to take account of more of the factors contributing to deaths.

ICD-10 defines the Underlying cause of death as 'the disease or injury which initiated the train of morbid events leading directly to death' and provides rules for its determination (WHO 1993). The objective of pinpointing a precipitating cause is to identify diseases or circumstances that could, or should, be the focus for prevention. 'Underlying cause' coded according to the internationally agreed rules for summarisation and reporting of causes of death has important strengths: It provides a way to assign a single cause to each death, and to do so in a way that should result in internationally comparable data. As shown in this report, these rules are, however, an imperfect way to identify deaths in which injury was involved.

At the heart of this study has been a comparison of *Conventional* and *Additional* injury deaths in order to explore the relationship between the two groups. As part of this exploration, the study looked at the Underlying causes of death assigned to *Additional* injury cases and at possible reasons why this group of cases had not received external cause UCoDs. In addition to the factors already mentioned above, likely reasons include:

- Characteristics of the ICD system (e.g. the appearance of codes for unintentional poisoning in both Chapters V and XX of ICD-10).
- A tendency towards non-specific coding of causes of death at older ages. Deaths at young ages tend to be seen as untimely, and in need of specific explanation.
- Most of the cases of Additional injury deaths were of older people with multiple co-morbidities. The Underlying causes that have been assigned to the Additional deaths tend to relate to the diseases that are common in old age. Goldacre's study has argued that there is a convergence, in the certification of deaths towards diseases of the circulatory and respiratory systems, an observation also made in the analyses undertaken for this report (Goldacre 1993).

The issue of co-morbidities, in particular, has strong implications for the selection of an Underlying cause of death. Despite having chronic conditions, older people can have a relatively high life expectancy. For example, in 2001–02, the life expectancy for Australians at 75 years of age was 13 years for females and 11 years for males. However, the experience of a serious injury such as a fractured femur considerably raises an older person's risk of dying. For example, the likely life span of a 75 year old suffering from Ischaemic heart disease may be several years. If, however, they fall and fracture a femur, the attendant trauma and its treatment can precipitate an acute event associated with the chronic condition (e.g. a myocardial infarction). This type of scenario poses a theoretical problem for the completion of a death certificate and determination of an Underlying cause of death. Which condition precipitated the train of events that lead to the death? Commonly, the myocardial infarction rather than the fall which caused the fractured femur will be chosen as the Underlying cause of the death, despite the likelihood that the person could have experienced several additional years of life were it not for the occurrence of the fracture.

This study has also shown that the quality of mortality data is impaired through a lack of account being taken of discharge records for those who died while in hospital. (The advanced age of many of the cases of *Additional* injury deaths in this study suggests that many of these deaths would have occurred in hospital.) Analysis of linked hospital and death records from Western Australia showed that information contained in hospital discharge records often does not find its way onto the death certificate at all, or it loses its specificity with respect to the nature of the injury sustained. This finding is consistent with studies undertaken by Goldacre and Johansson (Goldacre 1993; Johansson & Westerling 2002). Johansson also found that it is common for the occurrence of a fall not to be included on the death certificate. This possibility indicates that the underestimation of fall-related deaths could extend even beyond the scope of the *Additional* injury deaths that were identified for this study.

Conclusions

The findings of this report provide strong evidence that many deaths in which injury was involved, often crucially, are recorded in ways that either do not mention the involvement of injury, or record its involvement in a way that puts the case outside conventional definitions of 'injury death'.

There are compelling reasons for including most of the *Additional* injury deaths in routine mortality reports.

For the cases of unintentional poisoning, NISU has previously demonstrated that there is considerable overlap between *Conventional* and *Additional* injury deaths due to poisoning by drugs. In addition, the WHO has decided to update the ICD-10 classification system by grouping all cases of unintentional poisoning within one ICD-10 Chapter XIX category. This took effect in January 2006. There is a considerable lag time between the coding of data and the issuing of reports. It would therefore be prudent to begin including *Additional* cases of unintentional poisoning in mortality reports as soon as possible.

Most cases of *Additional* unintentional falls examined in this study involved older people, who tend to have multiple health problems. This report looked at some of the difficulties surrounding the certification of such deaths: For example, poor compliance with guidelines for death certification (Smith & Hutchins 2001); the high rate of certification by medical practitioners which, literature suggests, may be associated with a higher level of inaccuracy in completion of death certificates (Swift & West 2002; Peach & Brumley 1998).

A serious fall can precipitate an acute medical event associated with another condition such as Ischaemic heart disease which may otherwise not have proved life threatening in the short term. In such an eventuality, it could be argued that it was the fall that set in train the events which led to death. Under the rules of the ICD-10, following this logic would require that the fall be regarded as the Underlying cause of death. This logic is, however, contrary to practice.

Available literature suggests that deaths resulting from falls are grossly underestimated. Injury research, prevention and policy development require the most realistic picture of the burden that falls present and the greatest level of information for framing interventions. This study suggests that there is a strong element of chance involved in whether a fall-related death joins the *Conventional* category or the *Additional* one. For this reason, in particular, the case for including the *Additional* fall-related deaths for purposes of routine reporting is a compelling one.

Application of the *Operational Definition of Injury* is a straightforward response to the debate surrounding the concept of an 'injury' and offers other advantages such as greater specificity through the use of codes from ICD-10 Chapter XIX. Although the *Operational Definition of Injury* has adhered to the STIPDA scheme's practice of excluding the codes T78.8 *Other adverse effects, not elsewhere classified* and T79 *Certain early complications of trauma, not elsewhere classified* for the purposes of this study, subsequent consideration suggests that these codes should be included in the 'Definition'. Similarly, the routine inclusion of *Sequelae of External Causes* in the 'Definition' should be reviewed. *Sequelae of External Causes* can occur some time after the actual injury event that caused them. On occasions, this interval can be a matter of years. For this reason, the inclusion of this category of cases will distort estimates of mortality incidence arrived at by using the *Operational Definition of Injury* as it is currently specified. Information about *Sequelae of External Causes* may be valuable for some specific purposes (e.g. assessing the long-term outcomes of injury events). Unfortunately, the available sub-categories for *Sequelae* are fairly coarse and do not provide much scope for detail about the nature of the injuries being described.

Based on this study, there are good grounds for addressing some of the shortcomings and uncertainties associated with the death certification process. Some specific options include interventions to upgrade the certification skills of medical practitioners and research into the extent to which the current practice of treating the certification of cases of deaths associated with fractured femurs differently from other injury deaths can lead to an underestimation of fall-related mortality.

This study represents an early attempt to explore the usefulness of MCoDs for the purpose of reporting injury mortality. Further studies could build on this work. The NCIS offers the potential for more in-depth exploration of the most frequent classes of *Additional* deaths identified in this study, particularly if case-level linkage between the NCIS and ABS mortality data can be achieved. Further work using linked datasets from Western Australia (or elsewhere, if available) could also be of benefit in exploring this question.

1 Introduction

1.1 Multiple causes of death

The Australian Bureau of Statistics (ABS) is responsible for compiling mortality data for Australia. These data are provided to the ABS by the state and territory Registrars of Births, Deaths and Marriages. The information supplied by the Registrars is derived from Medical Certificates of Causes of Death prepared by the certifying medical practitioner.

Prior to 1997, a single Underlying cause of death (UCoD) was assigned to each mortality data record by the ABS. This UCoD takes the form of a code from Chapter XX of the *International Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10). The codes in Chapter XX specify a broad range of *external causes* of death (i.e. what caused fatal injury rather than the nature and extent of the physiological damage sustained).

The adoption by the ABS, in 1997, of the US developed Mortality Medical Data Software (MMDS) enabled the coding of Multiple causes of death (MCoDs). The MCoDs are all other conditions, apart from the UCoD, which appeared on the death certificate.

1.2 Public health significance of Multiple causes of death information

The availability of MCoD information has public health significance in several respects:

1. It has been recommended that injury should logically be defined in terms of the physiological damage which occurred, rather than what caused it (Harrison & Steenkamp 2002; Langley et al. 2002). This was not possible when the information was limited to the assignment of a single Underlying cause of death because UCoDs for injury cases only appear in the form of external cause codes from ICD-10 Chapter XX. MCoDs include both diagnosis codes from ICD-10 Chapter XIX and external cause codes. It is now possible, at least in theory, to comply with the recommendation of selecting injury cases according to physiological damage. Making information available regarding the physiological damage sustained by people who died as the result of an injury will provide previously unavailable data to support the development of protective interventions.
2. Consequently, selection of injury cases based on diagnoses derived from ICD-10 Chapter XIX would provide more valid estimates of injury incidence than would the presence of an E-code (external cause of injury code) (Langley et al. 2002). The availability of MCoD information makes it possible to alter the selection criteria for injury deaths towards the use of diagnosis codes.

3. MCoD information gives access to a greater range of detail in relation to some causes of death. An example of this is poisoning as the result of drugs, where the availability of codes from ICD-10 Chapter XIX enables the identification of a broad range of specific poisoning agents, something that is not possible when data analyses are restricted to the use of UCoDs.
4. The inception of MCoD coding has opened the possibility of including additional deaths as 'injury' cases. Specifically, these are cases where the Underlying cause of death was deemed to be a natural cause, but where one or more MCoDs was an external cause of injury. The identification of additional cases, not included by traditional methods, could provide a more complete and reliable picture of the burden of injury mortality.
5. Injury mortality data is the source for some indicators used for the National Health Priority Areas, of which injury is one (Commonwealth Department of Health and Family Services and Australian Institute of Health and Welfare 1998). More complete identification of injury deaths has the potential to improve the validity of reporting against the indicators.

1.3 Project aims

The aims for this technical paper are to:

1. Analyse aspects of MCoD data relevant to injury surveillance; and
2. Assess the potential for using MCoD information for routine reporting of injury mortality.

The aims are to be achieved by:

1. Giving consideration to issues associated with arriving at an operational definition of injury, and adopting a definition;
2. Making enquiries of the ABS about their coding practices, in particular the process followed in determining the Underlying cause of death, and about the structure of variables relating to Multiple causes of death information;
3. Undertaking analyses of ABS mortality data analysis based on MCoDs;
4. Examining cases of death resulting from accidental falls that are recorded in the National Coroners Information System (NCIS) in order to gain an insight into how death certificates are completed and how an Underlying cause of death is arrived at for this group of cases;
5. Examining linked hospital separations data and mortality data from Western Australia to gain an understanding of the relationship between these sources of information.
6. Identifying and reviewing published literature relevant to MCoDs and the assignment of UCoDs.

2 Methods

This section describes the methods used in this study. It also includes descriptions of the three main data sources used: ABS mortality data, the NCIS and the Western Australian linked dataset.

2.1 Operational definition of injury

In undertaking the analyses for this study, attention has been given to an on-going debate about the question of 'what is an injury?' In particular, there are differing views about the extent to which injuries associated with medical and surgical care should be included when reporting on injury mortality (Langley & Brenner 2003). Literature relevant to this topic is reviewed and this provides the basis for specifying an operational definition for use in this study.

2.2 ABS coding practices

Relevant ABS publications were reviewed. In addition, enquiries were directed to an experienced ABS coder, with respect to the process followed in coding mortality data. The officer was asked to detail the ABS coding procedures from the receipt of death certificate information from state and territory Registrars of Births, Deaths and Marriages, and from Coroners, through the processing by the SuperMICAR software, to manual intervention by coding staff.

The ABS coder was also requested to assign codes for a series of injury scenarios. These scenarios were constructed using information from the National Coroners Information System to create a blend of the chief elements of cases in the database. Identifying information such as time and place were excluded in order to preserve the confidentiality of these cases.

2.3 ABS mortality data

Unit record data for 2002 were obtained from the ABS via the Australian Institute of Health and Welfare (AIHW). The variable chosen as the main focus for analysis was the '*Entity Axis Data*', a variable that contains ICD-10 codes representing all of the conditions listed on the death certificate and preserves the order in which they appeared. The Australian death certificate, which adheres to an international standard created by the WHO, is made up of two separate parts (Figure 1). Part 1 should be used to list all those conditions that made up the causal chain of events leading to the death. Part 2 should be used to list other conditions which may have been significant, but were not part of the causal chain.

Guidelines issued by the ABS for medical practitioners in completing death certificates are prescriptive with respect to the sequencing of conditions listed on Part 1 of the certificate (the Underlying cause of death should be listed last) and in differentiating between the uses made of Parts 1 and 2 (ABS 2004a).

Figure 1: Example of death certificate

CAUSE OF DEATH		Approximate interval between onset and death
I *Disease or condition directly leading to death** *Antecedent causes* Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last.	(a) ……... due to (or as a consequence of) (b) ……... due to (or as a consequence of) (c) ……... due to (or as a consequence of) (d) ……... due to (or as a consequence of)	…… …… …… ……
II *Other significant conditions* Contributing to the death, but not related to the disease or condition causing it.	…… ……	…… ……

* This means the disease, injury or complication which caused death NOT ONLY, for example, the mode of dying, such as 'heart failure, asthenia', etc.

In analysing the ABS data, the ICD-10 codes listed as a text string in the *Entity axis data* variable were parsed into individual codes. The *Entity axis data* variable represents the information obtained from the death certificate in a way that distinguishes Parts 1 and 2 of the death certificate. The data are organised into 6 lines—lines 1–5 contain the codes derived from Part 1 of the certificate and line 6 the codes from Part 2, up to a maximum of 20 codes. The individual codes obtained from the *Entity axis data* were organised into separate variables which enabled the identification of their position of origin on the death certificate.

The data were also organised according to a scheme of major causes of injury which was developed by the National Injury Surveillance Unit (NISU) to assist its reporting in Australian injury mortality. The groupings in this report follow those used and specified in Injury deaths, Australia 2002 (Kreisfeld et al. 2004). Cases were assigned to major causes categories based on the presence of one or more ICD-10 Chapter XX external cause codes among the MCoDs. (In the case of poisoning by drugs, the drug-related codes from ICD-10 Chapter V *Mental and Behavioural Disorders*, F11–F16 and F19, were also used.) The data were further organised so as to be able to distinguish between the two parts of the death certificate. In the case of unintentional poisoning by non-pharmaceutical substances, for example, the following criteria were used to allocate cases to the relevant major cause category and the part of the death certificate on which the condition was listed:

Part 1: The presence of one or more codes within the range X45–X49 among the MCoDs representing conditions from Part 1 of the death certificate.

Part 2: The presence of one or more codes within the range X45–X49 among the MCoDs representing conditions from Part 2 of the death certificate.

For the more complex category of unintentional falls, the following criteria were followed:

Part 1: The presence of one or more codes within the range W00–W19 *Accidental Falls* among the MCoDs representing conditions from Part 1 of the death certificate, ***or*** the presence of X59 *Exposure to unspecified factor* in Part 1 ***plus*** an ICD-10 Chapter XIX code for a fracture in either Part 1 or Part 2.

Part 2: The presence of one or more codes within the range W00–W19 *Accidental Falls* among the MCoDs representing conditions from Part 2 of the death certificate, ***or*** the presence of X59 *Exposure to unspecified factor* in Part 2 ***plus*** an ICD-10 Chapter XIX code for a fracture in either Part 1 or Part 2.

The rationale for this is that, in Australia, many deaths at ages 75 and older, and involving a fracture, are given a UCoD code of X59 because enquiries which could have enabled more specific coding of external cause were not made (Kreisfeld & Harrison 2005). The NISU have previously shown that hip fractures are prominent in this group (Kreisfeld & Harrison 2005). Falls are likely to have been involved in most of these cases. Further investigation will be required to assess the extent to which this approach also includes cases that do not involve falls.

2.4 National Coroners Information System

Accidental falls was the category of *Additional* cases most frequently identified in this study. A subset of cases of Unintentional falls was selected for analysis from the NCIS. The selection criteria for the selected subset were all deaths which occurred between October and December 2002 among people aged 65 years and over in all states and territories excluding Queensland. All cases that had not yet been 'closed' by the date of the search (24 May 2004) were excluded. Cases were selected if they satisfied any of the following three conditions:

1. The Mechanism of fatal injury data item was searched for the presence of the specific code 'Falling, stumbling, jumping'.
2. Autopsy reports and Police Investigation reports were searched for occurrences of the terms 'fall' and 'fell'.
3. The Cause of Death text was searched for the presence of the terms 'fall' and 'fell'.

The search criteria selected 200 deaths. In 28 of these cases, it was clear from reviewing the documents, that a fall had not been material in causing the death (e.g. a reference to a fall which was merely incidental to a death having occurred—e.g. 'Deceased fell heavily to floor and twitched for approximately 2 minutes'.) These cases were excluded from the final dataset. A further 9 cases were omitted because they were not accidental in nature (i.e. probable suicides). 27 cases that had not been 'closed' were excluded because text documents, available for most closed cases, were not accessible. This left a subset of 136 cases which provide the basis for analyses undertaken for this report. Information about the selected cases was extracted and coded for analysis using the form which appears in *Appendix 2*.

A small group (n=15) of the 136 extracted coroners' records was reviewed by an experienced officer of the ABS. She was asked to follow her normal practice in determining the Underlying cause of death on the basis of the conditions listed on the death certificate and the sequence in which they appeared. She was further asked to

assess whether information contained in the accompanying documents would lead her to make a different determination and to comment on whether, in her opinion, the death certificate had been completed adequately on the basis of the information available. The main purpose of this exercise was to gauge the level of concordance between coroners and the ABS in deciding whether a death was the result of a natural or an external cause. Anonymous summaries of these 15 cases are given in *Appendix 4*.

2.5 Linked data

Datasets of injury-related hospitalisations and deaths that occurred in Western Australia during the period 1 July 2000 to 30 June 2001 were obtained by NISU from the Western Australian Data Linkage Unit. The datasets were obtained for the purpose of undertaking a set of studies related to the validity of injury indicators based on deaths data and hospital separations data. The studies were designed to investigate and, where possible, reduce problems identified by previous NISU work (Harrison & Steenkamp 2002). Permission to undertake the studies, which form part of a project entitled *Threats to reliability and validity of NHPA Indicators*, was given by the Social and Behavioural Research Ethics Committee of the Flinders University.

Hospital and deaths data were combined using an encrypted person identifier code.

The analysis reported here implements one of the studies for which NISU obtained access to the linked data: assessment of the relationship between injury deaths data and injury hospitalisations data. A subset of the linked dataset was constructed by selecting all cases where the principal diagnosis was a code in the range ICD-10 S00–T98, and where the mode of separation from hospital was death.

2.6 Literature search

Medline Ovid was searched for relevant literature on 1 February 2005. Searching was limited to articles published during or after 1980, in English, and where at least an abstract was available on-line. A search based on the phrase 'Multiple causes of death' yielded 33 citations. When this search was limited to the phrase appearing only in the title, 6 citations were found. Combination of the terms 'death certificate' and 'accuracy' found 95 references.

A manual review was undertaken of the selected citations to determine their relevance to this project. Papers were selected if they covered issues that have a bearing on Multiple causes of death information—e.g. the selection of an Underlying cause of death, the accuracy of death certification, levels of concordance in certification practices, possible anomalies in demarcation between 'injury' deaths and 'natural causes' deaths, etc.

Papers were also selected from proceedings of meetings of the International Collaborative Effort on Injury Statistics. Specifically, papers were chosen if they related to death certification and coding practices, Multiple causes of death, and to operational definitions of injury. Six such papers were identified (Smith et al. 1995; Smith & Wet ICE Collaborative group 2000; Rooney et al. 1999; Pickett 1999; Cox 2000; Langley & Brenner 2003).

A small number of other papers were obtained using an Internet search engine and the terms 'femur' and 'life expectancy' in combination; and 'life tables' (Goldacre 1993; Goldacre et al. 2002; Booth & Tickle 2004; ABS 2004b).

3 Findings

3.1 Operational definition of injury

At a meeting of the International Collaborative Effort on Injury Statistics in 2003, Langley et al. presented a paper which examined the strengths and shortcomings in existing theoretical and operational definitions of injury (Langley & Brenner 2003). In his paper, Langley argues that, most commonly, operational definitions of injury encompass all of the codes that appear in the Injury and Poisoning Chapter and the External Causes Chapter of the *International Classification of Diseases*. Langley suggests that this approach does not constitute a satisfactory operational definition of injury. He cites, for example, the ICD-9 code 994 *Effects of other external causes* which includes conditions such as motion sickness and the effects of hunger, both of which, he considers, not to be injuries. He also argues that some conditions which fall outside the Injury and Poisoning Chapter *should* be included—e.g. the ICD-9 codes 717, 718, 724 which relate to musculoskeletal conditions of the knee and back.

Langley's argument is supported by Pickett who points to the acknowledgement, in the ICD classification guidelines, that not all injury codes are located in the Injury and Poisoning chapter (Pickett 1999).

Perhaps the most significant source of debate surrounds the inclusion of the codes which make up *Complications of surgical and medical care*. Langley cites Smith et al. as arguing that all such conditions should be excluded from an operational definition of injury (Smith et al. 1991). Langley disagrees with this approach, arguing that it is inconsistent with the generally agreed theoretical definition of injury which refers to physiological damage sustained as the result of an energy exchange that causes a sudden effect.

Langley argues that, while many *Complications of surgical and medical care* are clearly not injuries, there are exceptions such as 998.2 *Accidental puncture or laceration during a procedure* and 998.4 *Foreign body accidentally left during a procedure*. After consideration of the issues, Langley concluded that, while the question of 'what is an injury?' is a complex one and will continue to be a source of debate for some time (Fingerhut 2004), in the interim a scheme of ICD codes for inclusion and exclusion produced by the US Injury Surveillance Workgroup of the State and Territorial Injury Prevention Directors Association (STIPDA) provides a suitable basis for proceeding (Langley & Brenner 2003).

STIPDA's scheme of ICD codes for inclusion and exclusion was developed by a specially convened Injury Surveillance Workgroup with representatives from STIPDA, the Council of State and Territorial Epidemiologists, the National Center for Injury Prevention and Control and the National Center for Health Statistics of the Centers for Disease Control and Prevention, and the National Association of Injury Control Research Centers. The aim of the Group was to produce a standardised approach to the analysis and reporting of hospital discharge data (Injury Surveillance Workgroup 2003). The scheme developed defines an injury hospitalisation as one where the patient's record lists the principal reason for admission as an injury (coded to a clinical modification of ICD-9), including the late effects of injury. Excluded from the definition

are cases where the principal reason for admission is adverse effects of the therapeutic use of drugs or of medical/surgical care and the late effects of those adverse effects. NISU have previously considered how to specify injury for purposes of Australian injury indicators (Harrison & Steenkamp 2002). NISU supported a set of criteria then being developed by Colin Cryer and a sub-group of the International Collaborative Effort on Injury Statistics, and applied a version of these. NISU implemented the criterion that case definition 'should be in terms of specified anatomical or physiological damage' (Harrison & Steenkamp 2002) by requiring cases to include codes in the range S00–T89 (ICD-10 and ICD-10-AM). This range includes the whole of the ICD-10 'Injury and Poisoning' chapter except sequelae (late effects) which were omitted because the purpose at hand was to define indicators of injury incidence. NISU agree with Langley's conclusion that debate will continue about an operational definition of injury. In particular, depending on the question at hand, it may or may not be appropriate to include cases attributed to late effects of injury, a range of cases due to complications or adverse effects, and cases given certain codes outside the 'Injury and Poisoning' chapter of the ICD. The STIPDA scheme is the product of a well-informed group. When NISU began this project, it had been published recently. A factor prompting us to use it was interest in assessing this response to the problem of defining injury. In addition, our project offered potential to develop the approach (NISU would need to translate the specification from ICD-9-CM to ICD-10) and broaden its use (the definition was developed for use with hospital data; NISU planned to apply it to deaths data). On this basis, NISU opted to use the scheme devised by STIPDA to provide the basis for the *Operational Definition of Injury* applied in this study.

The coding scheme produced by the US Injury Surveillance Workgroup of STIPDA represents a contemporary interpretation of those ICD codes which it deemed to be legitimate injury codes. The scheme was produced using the injury and poisoning codes from the American clinical modification of ICD-9. For this project, the STIPDA scheme was mapped to codes in Chapter XIX of ICD-10 which is used by the ABS to code Australian mortality data. The process followed was to manually compare ICD-9-CM with ICD-10 in order to produce a list of ICD-10 codes which corresponded to the STIPDA scheme. The results of this process were checked to establish the extent of concordance between codes in the two classification systems. The process was repeated by two people to ensure the accuracy of its results. The results of the mapping process were subsequently reviewed by the Australian National Centre for Classification in Health and their comments—all minor in nature—were taken account of. The scope of the *Operational Definition of Injury* derived from the STIPDA scheme and translated into ICD-10, is shown in Table 1 below. Table 2 provides a specific example of the mapping to the STIPDA ICD-9-CM codes to ICD-10. A detailed coding scheme for the *Operational definition of injury* in terms of ICD-10 is provided in Appendix 3.

Table 1: Scope of STIPDA scheme as mapped to ICD-10

Inclusions	Exclusions
S00–S99	A00–R99
T00–T75	T78.0–T78.4
T78.8	T80–T88
T79	T98.3
T90–T97	
T98.0–T98.2	

Table 2: Example of mapping from STIPDA codes to ICD-10 Chapter XIX codes

STIPDA code range ICD-9-CM	STIPDA description	Corresponding ICD-10 Chapter XIX codes	ICD-10 Chapter XIX Code descriptions	Notes
910–919	Superficial injury	S05.0	Injury of conjunctiva and corneal abrasion without mention of foreign body	
		S05.1	Contusion of eyeball and orbital tissues	
		S00	Superficial injury, head	
		S10	Superficial injury, neck	
		S20	Superficial injury, thorax	
		S30	Superficial injury, abdomen, lower back and pelvis	
		S40	Superficial injury, shoulder and upper arm	
		S50	Superficial injury, forearm	
		S60	Superficial injury, wrist and hand	
		S70	Superficial injury, hip and thigh	
		S80	Superficial injury, lower leg	
		S90	Superficial injury, ankle and foot	
		T00	Superficial injury, multiple body regions	
		T09.0	Superficial injury of trunk, level unspecified	
		T11.0	Superficial injury of upper limb, level unspecified	
		T13.0	Superficial injury of lower limb, level unspecified	
		T14.0	Superficial injury, unspecified body region	
920–924	Contusion with intact skin surface			Note: ‘Contusion’ is included under ‘superficial injury’ in ICD-10

3.2 ABS mortality coding

This section details the process followed by the ABS in receiving and coding mortality data. The description applies to the process as it was in 2004.

The ABS receives mortality data in electronic form from the Registrar General of Births, Deaths and Marriages in each state and territory. These data are converted into a standard format and batches of between 300 and 500 records are generated for each state to be submitted for processing by an automated software system (SuperMICAR) which endeavours to find matches for the terms used on the death certificate. The software also incorporates a thesaurus to make it more flexible in determining the appropriate ICD-10 cause codes (ABS, 2005, personal communication).

The automated system deals very well with natural causes cases but rejects over 90% of the cases where external causes of death were specified on the death certificate. The system is regarded as dealing satisfactorily with some types of external cause case such as suicide or homicide. For example, it will recognise the term 'stabbing' and will automatically assign a code from the homicide range. ABS coders manually process all cases that are rejected by the SuperMICAR software. They do not normally check the external causes cases that are not rejected by the software (ABS, 2005, personal communication).

Where the death has been referred to a coroner, coders consult a summary listing received from the coroners in each state and territory. If the summary listing indicates that an external cause appears on the death certificate, coders will investigate further, by reviewing the Coroner's findings or autopsy and police reports in the NCIS. In the case of a fall being listed on the death certificate, for example, such further investigation could lead to a death being classified as due to an external cause rather than to a natural cause. However, in a case that involved a person being admitted to hospital because of a fall and dying as the direct result of a respiratory arrest, further investigations may not take place if the fall does not appear on the death certificate. In the latter case, the death would be coded as having resulted from a natural cause (ABS, 2005, personal communication).

A summary listing of the conditions that appeared on the death certificate is provided to the Mortality section of the ABS Health and Vital Statistics Unit by the NCIS. This listing provides the basis for determining the ICD-10 codes which will be assigned for deaths that have been referred to the Coroner. In general, if the summary indicates that a death was due to natural causes, no further inquiries are made unless there is also specific mention of trauma in the summary, or there is some other reason to suspect that the summary does not provide an accurate picture of the nature of the death being recorded. Where further queries are made, these make use of the documents that accompany the NCIS record: i.e. autopsy and toxicology reports, and coroner's findings (ABS, 2005, personal communication).

For cases certified by medical practitioners, Registrars of Births, Deaths and Marriages in the various states and territories supply a copy of the death certificate to the ABS. As well as demographic information, the certificate provides the list of the conditions recorded by the doctor as having contributed to the death, and indicates if there was any surgical intervention. The information provided to the ABS does not include any text describing the circumstances surrounding the death and, hence, generally does not provide information necessary to assign an external cause code (ABS, 2005, personal communication).

Cases are coded using several instruction manuals supplied by the National Center for Health Statistics, a section of the Centers for Disease Control in the United States (ABS, 2005, personal communication).

Enquiries are directed to the certifier in around 10% of cases. Cases that involved people aged 75 years or over, where a fractured neck of femur was sustained as the result of a fall, are not queried. Limited query action is taken in relation to other deaths in this age group. For those deaths that were certified by a coroner, the NCIS is consulted. Delays in entering data into the NCIS affects ability of ABS coding staff to obtain the further information they require for more complete coding. In the case of deaths that were certified by a medical practitioner, a query about the death is sent to the certifying doctor. There is a low rate of response to such queries, so coding in these cases often relies exclusively on the written information that is supplied to the ABS by the state or territory Registrar, as described above (ABS, 2005, personal communication).

The ABS has recently published an Information Paper on data quality in relation to external causes of death. This provides a much more detailed and comprehensive overview of the acquisition and coding of deaths data by the Bureau, as well as highlighting a range of issues surrounding the quality of these data (ABS 2007).

3.3 ABS data analyses

ABS mortality data were analysed in order to gain an insight into the nature of those cases which would not meet the *Conventional* criteria for injury deaths (i.e. having, as an Underlying cause of death, an external cause code from ICD-10 Chapter XX), but have, as a Multiple cause of death, an injury and poisoning code from ICD-10 Chapter XIX. The cases in the latter group, referred to in this report as *Additional* injury deaths, fell into five main categories: unintentional falls; unintentional poisoning by drugs; unintentional poisoning by other substances; inhalations of gastric contents, food or other objects; and sequelae of external causes of injury.

The *Additional* cases were investigated with respect to the following: their age and sex profile, particularly as it compares to that for *Conventional* injury deaths; the pattern of distribution for jurisdictions in which the cases were registered in order to uncover indications of systemic dissimilarity; and differences between coroners and medical practitioners in their certification practices to determine if either group is more or less likely to allocate an 'external cause' code as the UCoD in preference to a 'natural cause' code.

3.3.1 Overview

The *Operational Definition of Injury* referred to in Section 3.1 was used as the basis for selecting a subset of all injury deaths from 2002 unit record data. The subset was made up of all deaths where one or more MCoDs was an ICD-10 Chapter XIX injury or poisoning code included in the *Operational Definition of Injury* which listed in Appendix 3.

A total of 133,707 deaths from all causes were registered in 2002. Of these, 11,519 had one or more codes from ICD-10 Chapter XIX as a Multiple cause of death. The latter subset was filtered to include only those cases where the Underlying cause of death was a 'natural cause'. This identified 3,818 deaths which would ***not*** have been included in NISU's routine reports of injury mortality for 2002 because they fell outside the conventional selection criteria which require that the UCoD be an external cause. (During 2002, a total of 7,820 deaths for which the UCoD was an external cause were registered. 7,693 (98.4%) of these also had one or more Chapter XIX codes as Multiple causes of death.) The *Operational Definition of Injury* selection criteria were then applied to the subset of 3,818 cases.

This process identified 2,535 deaths for which the UCoD was ***not*** an external cause ***but*** where one or more MCoDs was an inclusion code specified by the *Operational Definition of Injury*. These 2,535 cases represent an *Additional* group of deaths that is worthy of examination in order to evaluate whether or not they are suitable candidates for augmenting the injury deaths chosen using conventional criteria.

The various subsets referred to above are listed in Table 3.

Table 3: Selection criteria for subsets of data referred to in this report

	Number	Percentage of all deaths certified in 2002
Deaths certified in Australia during the period 1/1/2002–31/12/2002	133,707	100%
- Those including any code from Chapter XIX (S00–T98)	11,519	9%
- and UCoD = External cause	7,701	6%
- and UCoD = Natural cause	3,818	3%
- and satisfies the *Operational Definition of Injury* (Section 3.1)	2,535	2%

Table 4 shows the distribution of the 2,535 cases after they were assigned to major cause categories on the basis of the presence of external cause codes within the available MCoDs. Table 3 also shows the distribution of all cases with a Chapter XIX MCoD code plus a *natural* Underlying cause of death (n=3,818).

Table 4: Presence of major external cause code categories in *Additional* injury deaths

Major cause category	Total[(a)] (n=3,818)	Operational Definition of Injury[(b)] (n=2,535)
Unintentional falls	1,519	1,518
Complications of care	1,384	102
Other unintentional injuries	739	735
Unintentional poisoning by drugs	144	144
Unintentional poisoning by other substances	105	105
Transport	26	26
Sequelae of external causes	102	80
Drowning	11	11
Fire related injury	9	9
Suicide	0	0
Homicide	0	0
Undetermined intent	0	0

Note: Some cases had codes that made them relevant to more than one major cause category. For this reason, the sum of the values in both columns of Table 4 exceeds the number of cases.

(a) Cases where one or more of the Multiple causes of death was a Chapter XIX code and where the Underlying cause of death was a *natural* cause.

(b) Cases where one or more of the Multiple causes of death was a code specified for inclusion under the *Operational Definition of Injury* criteria and where the Underlying cause of death was a *natural* cause.

Shading denotes the reduction in cases of complications of care after application of the operational definition of injury.

Complications of care are not within the intended scope of the report, and the *Operational Definition of Injury* was chosen with this in mind. As shown in Table 4, restriction of the preliminary set of 3,818 *Additional* cases to the set of 2,535 that comply with the *Operational Definition of Injury* reduces the number of cases with the presence of one or more codes relating to *Complications of care* from 1,384 to 102. The 102 cases have one or more *Complications of care* diagnosis codes specified by the *Operational Definition of Injury*.

Complications of care is the only range of external cause codes whose frequency of presence is reduced substantially by application of the operational definition of injury (Table 5). Several other rows in Table 5 show small changes because codes for these types of external causes occurred occasionally in records that did not meet the operational definition of injury.

The remainder of this section focuses on the 2,535 deaths for which:

1. The underlying cause code value puts them outside the conventional definition of injury death; AND
2. At least one Multiple cause code is present which is in the range proposed by *Operational Definition of Injury* as comprising 'injury'.

Table 5: Distribution of major external cause category codes among *Additional* injury deaths according to position of code on the death certificate

	Cases with code(s) for the major cause category		
Major cause category	**Part 1**	**Part 2**	**Anywhere**
Unintentional falls	1,422	96	1,518
Complications of care	76	28	102
Other unintentional injuries	463	275	735
Unintentional poisoning by drugs	120	55	144
Unintentional poisoning by other substances	81	25	105
Transport	..	23	26
Drowning	8	..	11
Fire related injury	..	6	9
Suicide	0	0	0
Homicide	0	0	0
Undetermined intent	0	0	0
Sequelae of external causes	13	57	80

Note: Some cases had codes that made them relevant to more than one major cause category. For this reason, the sum of the values in both columns of Table 5 exceeds the number of cases.

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

Shading denotes the cases of complications of care which do not form part of the analyses undertaken for this report.

A total of 13,972 MCoDs were assigned to the 2,535 cases under examination. 2,878 of these were Injury and poisoning codes from ICD Chapter XIX, 2,662 were External cause codes and 102 were Chapter V codes in the range F11–F16, F19, which are included in the selection criteria for the major cause category *Unintentional poisoning by drugs*. In 927 (37%) cases, codes nominated by the *Operational Definition of Injury* criteria appeared on Part 1 of the death certificate; for 1,634 (64%) cases, they appeared on Part 2. In 26 cases, *Operational Definition of Injury* codes appeared on both Part 1 and Part 2.

2,025 (80%) of the 2,535 *Additional* injury deaths had been certified by a medical practitioner. For deaths registered in 2002 where the Underlying cause was an external cause, the pattern of certification was quite different: only 18% were certified by a medical practitioner. There was also a different pattern with respect to autopsies. Post mortems were known to have been performed for a smaller number of the Additional than the Conventional deaths (4.7% compared to 24.4%). The proportions of cases where it was unknown whether a post mortem had been performed were similar for the two subsets of deaths (*Additional* deaths 71.3%; *Conventional* deaths 69.7%) (Table 6).

Table 6: Comparison between *Additional* and *Conventional* deaths in the proportion of cases where an autopsy was performed

	***Additional* deaths**		***Conventional* deaths**	
Post mortem	**No of cases**	**Proportion**	**No of cases**	**Proportion**
Autopsy performed	118	4.7%	1,910	24.4%
No autopsy performed	610	24.1%	459	5.9%
Unknown if autopsy was performed	1,807	71.3%	5,451	69.7%
Total	**2.535**	**100.1%***	**7,820**	**100%**

For the cases where *Operational Definition of Injury* codes were found on Part 1 of the death certificate, 65% had been certified by a medical practitioner. For those cases where the codes appeared on Part 2, 88% were certified by a medical practitioner.

The level of detail provided on death certificates was assessed by calculating the number of causes of death listed on the death certificate for each case. This showed a small variation between medical practitioners and coroners in the mean number of conditions assigned as Multiple causes of death. There was no appreciable difference in the number of Multiple causes assigned between those cases where a post mortem or autopsy had been conducted and those where none had been performed (Table 7). There were no marked differences between states and territories within each of the subsets of deaths included in Table 8. However, the mean number of codes per case was consistently higher for *Additional* deaths than for *Conventional* or all deaths registered in 2002.

Table 7: Comparison between mean number of MCoD codes assigned to *Additional* cases of death: Doctor certified vs Coroner certified and Autopsy vs no Autopsy

	Doctor certified deaths	**Coroner certified deaths**	**Autopsy performed**	**No autopsy performed or unknown if autopsy performed**
Number of cases	2,025	510	118*	2,417
Total number of MCoD codes assigned	11,456	2,516	616	13,356
Mean number of codes assigned per case	5.7	4.9	5.3	5.5

* This figure represents the number of cases where it was known that an autopsy was performed

Table 8: Comparison between mean numbers of MCoD codes assigned by state and territory of death registration

	Additional deaths Doctor certified: 80%			*Conventional* deaths Doctor certified: 18%			All deaths Doctor certified: 87%		
	Number of cases	Total number of codes assigned	Mean number of codes per case	Number of cases	Total number of codes assigned	Mean number of codes per case	Number of cases	Total number of codes assigned	Mean number of codes per case
NSW	912	5,019	5.5	2,580	9,594	3.7	45,939	148,042	3.2
Vic	605	3,393	5.6	1,766	5,545	3.1	33,777	106,717	3.2
Qld	461	2,486	5.4	1,609	5,417	3.4	24,196	74,359	3.1
WA	268	1,507	5.6	756	2,673	3.5	11,327	35,869	3.2
SA	138	745	5.4	599	1,789	3.0	12,028	33,607	2.8
Tas	92	511	5.6	237	825	3.5	3,971	12,925	3.3
ACT	29	152	5.4	89	277	3.1	1,563	4,530	2.9
NT	30	159	5.3	184	882	4.8	906	3,449	3.8
Australia	**2,535**	**13,972**	**5.5**	**7,820**	**27,002**	**3.5**	**133,707**	**419,498**	**3.1**

83% of the 2,535 *Additional* cases were aged 65 years and over; 71% were aged 75 years and over. Rates were particularly high among the very old: 138.0 per 100,000 deaths in the 80–84 year age group; 366.3 per 100,000 for those aged 85 and over (Figure 1). Females made up a slightly larger proportion (53%) of the *Additional* injury deaths.

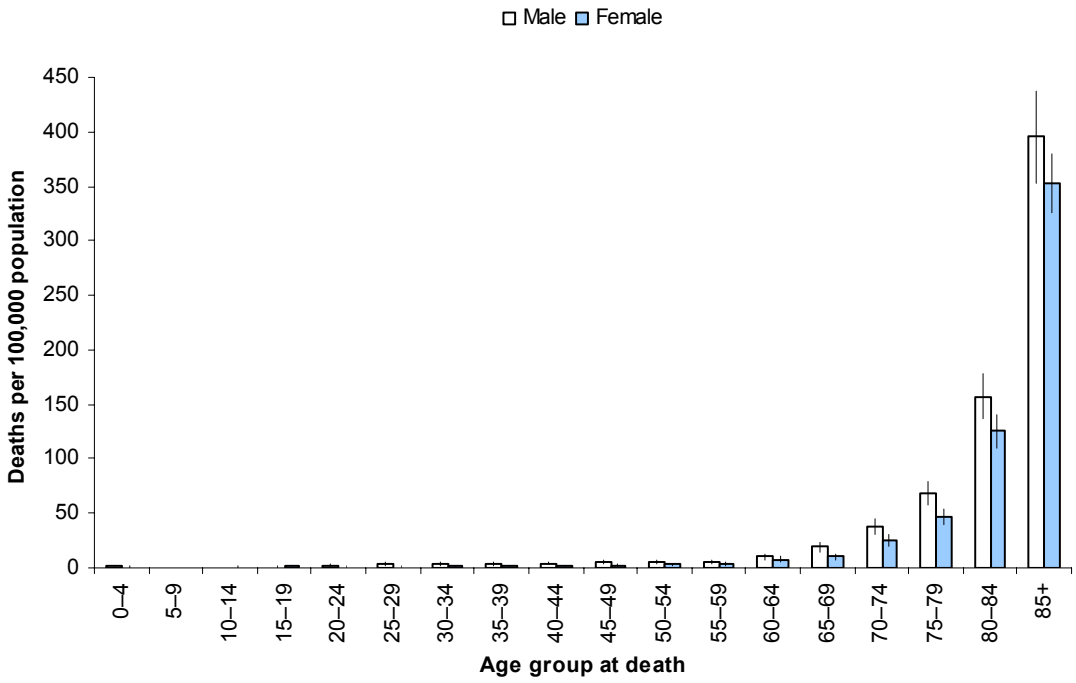

Figure 2: Age specific rates for all *Additional* injury deaths, Australia 2002

The impact of including *Additional* cases differs with age, adding only slightly (a few percentage points) to numbers of injury deaths at young ages, and approximately doubling numbers in the oldest age groups (ranging from increases of 2.4% for the 20–24 year age group to 105.9% for the age group 85 years and over) (Figure 2).

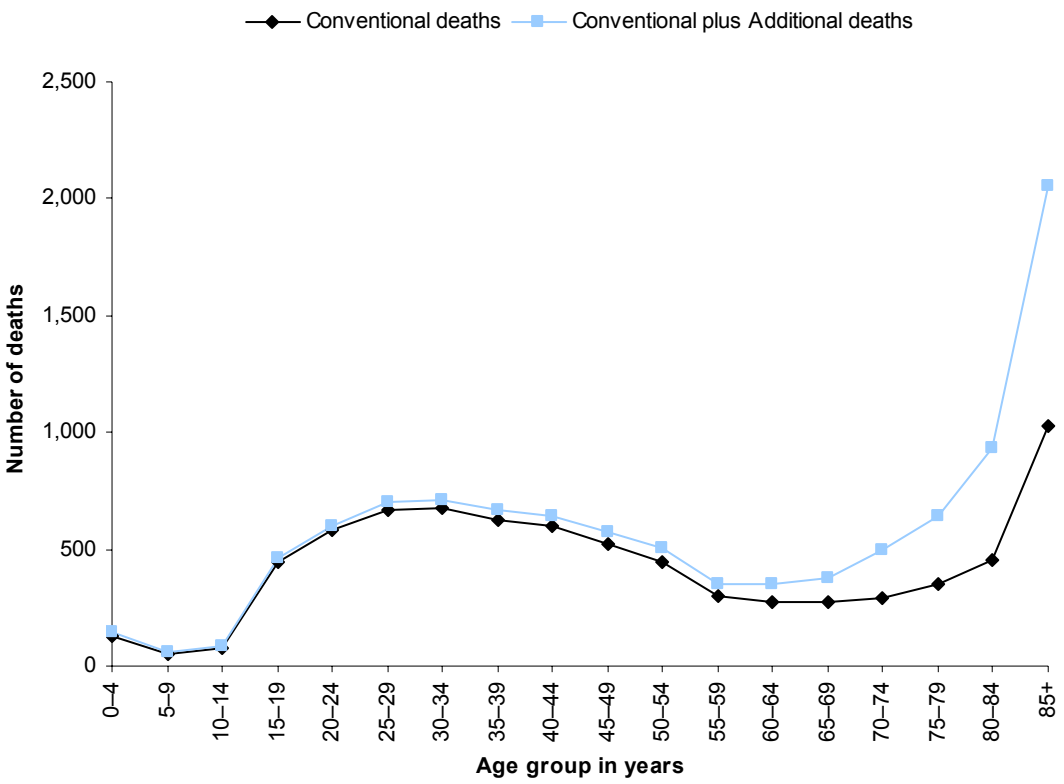

Figure 3: Impact on total number of cases by adding *Additional* to *Conventional* deaths by age group

Differences were found between the states and territories in the rate of this type of death. Figure 3 shows that the rates for South Australia, Tasmania, Queensland, and the Northern Territory differed significantly from the Australian rate of 12.6. South Australia had the lowest rate of cases (7.4) and the Northern Territory the highest (33.8). Although the rates are substantially lower, the distribution by jurisdiction shown in Figure 4 is somewhat similar to that for *Conventional* injury deaths (i.e. those deaths with an external cause code as the UCoD). In particular, the disproportionately high rate for the Northern Territory is present for both subsets (Figures 3 and 4).

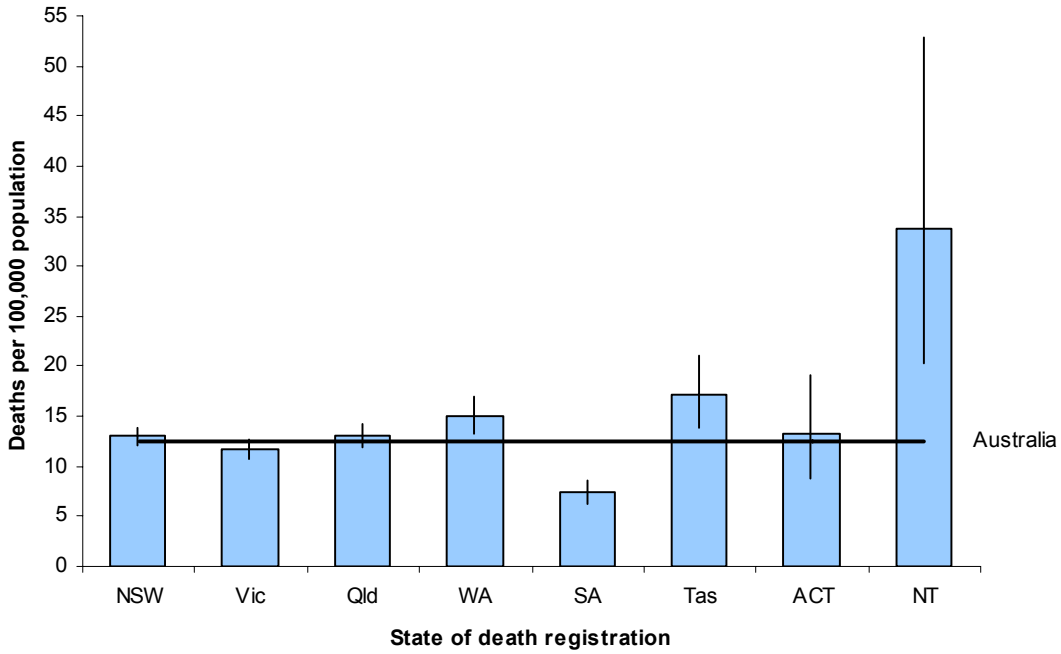

Figure 4: All *Additional* injury deaths by state or territory of registration, Australia 2002

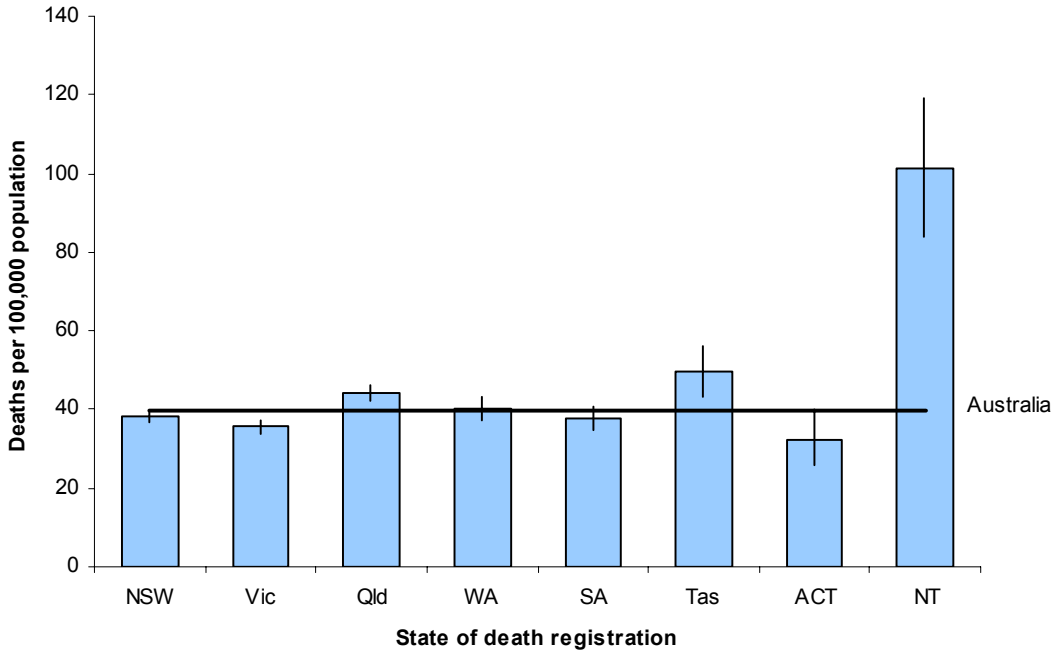

Figure 5: All *Conventional* injury deaths by state or territory of registration, Australia 2002

3.3.1.1 ABS coding of case scenarios

The ABS staff member who undertook the coding of the 15 case scenarios found 6 of the death certificates to have been poorly completed, and expressed some reservations about the quality of a further certificate. The coded scenarios are included as Appendix 4.

For 3 cases, the ABS coder indicated that, if coders did not have sufficient time available, X59 *Exposure to unspecified factor* would have been substituted for a more specific fall-related code as the UCoD.

Among the comments received was that coders are very reliant on the type of language used, and the arrangement and sequence of conditions listed on the death certificate by the certifier. For cases certified by a coroner, coders will often make use of information about the case from the NCIS. When the death certificate has been completed by a medical practitioner, the arrangement or sequence of the conditions listed on the certificate will normally dictate the selection of the Underlying cause of death. Clearly, the accuracy of the death certificate is dependent on the medical practitioner's knowledge and understanding of the guidelines for its completion. In some cases where ABS coders harbour doubts about the accuracy of a death certificate, a query will be directed to the certifier in order to clarify the details that appear on the certificate. This occurs in around 10% of cases. Information about the deaths of people aged 75 years and over are subject to limited query action as was described Section 3.2. In this study, the 71% of *Additional* deaths identified involved people over the age of 74 years.

The rules governing the selection of an Underlying cause of death under ICD-10 are highly prescriptive. A couple of the scenarios illustrate this:

In Scenario 2, the deceased fell and fractured a femur. After surgery to rectify the fracture the person had a myocardial infarction. *Myocardial ischaemia* due to *atherosclerotic heart disease* were specified on the first two lines of Part 1 of the certificate. *Surgical repair of the fracture* appeared on Part 2. The sequence *myocardial ischaemia* due to *atherosclerotic heart disease* automatically dictated that the Underlying cause of death would be coded as I21.9 *Acute myocardial infarction, unspecified.*

Scenario 3 provides a similar example. The person lost balance, fell, and sustained a fractured femur. The person was admitted to hospital, and later died there of a heart attack. The first two lines of the death certificate specified that the deceased had died of a *myocardial infarction* due to *ischaemic heart disease*. This sequence dictated an Underlying cause of I21.9 *Acute myocardial infarction, unspecified*. The fact of the fall did not appear on the death certificate.

Scenario 6 provides an example of the importance placed by coders on the wording of the certificate. The deceased had fallen and fractured a femur. The person was admitted to hospital and subsequently suffered a cardiac arrest. *Ischaemic heart disease (IHD)* appeared on the first line of Part 1 of the certificate. *IHD* is considered to be a long-term condition which, under the ICD-10 coding rules, automatically lead to the assignment of I25.9 *Chronic ischaemic heart disease, unspecified* as the Underlying cause of death. Had the first line of the certificate instead stated *acute ischaemia,* coders would have looked at information contained on Part 2 of the certificate, which mentioned the fracture.

The rules governing certification of deaths of people aged 75 years and over who fractured their femur are illustrated by Scenario 11. In this case, a fall that resulted in a fractured neck of femur lead to admission to hospital. During surgery to repair the fracture, the patient suffered suspected heart failure. I50.0 *Congestive heart failure* was coded as the Underlying cause of death. The coder has commented that she had some suspicions about the accuracy of this UCoD but, because the person was aged over 74, the case would not have been queried.

3.3.2 Unintentional falls

3.3.2.1 Summary

Three sources of data were used in investigating this category: ABS mortality data; the NCIS; and linked hospitalisation and deaths data from Western Australia.

1,518 *Additional* cases were identified in the ABS data in which a fall had been coded as having contributed to the death. This group of cases includes those that had the presence of the code X59 *Exposure to unspecified factor PLUS* a code indicating that a fracture had occurred. Previous work undertaken by NISU has provided evidence that most deaths coded to a combination of X59 *plus* a fracture were the result of a fall (Kreisfeld & Harrison 2005). The deaths were mainly among the very old. 90% had been certified by a medical practitioner. 1,108 (73%) deaths involved an injury to the hip or thigh—in all but one case the injury was a fracture of the femur. (Although there is variation between states and territories with respect to legal requirements for notifying coroners of deaths due to fractured neck of femur in the elderly, the ABS has included the following guideline for medical practitioners in its information paper *Cause of death certification, Australia 2004* (ABS 2004a):

> *Deaths from complications of fractured neck of femur in the elderly*
>
> Depending on differing legal requirements between the states and territories, notifications of these deaths to the coroner may be unnecessary when the injury occurs as the result of a fall at home in the following circumstances:
>
> - If the fracture has occurred due to fragility of the bone caused by osteoporosis.
> - When the fall is contributed to by the general condition of the patient, (e.g. because of loss of agility, slow reflexes, poor balance and deteriorated vision).
>
> The fall and consequent injury may therefore be considered as a feature of the patient's general frailty. Each case should be carefully considered and *the coroner notified or consulted in cases of doubt*.

Further analysis of this set of ABS cases is presented in Section 3.3.2.2.

136 cases of fall-related deaths from the NCIS were analysed. 71% of these had been designated by coroners as being due to *natural* causes. In a high proportion of the cases, a serious injury had been sustained. For example, 40% involved a femoral fracture and 30% a head injury. However, in 58% of the 136 cases, the death was ascribed to a disease of the circulatory or respiratory systems. Section 3.3.2.3 provides further information on this set of cases.

The most common scenarios for the NCIS deaths were post-operative deterioration in the patient's condition, deterioration without prior surgical intervention, or being found dead in circumstances that indicated a fall had taken place.

A third source of data used in this report was a subset of linked hospitalisation and death records from Western Australia for people who died whilst in hospital. 129 fall related cases were identified from these records. The mean age was 81.9 years. 86.8% of these deaths had been certified by a medical practitioner and, in 70.5% of cases, the death had been attributed to *natural* causes.

Around half of the 129 cases involved a fractured femur, a serious injury, particularly in the elderly. Yet in fewer than half of these cases had the fractured femur been deemed to have been the condition that set in train the events leading to death.

The Western Australian data showed that there was poor correlation between the hospital discharge and death records. In particular, the data shed light on two characteristic practices: Death records tended to contain fewer conditions than did hospital discharge records, and a loss of specificity in death records (e.g. the appearance of a code in the death record indicating an unspecified head injury, despite more specific information about the injury being available in the hospital discharge record). These characteristics were also evident in a Swedish study by Johansson et al. who found that adding all of the conditions which appeared in the hospital discharge record to the death certificate, resulted in an increase of 58% in the number of cases that had an accidental fall as the Underlying cause of death (Johansson & Westerling 2002). More extensive information on analysis of this source is given in Section 3.3.2.4.

3.3.2.2 ABS data

For the majority of these cases, fall-related codes appeared on Part 1 of the death certificate (1,422, 94%). In 90% of the 1,518 cases, codes were derived from information supplied by medical practitioners; the remaining 10% were taken from death certificates issued by a coroner. In 2002, 66% of deaths where the Underlying cause was an unintentional fall, were certified by medical practitioners. The high level of certification of falls deaths by medical practitioners may be explained by the guideline for certifying deaths due to fractures of the neck of femur as outlined in Section 3.3.2.1, above, and the state and territory legislation referred to there.

91% of the cases for which an accidental fall appeared on Part 1 of the death certificate were certified by a medical practitioner. Where the condition appeared on Part 2 of the certificate, 79% were certified by a doctor.

8,438 separate MCoD codes were assigned to the 1,518 deaths in this category. 1,656 of these were injury and poisoning codes from Chapter XIX, and 1,565 were external cause codes from Chapter XX. Of the latter, 1,383 (88%) were X59 *Exposure to unspecified factor*. This code is commonly used for cases for which there is insufficient information available to determine with certainty that a fall caused the death. As is explained in the NISU report *Injury Deaths, Australia 1999*, the presence of this code in combination with a fracture code is a good indication that the case was fall-related (Kreisfeld & Harrison 2005).

The age distribution of the *Additional* falls cases was similar to that for the *Additional* cases as a whole. 1,459 (96%) were aged 65 and over; 1,334 (88%) were aged 75 and over. Rates were highest among the very old: 99 per 100,000 in the 80–84 year age group; 284 per 100,000 in the 85 plus age group (Figure 5). 64% of the *Additional* cases were female. The age distribution of the *Additional* fall-related deaths (Figure 5) was very similar to that for the *Conventional* deaths that were registered in 2002 (Figure 6).

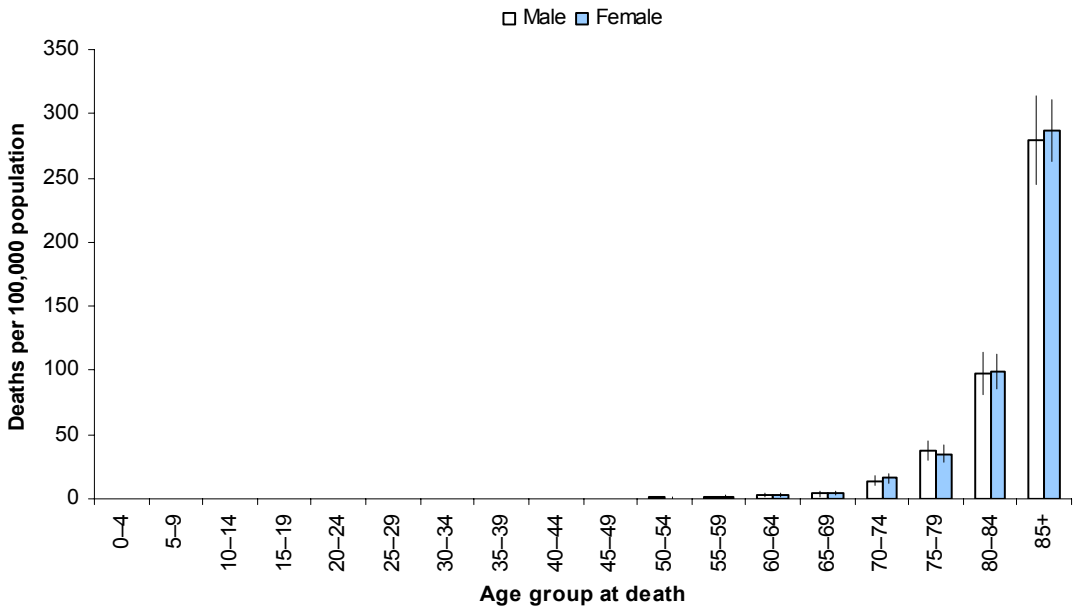

Figure 6: Age specific rates for *Additional* fall-related deaths, Australia 2002

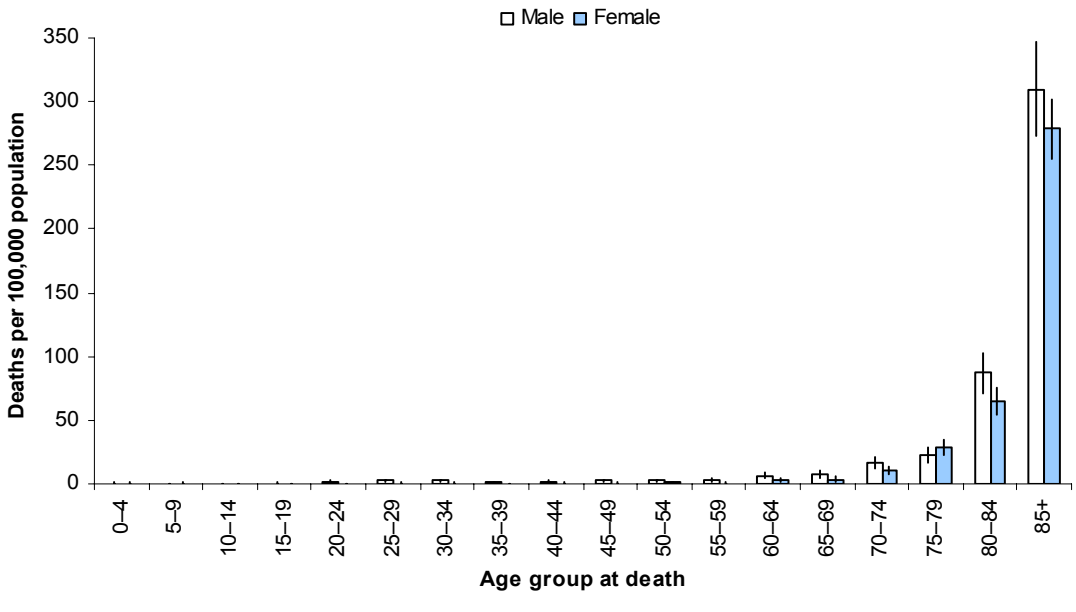

Figure 7: Age specific rates for *Conventional* fall-related deaths, Australia 2002

The pattern of age-adjusted rates of *Additional* fall-related cases by state and territory was similar to that for the 2,535 *Additional* cases as a whole. The pattern of rates for *Additional* cases was virtually identical to that for *Conventional* fall-related cases (Figures 7 and 8).

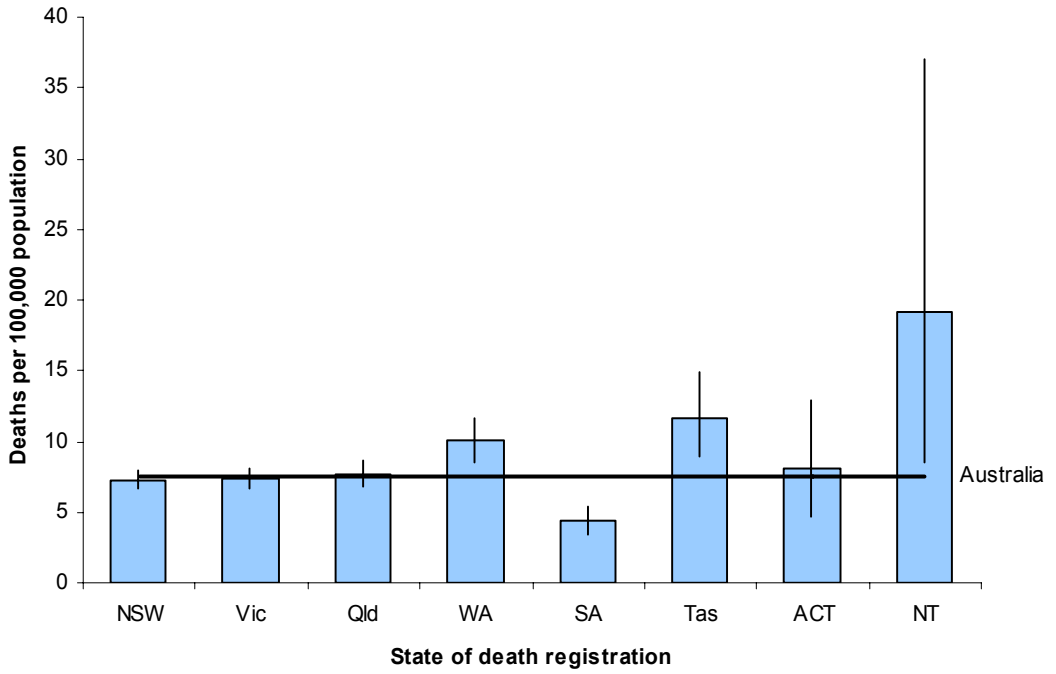

Figure 8: *Additional* fall-related deaths by state or territory of registration, Australia 2002

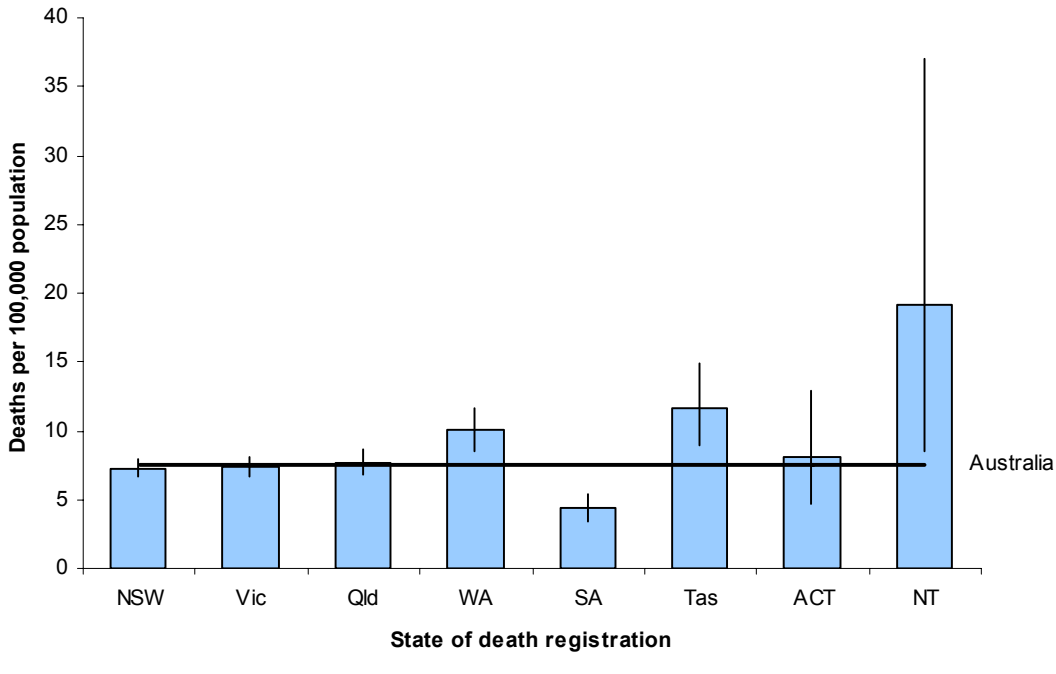

Figure 9: *Conventional* fall-related deaths by state or territory of registration, Australia 2002

The Underlying causes of death for the *Additional* fall-related cases are shown in Table 9:

Table 9: *Additional* fall-related deaths by Underlying Cause

ICD-10 Chapter	Number	Percentage
Circulatory system diseases	739	49%
Neoplasms	197	13%
Respiratory system diseases	172	11%
Nervous system diseases	80	5%
Mental and behavioural disorders	80	5%
Endocrine system diseases	74	5%
Digestive system diseases	68	4%
Genitourinary system diseases	63	4%
Other	45	3%
Total	**1,518**	**100%**

The use of MCoDs makes it possible to look at patterns of injury conditions recorded, something not previously the case when reporting was restricted to the use of UCoDs. This type of analysis of *Additional* falls deaths shows that injuries to the hip and thigh predominate (73.0%) (Table 10). Injuries to the hip and thigh are also the most common type recorded for *Conventional* fall-related injury deaths, though comprising a smaller proportion (53.9%), and followed by head injuries (24.7%).

Table 10: Comparison of body regions injured between *Additional* and *Conventional* fall-related deaths, Australia 2002

	***Additional* fall deaths (n=1,518)**		***Conventional* fall deaths (n=1,517)**	
Body region injured	**No of cases with injury to specified body region**	**Percentage of fall cases**	**No of cases with injury to specified body region**	**Percentage of fall cases**
Hip and thigh	1,108	73.0%	817	53.9%
Abdomen, lower back, lumbar spine and pelvis	141	9.3%	119	7.8%
Shoulder and upper arm	100	6.6%	43	2.8%
Thorax	60	4.0%	110	7.3%
Head	43	2.8%	374	24.7%
Knee and lower leg	33	2.2%	24	1.6%
Elbow and forearm	13	0.9%	6	0.4%
Multiple body regions	7	0.5%	31	2.0%
Wrist and hand	8	0.5%	..	0.3%
Ankle and foot	..	0.1%	..	0.1%
Neck	0	0.0%	41	2.7%
Unspecified body region	54	3.6%	63	4.2%

Note: Some cases had codes relevant to more than one body region. For this reason, the sum of the values in both columns of Table 9 exceeds the number of cases.

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

The relative proportions of cases certified by medical practitioners and coroners differed for *Additional* and *Conventional* fall-related deaths in relation to the two most frequently injured body regions—the hip and thigh, and the head. Coroners certified 76% of the *Conventional* head injury cases, but only 42% of the *Additional* cases. This disparity is partly explained by the high proportion of older ages among the *Additional* cases and may, to some extent, reflect a different approach on the part of coroners and medical practitioners to the assignment of an Underlying cause of death. For injuries to the hip and thigh, certification by a coroner was comparatively infrequent for both *Additional* and *Conventional* deaths, but slightly more so for the latter (Table 11).

Table 11: *Additional* and *Conventional* fall-related deaths by type of certifier

	Head injuries		Hip and thigh	
Certifier of death	***Additional*** **deaths (n=43)**	***Conventional*** **deaths (n=374)**	***Additional*** **deaths (n=1,108)**	***Conventional*** **deaths (n=817)**
Medical practitioner	58%	24%	91%	84%
Coroner	42%	76%	9%	16%

3.3.2.3 NCIS data analyses

As at 24 May 2004, the NCIS contained a total of 234 fall-related deaths which had occurred between 1 October and 31 December 2002. Cases were deemed to be fall-related if the mechanism of death was coded as 'falling, stumbling or jumping' or autopsy or police reports, or the NCIS cause of death text contained the terms 'fall' or 'fell'. In 28 of the selected cases, it was clear from reviewing the available documents, that a fall had not been material in causing the death. These cases were excluded from the final dataset. A further 9 cases were also omitted because they were not accidental in nature; 27 cases because they were still designated as 'open'; and 34 because the date of death was before the final quarter of 2002. This left a subset of 136 cases which provide the basis for analyses undertaken for this section.

Four-fifths of the selected cases were derived from New South Wales and Victoria (41% and 39% respectively).

A review of all available information in the NCIS lead to the conclusion that, in 112 of the 136 cases (82%), the deceased had definitely fallen (Table 6). In 7% of these cases, the fall had occurred after admission to hospital. In the remaining 24 cases (18%), the information suggested that there had *probably* been a fall involved in the death. Examination of the conditions listed in the cause of death section of the NCIS, showed the term 'fall' appeared only 10 times in the text describing the Underlying cause of death, 7 times as on other lines of Part 1 of the certificate, and only twice on Part 2 of the certificate. Mention was frequently made on the death certificate of fractures of the femur and their repair, and head injuries, conditions which are typical outcomes of falls.

96 (71%) cases had been designated by coroners as being the result of natural causes, the remaining 39 (29%) were deemed to be due to external causes. (An Underlying cause of death had not been assigned to one case.) It must be mentioned that the ABS, in coding these cases, would not necessarily have adhered to the designations arrived at by the coroners. In making decisions about the causal status of cases, the ABS reviews the range of causes that appear on the death certificate and, in a proportion of instances, also reviews available documents such as autopsy, police and coroners' findings (ABS 2005).

Review of death certificates and other documents in the NCIS indicated that two conditions were common in this group. Femoral fractures were identified in 30% of the cases and head injuries in 40% of cases.

In 2% of cases, it was clear that a morbid event such as a stroke or cardiac arrest, had immediately preceded the fall. In addition, in a further 17% of the 136 deaths, the information available was suggestive of this having occurred. There was no indication of a prior morbid event in the remaining 81% of cases.

In 96 (71%) cases there was a significant level of injury consistent with a fall. Insufficient information was available to determine the extent of injuries resulting from the fall in 25 (18%) cases.

88 cases (65%) were admitted to hospital prior to death. In 11 of these instances, the person had probably fallen while in hospital.

35 cases (26%) underwent surgery prior to death. Police and autopsy reports indicated that it was common for patients to be considered unsuitable for surgery such as the repair of a hip because of their compromised health status.

In 77 cases (57%) death occurred in hospital. The most common circumstance was death pursuant to a deterioration in the patient's condition after non-operative treatment (Table 12).

Table 12: Circumstances of fall-related deaths investigated by coroners

Circumstances of death	Number	Percentage
Died in hospital during or soon after surgery (i.e. within 24 hours)	12	8.8%
Died in hospital up to 7 days after surgery	14	10.3%
Died in hospital, non-operative treatment (condition deteriorated, patient died)	51	37.5%
Died after release from hospital	..	2.9%
Found dead	23	16.9%
Other or unknown circumstances	24	17.6%
Insufficient or no information	8	5.9%
Total	**136**	**100.0%**

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

Examination of the death certificate information provided by coroners showed that the conditions identified as the Underlying cause of death were most commonly those listed in ICD-10 Chapter 9: Diseases of the circulatory system. The next most common group were from the closely allied chapters dealing with Injury and poisoning and with External causes. The latter group represents those conditions which have traditionally fallen within the bailiwick of routine injury reporting. (It should be noted that, for some cases, more than one condition was listed as the Underlying cause of death (Table 13.))

Table 13: Conditions identified by coroners as the Underlying cause(s) of death according to chapters of ICD-10

ICD-10 Chapter(s)	Number	Percentage
Chapter 9: Diseases of the Circulatory system	65	41.1%
Chapters 19 & 20: Injury & poisoning; External causes	52	32.9%
Chapter 10: Diseases of the Respiratory system	26	16.5%
Other	15	9.5%
Total	**158**	**100.0%**

3.3.2.4 Analyses of Western Australian linked data

A total of 212 records of hospitalisation that terminated in death and had a principal diagnosis in the range ICD-10 S00–T98 were identified in the subset of Western Australian linked data (described in section 2.5). Five of these were excluded because they contained no codes in the MCoD information, leaving 207 linked hospital and death records.

Fall-related records were identified from the subset of 207, using the criterion that one or more of the external cause codes appearing in the hospital data was in the range ICD-10 W00–W19 *Falls*. This yielded 129 records.

The 129 records were fairly evenly divided between males and females (46.5% and 53.5% respectively). 106 (82.2%) involved persons aged 75 years or over. The mean age was 81.9 years. 112 (86.8%) of the deaths had been certified by a medical practitioner. A post mortem had been performed for 18 (14.0%) of the fall-related deaths. At time of separation from hospital, 64 (49.6%) of the records had a principal diagnosis of S72 *Fracture of femur* and 35 (27.1%) had a principal diagnosis in the range S00–S09 *Injuries to the head*.

Analyses of fall-related cases

The relationship between the hospital data component and death data component of the 129 fall-related linked records selected for this study was investigated to gauge the level of concordance between the two. The principal findings of these investigations were as follows:

Codes derived from hospital discharge information enabled all 129 records to be identified as deaths following a fall. This was based on the presence of a code in the range W00–W19 among the external cause codes assigned to the hospitalisations data. Only 36 (28%) of the same 129 cases could be identified as a fatal fall in the deaths data.

There was evidence of a loss of specificity of codes between hospital records and death records (e.g. the presence of the codes S06.8, S06.04, S02.0, S02.1 which identify specific types of head injury, S06.8 relating to specific types of head injury in the hospital record, make way for S09.9 *Unspecified injury of the head*). For Chapter XIX codes, the level of this was modest—16% of records had less specific Chapter XIX codes in the death record than in the hospital record. The trend was far more apparent in relation to Chapter XX codes where 55 (42.6%) records with a code in the range W00–W19 *Falls* among the hospital diagnoses at time of separation, lost this code in favour of X59 *Exposure to unspecified factor* in the corresponding deaths data. This is consistent with previous work by NISU, in which it has been shown that most deaths in Australia, at ages 75 and older, in which a fracture is recorded as a multiple cause of death, are not assigned a specific external cause code, but are coded to X59 *Exposure to unspecified factor* (Kreisfeld & Harrison 2005). This probably reflects the limited nature of the query process described in Section 3.2.

Deaths data contain fewer ICD codes than does hospitals data, both with respect to the total number of codes assigned, and to the comparative number of Chapter XIX and XX codes (Table 14).

Table 14: Comparison between hospital and deaths data with respect to the mean number of ICD-10 codes assigned to in-hospital deaths following a fall (n=129)

	Hospital data	Deaths data
Type of ICD codes in record	Mean no of codes	Mean no of codes
Chapter XIX diagnosis codes	2.0	0.8
Chapter XX external cause codes	1.3	0.7
All ICD codes	9.5	4.6

As shown in Tables 15 and 16, for more than a third of the cases that could be clearly identified as being fall-related according to the hospital separation record had no indication at all that an injury had been sustained in the corresponding death record—i.e. no presence of Chapter XIX or XX codes among the multiple causes of death.

Table 15: Level of concordance between ICD-10 Chapter XIX codes in hospital and deaths data for fall-related records in the Western Australian linked dataset (n=129)

Match between codes in hospitalisations and deaths data	ICD-10 Chapter XIX diagnosis codes
Records with at least one Chapter XIX code among the Hospital diagnosis codes but no Chapter XIX codes among the multiple causes of death	37.2%
Records with one or more Chapter XIX codes that match at the 4 character level	25.6%
Records with one or more Chapter XIX codes that match at the 3 character level	33.3%
Records with no match at 3 or 4 character level between Chapter XIX codes in the hospital and deaths data	26.4%

Note: Percentages total to more than 100 because records can be included in more than one category.

Matches at the 3 and 4 character level of Chapter XX codes in hospital and deaths data were found in only a small proportion of cases (3.1% and 5.4% respectively). This is largely due to the substitution of X59 in the deaths data for codes in the range W00–W19 found in the hospitals data (41.9% of records) (Table 16).

Table 16: Level of concordance between ICD-10 Chapter XX codes in hospital and deaths data for fall-related records in the Western Australian linked dataset

Match between codes in hospitalisations and deaths data	ICD-10 Chapter XX external cause codes
Records with at least one Chapter XX code among the Hospital diagnosis codes but no Chapter XX codes among the Multiple causes of death	34.9%
Records with one or more Chapter XX codes that match at the 4 character level	3.1%
Records with one or more Chapter XX codes that match at the 3 character level	5.4%
Records with no match at 3 or 4 character level between Chapter XX codes in the Hospital and Deaths data	62.0%

Note: Percentages total to more than 100 because records can be included in more than one category.

91 (70.5%) of the 129 cases that were attributed to a fall at the time of separation from hospital, were assigned a 'natural cause' as the underlying cause of death. Around half of the 91 *natural cause* deaths had one or more Chapter XIX and XX codes among the multiple causes of death. The remainder showed no indication of an injury in the deaths data.

Table 17: In-hospital deaths following falls by assigned 'Underlying cause of death'

Underlying cause of death	No of records	Proportion of total
External causes:		
Unintentional falls	18	14.0
X59 *Exposure to unspecified factor**	18	14.0
Natural causes:		
Diseases of the circulatory system	45	34.9
Endocrine, nutritional and metabolic diseases	10	7.8
Diseases of the respiratory system	10	7.8
Neoplasms	8	6.2
Diseases of the digestive system	8	6.2
Other conditions	12	9.3
Total	**129**	**100.0**

The effect of age on coding patterns observed for fall-related cases

The subset of fall-related records represents a very elderly group within the community (mean age 81.9 years). Some further analyses were conducted using all the linked records for injury deaths in hospital in 2000–01 (n=207) in order to ascertain whether advanced age could be a determinant for some of the patterns reported above.

The 207 linked records were split into two subsets—those aged 0–64 years (mean age 29.9) and those aged 65 years and over (mean age 84.6).

The values shown for the older age group in Tables 17, 18 and 19 below, are very similar to those for means and proportions calculated for the fall-related records in Tables 13, 14 and 15. There were some notable differences for the younger age group.

The average number of Chapter XIX codes and Chapter XX codes per record was higher for the younger group. However, the ratio between the number of codes assigned in death records to the number assigned in hospital records was lower for the younger group.

Table 18: Comparison between hospital and deaths data with respect to the mean number of ICD-10 codes assigned to all in-hospital deaths following injury (n=207)

Type of ICD codes in records	0–64 years (n=60)		65 years and over (n=147)	
	Mean number of codes		Mean number of codes	
	Hospital data	Deaths data	Hospital data	Deaths data
Chapter XIX diagnosis codes	5.4	1.1	2.0	0.8
Chapter XX external cause codes	1.2	0.9	1.3	0.7
All ICD codes	10.1	2.6	9.3	4.6

The older age group had close to double the proportion of records without the presence of a Chapter XIX code in the deaths data than did the younger age group. However, in the 0–64 year age group, there was a comparatively low level of concordance between Chapter XIX codes in the hospital and deaths data for those records where there was a Chapter XIX code in the deaths data: 58% of the 48 records with a Chapter XIX code in the deaths data did not match at the 3 or 4 character level. This compared with no match at the 3 or 4 character level in 18% of 90 cases with a Chapter XIX code in the deaths data for the group aged 65 years and over. Examination of the data for the younger age group showed that, in most cases, the Underlying cause of death was conceptually similar to the external causes contained in the hospital data. The comparatively high proportion of codes in the older group that match at the 3 character level is largely due to a large number of cases coded to S72 *Fracture of femur*. Typical changes in coding involved variations in intent (e.g. from unintentional to self-harm), or variations in the mechanism of an injury (e.g. from collision with a car, to collision with heavy transport vehicle). The ability to draw on the results of a post mortem would lead to different, but more precise, codes in the deaths data.

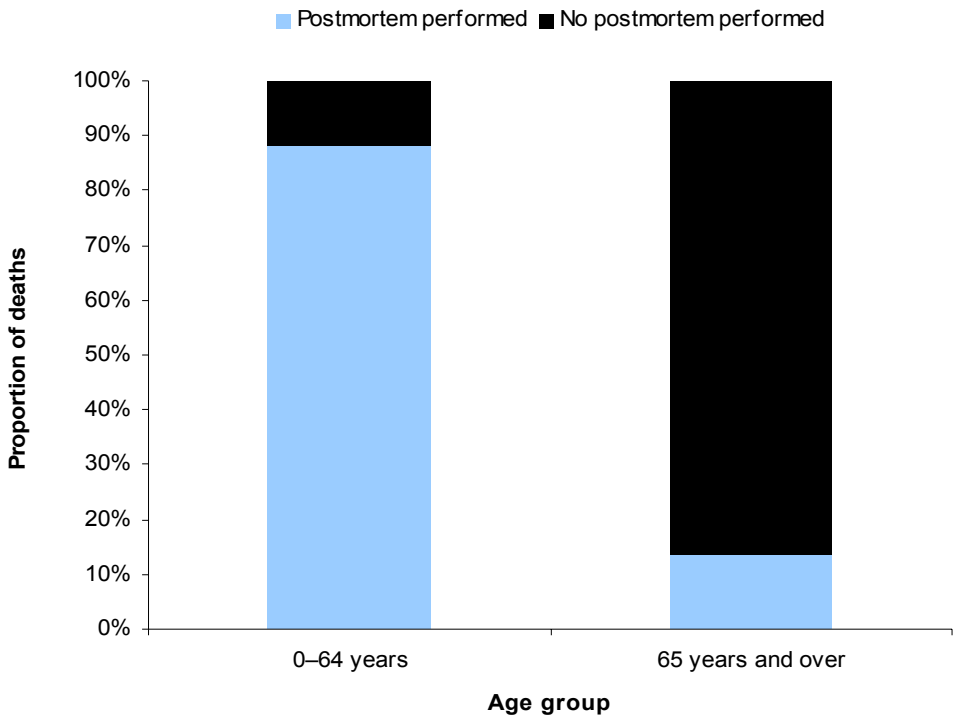

Figure 10: Proportion of deaths where a post-mortem was performed, by age group, Australia 2002

Table 19: Level of concordance between ICD-10 Chapter XIX codes in hospital and deaths data for all records in the Western Australian linked dataset

Match between codes in hospitalisations and deaths data	ICD-10 Chapter XIX diagnosis codes	
	0–64 years (n=60)	65 years and over (n=147)
Records with one or more Chapter XIX codes in each data source that match at the 4 character level	16.7%	22.4%
Records with one or more Chapter XIX codes in each data source that match at the 3 character level	20.0%	29.9%
Records with at least one Chapter XIX code in each data source, but none matching at 3 or 4 character level	63.3%	28.6%
Records with no Chapter XIX codes among the multiple causes of death	20.0%	38.8%

Note: Percentages total to more than 100 because records can be included in more than one category.

The death records for the 0–64 year age group usually had only one MCoD which was very commonly a broad residual category from Chapter XIX (e.g. S09.9 *Unspecified injury of head* or T07 *Unspecified multiple injuries*). In contrast, the cases in the 65 years and over age group tended to have several MCoDs—consistent with the multiple co-morbidities found in older people—though usually only one of these was from Chapter XIX. That code was S72 *Fracture of femur* in 37% of cases, reflecting the profile of injuries in this age group and being rated in the table as a more specific match.

In a notable proportion of cases, multiple specific diagnosis codes in the hospital data gave way to only one or two broad residual codes in the deaths data. In the most extreme case, 17 separate codes in the hospital data (9 specific to head injury, and the balance relating to other injured body parts) were subsumed into only one residual code in the deaths data, S09.9 *Unspecified injury of head*.

Close to three times as many records in the older age group did not have any Chapter XX external cause codes in the hospital data (Table 20).

Table 20: Level of concordance between ICD-10 Chapter XX codes in hospital and deaths data for all records in the Western Australian linked dataset

Match between codes in hospitalisations and deaths data	ICD-10 Chapter XX external cause codes	
	0–64 years (n=60)	65 years and over (n=147)
Records with one or more Chapter XX codes that match at the 4 character level	8.3%	4.8%
Records with one or more Chapter XX codes that match at the 3 character level	28.3%	6.1%
Records with at least one Chapter XIX code in each data source, but none matching at 3 or 4 character level	56.7%	54.4%
Records with no Chapter XX codes among the multiple causes of death	13.3%	37.4%

Note: Percentages total to more than 100 because records can be included in more than one category.

Summary

- Death records had fewer ICD codes and Chapter XIX or XX codes than corresponding hospital records.
- Where both death and hospitalisation records included Chapter XIX or XX codes, in all but a small proportion the two records appeared to be broadly consistent with one another.
- However, death record codes were often allocated to section (e.g. S09.9) or chapter (e.g. T14.9) residual categories, suggesting a loss of specificity for conditions appearing on the death certificate. For example, the record of separation from hospital for a person who had sustained head injuries, often contains multiple codes specifying the nature of their injuries. Typically, much of this information is not carried over to the death certificate, where the multiple conditions are subsumed within one residual category such as S09.9 *Unspecified injury of head*.
- Cause of death coding in records with no Chapter XIX or XX code seemed often to have been limited to terminal conditions. In a hypothetical example, typical of those seen, a person has fallen and sustained a fractured femur and wrist. After being taken to hospital, they have undergone surgery to repair these fractures and have subsequently suffered a post-operative myocardial infarction after which death occurred. The hospital separation record lists codes for all of these separate conditions. However, the associated death record only lists the myocardial infarction.

3.3.3 Poisoning by drugs

3.3.3.1 Overview

144 *Additional* cases were found in ABS mortality data with a Multiple cause of death in the range X40–X44 (Accidental poisoning by drugs). Most of these cases were young and middle-aged males. 89% of the cases had been certified by a coroner. For two-thirds of the 144 cases, a mental and behavioural disorder due to psychoactive substance use (F11–F16, F19) was the Underlying cause of death. Previous work done at NISU has shown that there is no clear demarcation between the ranges X40–X44 and F11–F16, F19. NISU therefore took the step, in its 2002 mortality report, of including all deaths due to drugs, irrespective of whether they have an *external* or *natural* cause as their Underlying cause of death. The WHO has also implemented a change to ICD-10 whereby deaths due to mental and behavioural disorders that make mention of poisoning on the death certificate, are given a UCoD in the range X40–X49 (Walker 2007). This change took effect in January 2006.

The use of Multiple causes of death information has an additional advantage for reporting on deaths due to poisoning by drugs. Access to the poisoning codes from the range T36–T50 (which cannot be used as the Underlying cause of death), provide more details about the type of drug involved.

3.3.3.2 ABS data

144 cases had attracted an External cause code in the range ICD-10 X40–X44 as an MCoD, indicating that a drug had contributed to the death. In 120 (83%) cases, the codes appeared on Part 1 of the Death certificate. 128 (89%) of the 144 cases had been certified by a coroner.

72% of the cases in this category were male. Of the males, 85% were concentrated in the age range 15–54 years of age.

In 97 (67%) of the 144 cases of poisoning by drugs, the UCoD was coded as a mental or behavioural disorder due to the use of a pharmaceutical agent(s) (ICD-10 Chapter V). In 64 (66%) of the 97 cases ascribed to a mental or behavioural disorder, the agent was an opioid. A further 29 (30%) of the cases involved poisoning by the use of multiple drugs. This finding was consistent with previous work undertaken at NISU which showed that there is considerable overlap between cases with a UCoD in the range F11–F16, F19 and X40–X44 (the latter being the range which defines the cases traditionally reported as deaths due to injury by pharmaceutical poisoning) (Kreisfeld & Harrison 2005). Advice from the ABS about their coding protocols for this type of case are that, if terms such as 'abuse', 'dependence' or 'addiction' appear on the death certificate, a code from ICD-10 Chapter V is used. If, however, a term such as 'overdose' is used, the death is given an external causes code in the range X40–X44. There is some evidence that there is variation between states and territories in the relative frequency with which the different terminology is used. In particular, it is reported that Victoria has a policy of limiting the use of the terms 'abuse' or 'dependence' (ABS 2005).

Deaths in this category are commonly associated with multiple drug use.

Overall, 244 drug-related MCoDs from ICD-10 Chapter XX External Causes and Chapter V: Mental and Behavioural Disorders were assigned (the latter being accorded the same status as external cause codes for the purposes of quantifying deaths related to unintentional poisoning by drugs). The types of poisoning agents specified by these codes are listed in Table 21.

Table 21: MCoDs assigned to cases of unintentional poisoning by drugs indicating type of drug

Type of drug or toxic substance	ICD-10 code	Number of MCoDs
Opioids	F11	64
Cannabinoids	F12	..
Sedatives	F13	..
Cocaine	F14	..
Other stimulants including caffeine	F15	..
Multiple drug use and other psychoactive substances	F19	30
Nonopioid analgesics, antipyretics and antirheumatics	X40	..
Antiepileptics, sedative-hypnotic, antiparkinsonism and psychotropic drugs	X41	20
Narcotics & psychodysleptics (hallucinogens)	X42	46
Other and unspecified drugs, medicaments and biological substances	X44	74
Total number of MCoD codes assigned		**244**

Note: The number of codes (n=244) exceeds the number of cases in this group (n=144) because some cases were assigned more than one code.

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

Until the introduction of MCoDs in 1997, available information about unintentional poisoning by drugs was limited to the codes derived from these two chapters. Codes in the range T36–T50 from ICD-10 Chapter XIX , which only appear in the form of MCoDs, provide a much more detailed source of information about the specific agents of poisoning than do the external cause codes. For example, for the 144 deaths in this category, a total of 116 MCoDs were coded to *T40 Poisoning by narcotics and psychodysleptics (hallucinogens)*. A detailed breakdown of these is shown in Table 22 below. This level of detail would not have been available prior to 1997.

Table 22: MCoDs coded to T40 Poisoning by narcotics and psychodysleptics (hallucinogens)

ICD-10 code	Poisoning agent	Number of MCoDs	Percentage
T40.1	Heroin	17	15%
T40.2	Other opioids (codeine/morphine)	39	34%
T40.3	Methadone	32	28%
T40.4	Other synthetic narcotics (pethidine)	..	2%
T40.5	Cocaine	5	4%
T40.6	Other and unspecified narcotics	14	12%
T40.7	Cannabis (derivatives)	7	6%
Total coded to T40		**116**	**100%**

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

An analysis undertaken of the *Drugs flag* variable used by the ABS in coding mortality data prior to 2003 registrations yielded a larger number of cases in which a drug other than alcohol or tobacco was involved. (The *Drugs flag* identified 187 cases compared to the 144 cases identified by the presence of an ICD-10 Chapter XX external cause code in the range ICD-10 X40–X44 or an ICD-10 Chapter V code in the range F11–F16, F19 as an MCoD.)

The distribution of cases identified by the *Drugs flag* is given in Table 23:

Table 23: Drugs flag assigned to deaths

Presence of drug	Number of cases
Drug other than alcohol or tobacco	149
Smoking and drug other than alcohol	..
Alcohol and drug other than tobacco	36
Combination of smoking, alcohol and other drugs	..
Total	**187**

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

Additional cases of unintentional poisoning by drugs were concentrated in the 20–49 year age group. The highest age specific rates were found in the five year age groups 25–29 (1.8 per 100,000) and 85 years and over (2.5 per 100,000). 72% of the cases were male (Figure 10).

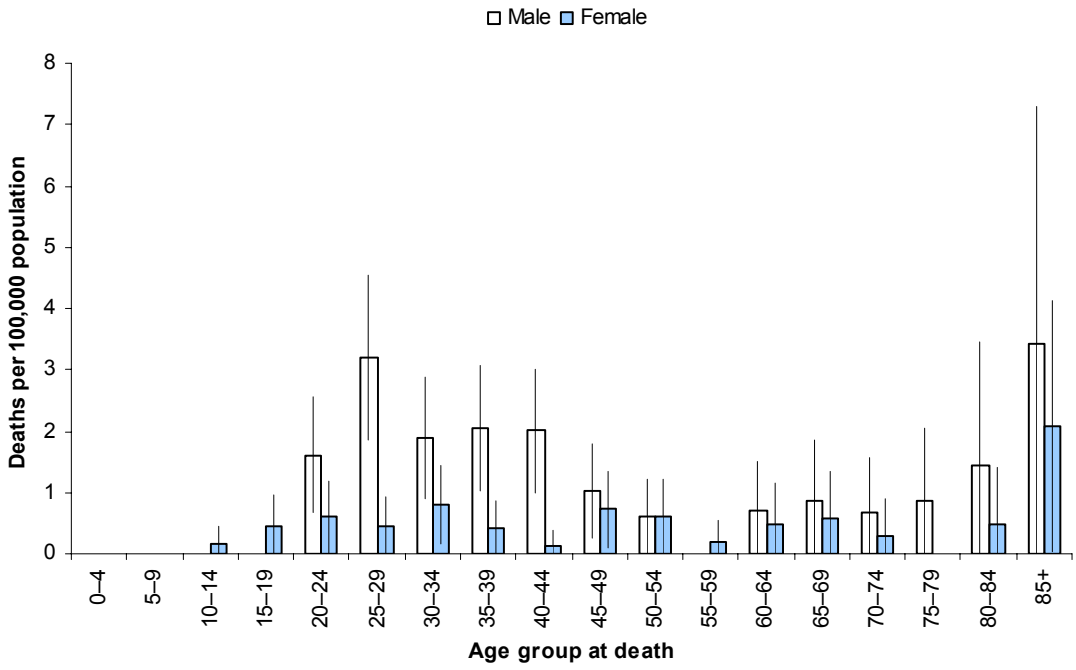

Figure 11: Age specific rates for *Additional* deaths due to unintentional poisoning by drugs, Australia 2002

For *Conventional* deaths, cases were most frequent among young and middle-aged people—76% of cases occurred between the ages of 25 and 54. 67% of the deaths in this subset involved males (Figure 11).

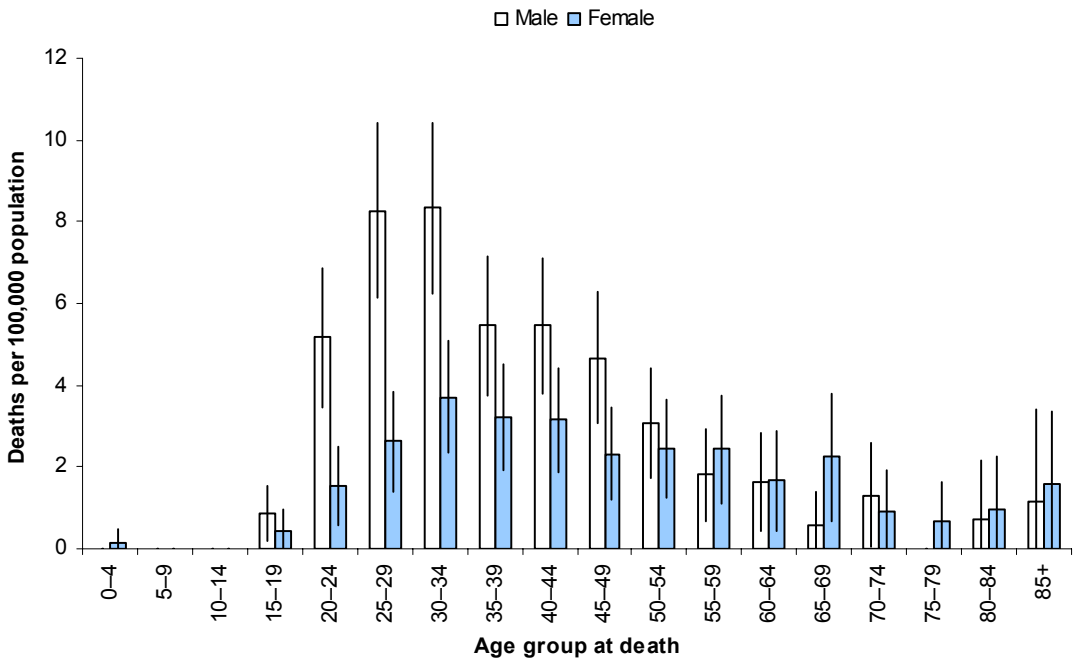

Figure 12: Age specific rates for *Conventional* deaths due to unintentional poisoning by drugs, Australia 2002

For *Additional* deaths due to unintentional poisoning by drugs, two states had rates that were significantly lower than that for Australia as a whole (0.7 per 100,000 population): Queensland (0.2) and South Australia (0.1). The rate for New South Wales (1.2) was significantly higher than that for Australia. Caution should be exercised in interpreting these rates because of the low numbers involved (Figure 12).

Conventional deaths exhibited a different pattern to that for *Additional* deaths. Most notably, no states or territories had rates that differed significantly from the Australian rate (Figure 13). As for *Additional* deaths, however, caution should be exercised in interpreting the rates shown in Figure 12 due to the small number of cases involved.

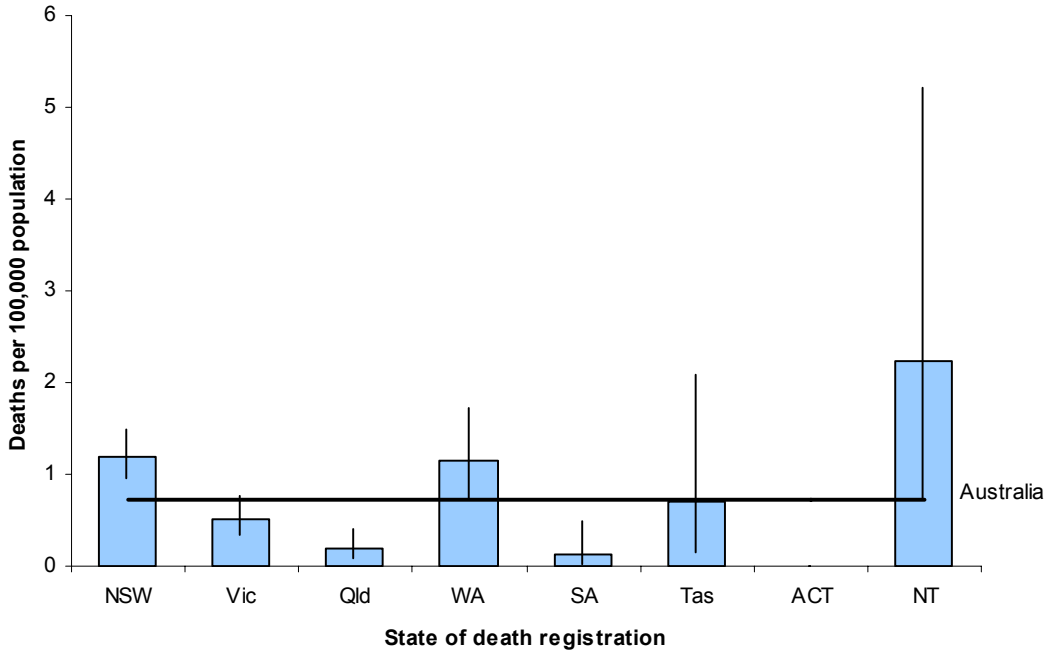

Figure 13: *Additional* deaths due to unintentional poisoning by drugs, Australia 2002

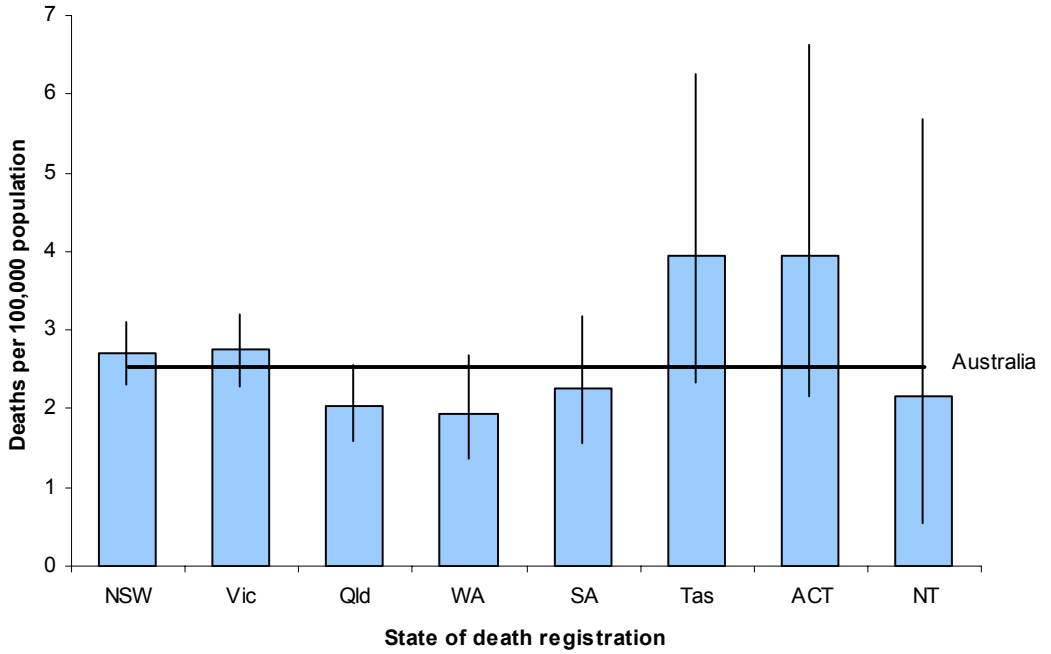

Figure 14: *Conventional* deaths due to unintentional poisoning by drugs, Australia 2002

3.3.4 Poisoning by other substances

3.3.4.1 Overview

There were 105 *Additional* deaths due to poisoning by other substances identified in ABS mortality data, many of which had codes indicating that alcohol had been a contributing factor. There were also many cases of multiple drug use suggesting that there is overlap between this category and that of poisoning by drugs.

As was the case for poisoning by drugs, in a substantial proportion of this group of cases, a mental or behavioural disorder had been selected as the cause of death. Updates made by the WHO mean that the coding of deaths registered from January 2006 should no longer use codes from the mental and behavioural disorders chapter of ICD-10 (Walker 2007).

3.3.4.2 ABS data

As with Poisoning by drugs, in a substantial proportion of these deaths, the Underlying cause was coded as a mental or behavioural disorder (48% of 105 cases). Advice from the ABS indicates that, when the term 'alcohol intoxication' appears, deaths in this category would be coded as being due to the 'natural cause' ICD-10 F10 Mental and behavioural disorders due to the use of alcohol. Multiple drug use was also evident. A total of 244 MCoD codes relating to unintentional poisoning by alcohol or a toxic substance other than those included in Section 3.2, were drawn from ICD-10 Chapters V, XIX and XX. The nature of these substances is listed in Table 24.

Table 24: MCoD codes assigned to *Additional* cases of unintentional poisoning by other substances indicating type of toxic substance, Australia 2002

MCoD code	Type of toxic substance	Number of MCoDs
F101	Alcohol, harmful use	5
F102	Alcohol, dependence syndrome	25
F103	Alcohol, withdrawal state	..
F107	Alcohol, residual and late-onset psychotic disorder	..
T510	Ethanol	..
T511	Methanol	..
T519	Alcohol, unspecified	61
T520	Petroleum products (including petrol, kerosene, paraffin wax, ether, naphtha, spirits)	..
T561	Mercury and its compounds	..
T568	Other metals	..
T578	Other specified inorganic substances	32
T598	Other specified gases, fumes and vapours	..
T599	Gases, fumes and vapours, unspecified	..
T629	Noxious substance eaten as food, unspecified	..
T659	Toxic effect of unspecified substance	..
X45	Accidental poisoning, alcohol	63
X46	Accidental poisoning, Organic solvents and halogenated hydrocarbons and their vapours	..
X47	Accidental poisoning, gases and vapours	..
X49	Accidental poisoning, other and unspecified chemicals and noxious substances	37
Total number of MCoD codes		**244**

Note: The number of codes (n=244) is greater than the number of cases (n=105) because some cases have been assigned more than one code.

.. Cell counts of fewer than five cases have been suppressed in order to preserve confidentiality in ABS Deaths Data.

In 64% of the cases in this category, the death had been certified by a coroner. The proportion of Coroner certified deaths varied between states and territories. For example, in the two largest states, New South Wales and Victoria, coroners certified 85% and 63%, respectively, of cases in this category, compared with Western Australia and Queensland where they certified 42% and 21% respectively.

There was a greater spread of cases between the adult age groups than was seen for some of the other categories, notably falls. However, cases were still most frequent among older people. 84% of the cases were male. The highest rate (5.7 per 100,000) was for males aged 85 years and over (Figure 14).

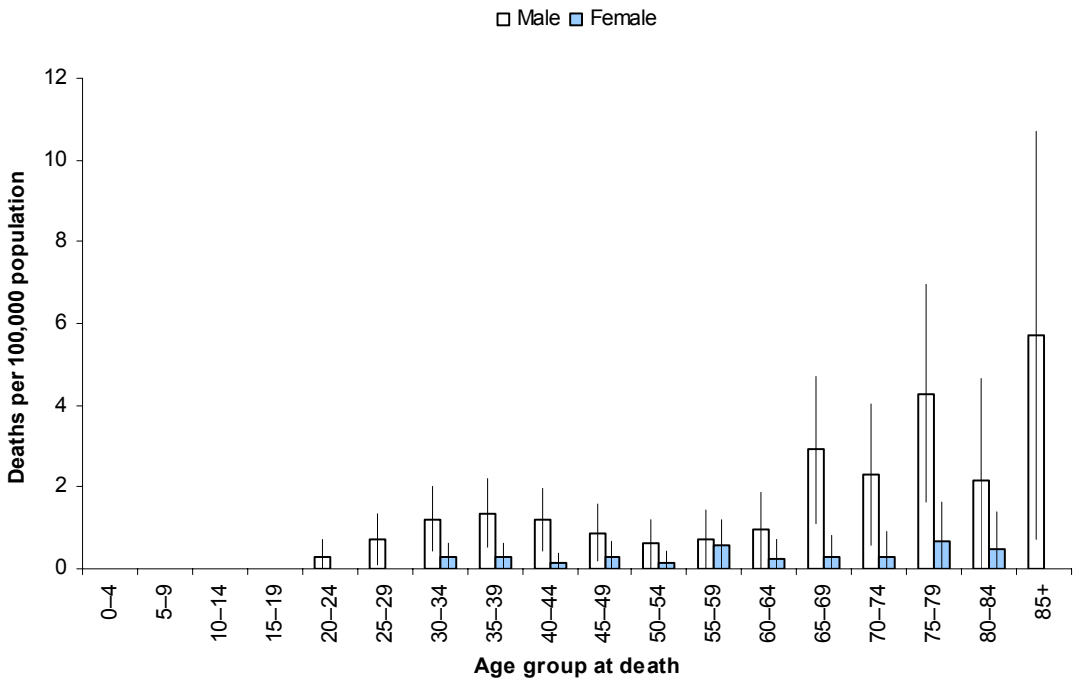

Figure 15: Age specific rates for *Additional* deaths due to unintentional poisoning by other substances, Australia 2002

Most notable among the differences between states and territories was that for the Northern Territory (6.0 per 100,000) which was significantly higher than that for Australia (0.5) (Figure 15). Small case numbers complicate interpretation and caution should therefore be exercised.

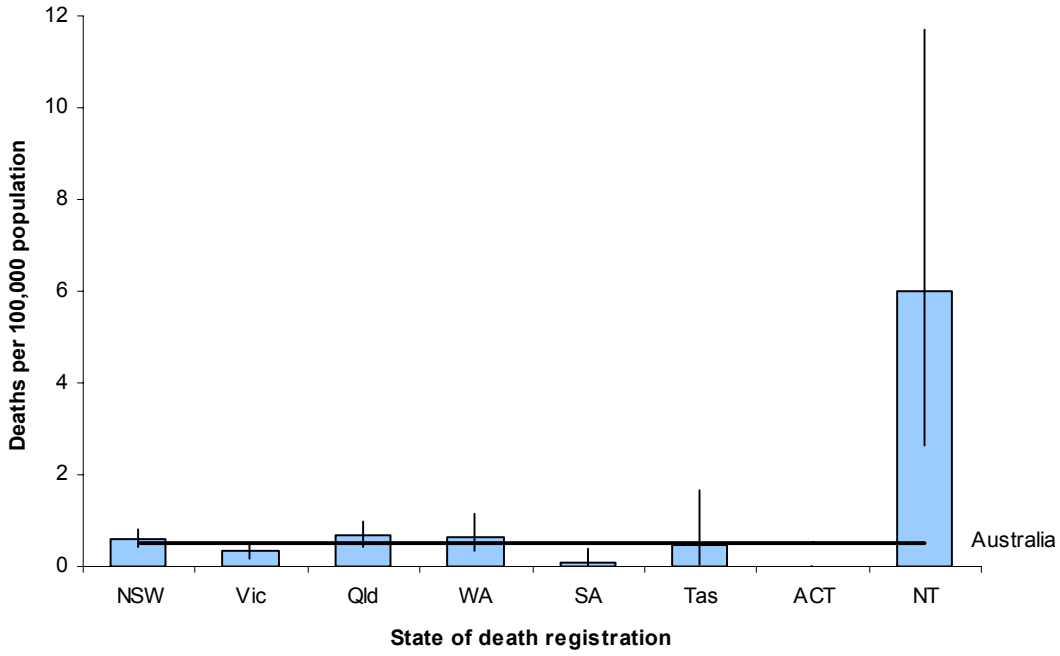

Figure 16: *Additional* deaths due unintentional poisoning by other substances by state and territory of registration, Australia 2002

3.3.5 Inhalations

482 (67%) deaths in the category *Other unintentional injury* had codes indicating that the person had inhaled gastric contents, food or some other object. The UCoDs for these cases are shown in Table 25.

Table 25: *Additional* inhalation-related deaths by Underlying cause

ICD-10 Chapter	Number	Percentage
Disease of the circulatory system	146	30%
Neoplasms	73	15%
Diseases of the nervous system	72	15%
Diseases of the digestive system	59	12%
Mental and behavioural disorders	49	10%
Diseases of the respiratory system	44	9%
Endocrine, nutritional and metabolic diseases	13	3%
Other	26	5%
Total	**482**	**100%**

Anecdotal information received from the ABS points to a pattern that has been observed in the coding of such deaths. In many cases of inhalation investigated by the coroner, death was associated with the use of a 'peg' (percutaneous endoscopic gastrostomy) which had been inserted into the patient to assist them with eating. This procedure is common in conditions such as some forms of cancer (ABS 2005).

Deaths were concentrated in older age groups: 74% were aged 65 years and over, 56% 75 years and over. Death rates were highest among the very old: 24.9 in the 80–84 year age group; 46.0 in the 85 and over age group (Figure 16).

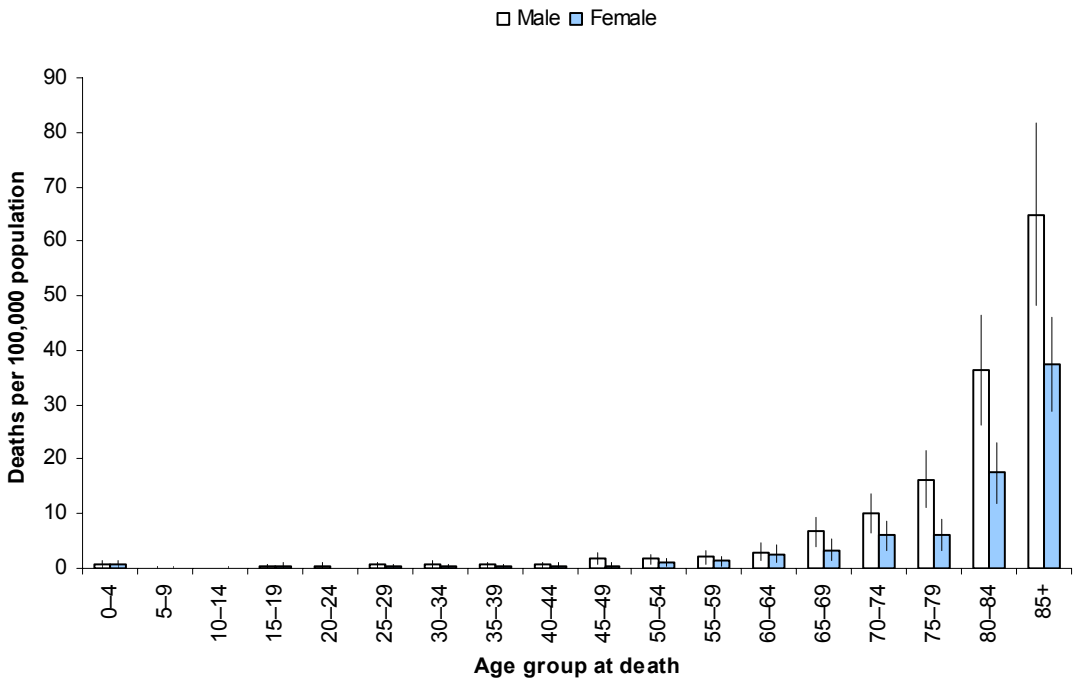

Figure 17: Age specific rates for *Additional* deaths due to inhalation, Australia 2002

Although there was variation between the rates for different jurisdictions, only that for South Australia differed significantly from the Australian rate, though only marginally. As for other categories of death in this report, small numbers make it difficult to interpret the variations between states and territories (Figure 17).

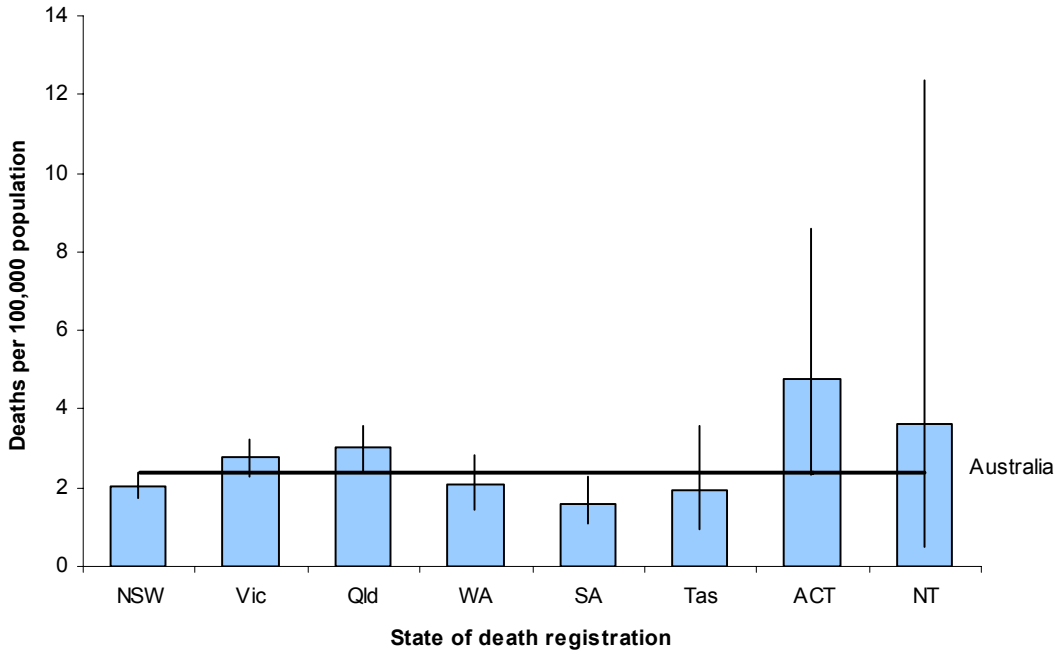

Figure 18: *Additional* deaths due to inhalation by state and territory of registration, Australia 2002

3.3.6 Sequelae of external causes

80 *Additional* cases were identified in which one or more of the MCoDs was a code in the range T90–T98, which refer to sequelae of external causes. In over half of these cases the Underlying Cause of death was a *Disease of the circulatory or respiratory system* (Table 26).

Table 26: Underlying cause of death for *Additional* cases due to sequelae of external causes

Underlying cause of death	Number	Percentage
Diseases of the circulatory system	30	38%
Diseases of the respiratory system	12	15%
Diseases of the Nervous system	9	11%
Neoplasms	8	10%
Mental and behavioural disorders	8	10%
Other conditions	13	16%
Total	**80**	**100 %**

79% of the cases had been certified by a medical practitioner and an autopsy had been conducted in only 5% of cases.

53 (66%) of the cases were aged 65 years or over. 35 (44%) were aged 75 years and over. 61% of cases involved males. The rate was highest among those aged 85 years and over (7.1 per 100,000 population) (Figure 18).

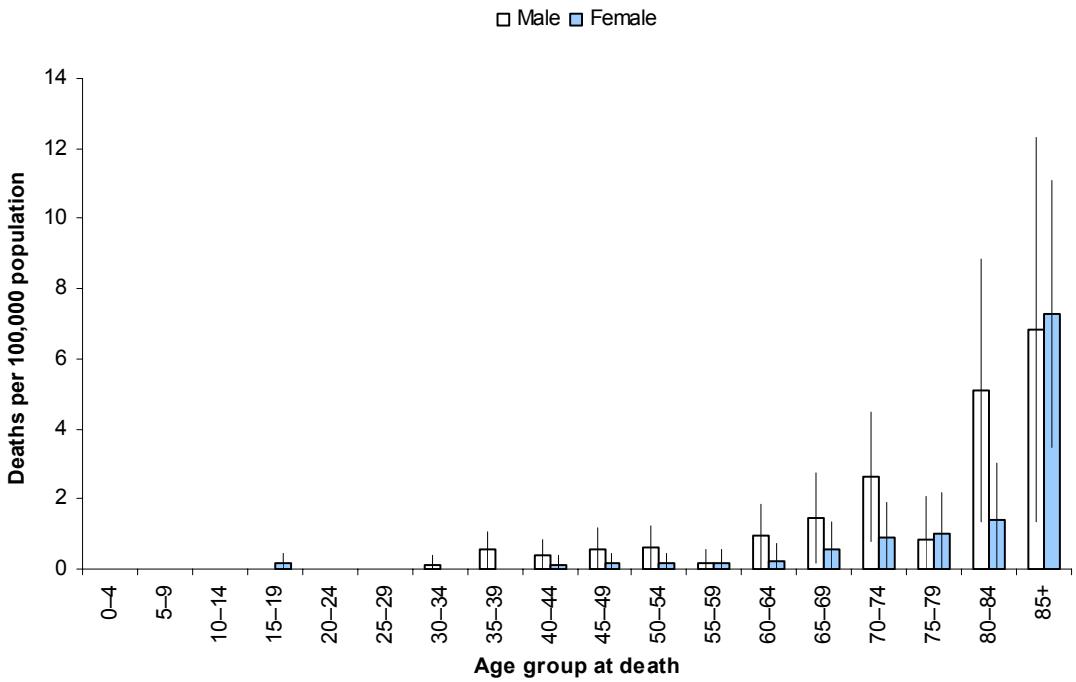

Figure 19: Age specific rates for *Additional* deaths due to sequelae of external causes of injury, Australia 2002

The rates for states and territories did not differ significantly from that for Australia as a whole (0.4 per 100,000) (Figure 19).

Figure 20: Age standardised rates for *Additional* deaths due to sequelae of external causes of injury by state or territory of registration, Australia 2002

3.4 Literature review

No Australian literature was found which reported on the use of MCoDs in the analysis and reporting of mortality data. A small number of references were found for international papers that dealt with the use of MCoDs. Most notable among these were: Nelson et al. who describe the successful use of Multiple causes data as a source of information for the surveillance of deaths associated with head or neck injuries (Nelson et al. 1993); Smith et al. who report on the value of Multiple cause data in identifying cases of drowning mortality (Smith & Wet ICE Collaborative group 2000); and Cox, who examines practical uses of Multiple cause data for the purposes of reporting mortality (Cox 2000).

Several papers were found regarding the certification and coding of mortality data. A number of these raised issues in relation to lack of knowledge and consistency in the completion of death certificates, and focussed on difficulties inherent in deciding on an Underlying cause of death.

A study undertaken by Messite et al. required 68 clinicians with differing levels of experience to code six written clinical cases. All participants indicated that they had received little or no training during their careers in the completion of death certificates. The study found poor agreement between the subjects' death certificate entries and the correct cause-of-death sequences as determined by a professional nosologist who had received training from the US National Coding Center for Health Statistics (Messite & Stellman 1996).

Smith et al. (2001) showed poor compliance between completed death certificates and published guidelines for their use (Smith & Hutchins 2001). In the study, completed death certificates from 494 autopsies were compared with published guidelines and definitions issued by the College of American Pathologists and the US National Center for Health Statistics. The overall finding was that, in 41% of cases, the causes of death were improperly completed. Differing levels of accuracy were also identified between clinicians and pathologists in their completion of the death certificates—clinicians significantly outnumbered pathologists in completing causes of death. It was also found that the duty of certifying deaths was often made the responsibility of junior members of staff (Swift & West 2002). Variation between differing groups of medical staff in terms of the accuracy of their completed death certificates was found by Peach et al. They found that the accuracy of death certificates completed by resident medical officers was significantly lower than that for specialists and general practitioners (Peach & Brumley 1998).

Poor levels of consistency in death certification were found in a study conducted by Roberts et al. (Roberts et al. 2000). In the study, 16 clinical scenarios, with causes of death, were circulated to all coroners in England and Wales (n=143). Sixty four questionnaires were returned. There was near consensus (>80% concordance) in relation to two of the scenarios. For five, there was no significant agreement. The latter included three cases in which death resulted from a combination of injury and natural disease: falls resulting in fractures of bones affected by metastatic carcinoma and osteoporosis); bronchopneumonia after hip replacement for osteoarthritis and Creutzfeldt-Jakob disease; and a fall after a *grand mal* fit.

An international comparison of injury mortality in the elderly suggests that variations in the selection of a cause of death are not limited to individuals (Langlois et al. 1995). The study by Langlois et al. found that the New Zealand death rate from falls for ages 65 and over were nearly three times that for the United States, while hospitalisation rates for both falls and hip fractures are similar for the two countries. They conclude that this can not be fully explained by actual differences in the incidence of falls, but are likely to be due to differences between countries in death certification and coding practices. They point to studies of other conditions to support this view (Jougla et al. 1992; Percy et al. 1981; Kelson & Farebrother 1987; Percy & Muir 1989).

A further issue was raised by the literature. It has been suggested that there is sometimes a tendency for a 'natural cause' to be chosen over an 'external cause' as the Underlying cause of death (Pemberton 1988; Calder et al. 1996; Roberts 1996; Maxwell 1986). Among the proponents of this view is Pemberton who cites as an example the case of two British regions which were observed to have an unusually high death rate attributed to osteoporosis and a low death rate from hip fractures during the 1980s. This was found to be the result of a policy instituted 15 years previously by a coroner. Under this policy, certifying doctors were instructed, in the case of a hip fracture in a person suffering from osteoporosis, to list the latter condition as the Underlying cause of death. Although doctors were still required to report these deaths to the coroner, in the absence of criminal violence or neglect, the death could be ascribed to *natural* causes and would thus not necessitate an inquest. The belief was expressed that some medical practitioners deliberately approached the completion of death certificates in a way that would avoid the necessity for further investigations that they believed were unnecessary and would distress the family of the deceased person (Calder et al. 1996; Dijkhuis et al. 1994; Pemberton 1988).

Several papers advocated improvements to the process of certifying deaths (Peach & Brumley 1998; Myers & Farquhar 1998; Swift & West 2002; Maudsley & Williams 1996). This commonly took the form of promoting the better education of certifying practitioners (Myers & Farquhar 1998; Peach & Brumley 1998; Messite & Stellman 1996), although one paper suggested that available evidence does not support the success of the education interventions that have been tried (Swift & West 2002). Swift et al. made a number of suggestions for improving death certification within a hospital context: death certificates should only be completed by senior medical staff with delegation to junior doctors being closely supervised; encourage the use of hospital necropsy; adopting a practice, widely used in Finland, of having a pathologist or professional clinical coder screen all completed certificates (Swift & West 2002). Myers & Farquhar suggest the following possibilities: that the completion of a workshop on death certification by resident doctors be made mandatory; that questions about death certification be included in speciality examinations; and that hospital-based expert panels be established to amend inaccurately completed certificates (Myers & Farquhar 1998). Maudsley et al. point to the need for feedback to certifiers to assist them in understanding the construction of mortality data; evidence-based interventions, educational commitment, and an integrated process of on-going quality assurance within an audit structure (Maudsley & Williams 1996). Other suggested interventions included routine updating of the death certificate after an autopsy had been conducted the development of software to guide physicians through the death certificate completion process. The latter would be distributed to hospitals for everyday use (Messite & Stellman 1996).

In making use of international literature, it is important to note that there is variation between countries with respect to their certification and coding practices. In particular, Rooney et al. have identified differences in relation to certification, investigation, registration and coding of causes of injury deaths (Rooney et al. 1999).

4 Discussion

Multiple causes information provides the potential for enhancing the routine reporting of injury deaths and has already been made use of by NISU in its routine mortality reports (Kreisfeld et al. 2004).

The aims of this study were twofold:

1. To analyse aspects of MCoD data relevant to injury surveillance; and to
2. Assess the potential for using MCoD information for routine reporting of injury mortality.

The following discussion is structured around these two aims.

4.1 Aspects of MCoD data relevant to injury surveillance

4.1.1 What is an injury?

This report began by considering issues associated with arriving at an operational definition of injury. Haddon's theoretical definition of an injury as being the sudden physiological damage that results from an energy exchange has been widely accepted as a way to characterise injury during recent decades (Haddon 1973). However, before MCoDs were introduced in Australia in 1997, injury deaths could only be defined on the basis of a single external cause. The introduction of MCoDs makes it possible to specify injury deaths in terms of injury codes (rather than external causes codes), an approach with support from injury epidemiologists (Langley & Brenner 2003; Harrison & Steenkamp 2002). Accepting this approach is not equivalent to specifying selection criteria for 'injury' cases. In the period since MCoD information became available, a debate has evolved regarding which ICD codes should be included or excluded from an operational definition of injury.

A review of the literature indicates that the debate regarding an operational definition of injury is a complex one and is unlikely to be entirely or finally resolved in the near future. This notwithstanding, having a well-specified definition of injury is vital for surveillance and reporting. With this in mind, a scheme developed by the US Injury Surveillance Workgroup of the State and Territorial Injury Prevention Directors Association (STIPDA) was adopted as the basis for an *Operational Definition of Injury* to be used in this study. The rationale for selecting the STIPDA coding scheme was that it had been produced by individuals with a key role in administering injury surveillance practice in the United States. It was felt that a coding scheme which had resulted from considered discussion of the issues by skilled and experienced injury surveillance personnel would serve well as a tool for identifying injury cases.

The chief feature of the STIPDA scheme, and the *Operational Definition of Injury* derived from it, is the exclusion of cases of *Complications of surgical and medical care*. This important group of deaths warrants analysis and reporting. However, the nature and circumstances of these deaths differ from those for most deaths due to acute trauma.

Progress in understanding both types of mortality is likely to be enhanced by largely separate analysis. The inclusion of T78.8 *Other adverse effects, not elsewhere classified* was found to be confusing and, although retained for the inclusion criteria for this study, this code should probably be excluded in any future work. NISU also excluded cases of *Sequelae of external causes*, because our focus was on injury incidence in a defined period and cases coded as sequelae may refer to injury events long before death.

The work reported in this document encourages us to continue developing and using operational definitions of injury cases that are framed in terms of the presence in death records of conditions coded (or codable) to injury conditions, rather than specifying injury in terms of external cause codes. Optimal ways of defining 'injury' are likely to differ with purposes, context and over time. For example, while it is currently usual to focus on conditions codable to Chapter XIX of ICD-10, other conditions, such as certain musculoskeletal conditions, and some obstetric conditions, have characteristics that might sometimes prompt their inclusion in studies of injuries.

4.1.2 Certification of death

A fundamental aspect of the quality of available mortality data is the process of death certification that underpins it. The basic concept of certification is to describe the events which lead to the death and to identify the single condition which was deemed to have set in train those events. Review of the literature provided strong indications that the certification process, particularly the arrival at a UCoD, is fraught with uncertainty.

Several factors can influence the choice of an appropriate UCoD. For example, inexperience on the part of the certifier; a lack of clarity about how the causal chain is constructed; weaknesses associated with the ICD classification system (e.g. the appearance of codes for unintentional poisoning in both Chapters V and XX) and age-related differences in procedures for seeking information, all have the potential to affect the correct and complete identification of causes of injury deaths.

For this reason, it is difficult to ascertain the relationship between *Conventional* and *Additional* injury deaths. Technically, these types of cases ***are*** different because the *Additional* injury deaths do not have an External cause as the UCoD. However, the work undertaken for this study suggests that the distinction between deaths in the two groups is often less clear than this might suggest, and not necessarily a good guide to which deaths are attributable to injury.

The literature suggests that little or no training in filling out death certificates is the norm within medical degree programs and that inexperienced medical practitioners are less likely to be familiar with certification rules or how to apply them (Messite & Stellman 1996; Smith & Hutchins 2001). 80% of the *Additional* injury deaths investigated in this study were certified by medical practitioners. In addition, poor levels of consensus have also been found between coroners, who are, presumably, familiar with the certification process (Roberts et al. 2000). Systemic differences in certification were also found in the literature: differences between geographical regions within the same country and in international comparisons (Pemberton 1988; Langlois et al. 1995).

Analyses of the fall-related cases from the ABS and the Western Australia linked dataset found that, in a substantial proportion of cases, the death had been ascribed to diseases of the circulatory or respiratory systems, a finding consistent with work undertaken by Goldacre (Goldacre 1993; Goldacre et al. 2002). Goldacre, while acknowledging that deaths such as this are sometimes accurately described on the death certificate, speculates that this 'convergence to cardiovascular and respiratory causes … may reflect an insufficient distinction between the mode of dying and the cause of death' (Goldacre 1993).

The literature, combined with our analysis of Australian data, leads us to conclude that factors other than inherent characteristics of deaths have considerable potential to influence whether or not the statistical summary data on causes of death mentions injury or external causes of injury at all, whether the case is assigned an external cause code as the Underlying cause of death, and which injury or external cause codes are assigned to it. The factors certainly have potential to result in otherwise equivalent deaths appearing as *Conventional* or as *Additional* injury deaths.

4.1.3 Data analyses

Use of the *Operational Definition of Injury* and MCoD information identified 2,535 deaths registered in Australia in 2002 which would not meet the conventional definition of an injury death as being one which had an External cause as the UCoD. These cases all had at least one of the injury condition codes included in the *Operational Definition of Injury* as an MCoD. This subset of deaths fell, principally, into five categories: Unintentional falls; Complications of care; *Other unintentional injury*; Unintentional poisoning by drugs; and Unintentional poisoning by other substances. Analyses of these subsets of cases illustrated some of the advantages offered by MCoD information:

- The identification of additional cases has the potential to provide a more complete picture of the burden that injury imposes on the community;
- Access to MCoD information has already proven useful to NISU in improving the identification of cases of fall-related mortality through underpinning a method of determining if any of the substantial number of deaths coded to X59 *Exposure to unspecified factor* are relevant.
- Previously unavailable information about the patterns of injury sustained—such as was shown in Table 10—could assist practitioners in developing interventions;
- The Chapter XIX codes available as MCoDs can sometimes provide more detail than do external cause codes making it possible to identify particular injury issues. For example, the Chapter XIX poisoning codes are a rich information source for the specific types of poisoning agents involved in a death.

Such advantages notwithstanding, however, this study has highlighted a number of technical barriers to the practicability of using MCoD information for surveillance purposes.

Analysis of linked data from Western Australia showed a poor correlation between hospital and death records. In general, hospital separation records contained twice as many codes as did death records of the same cases. Commonly, this resulted from the fact that a range of ***specific*** codes in the hospital record had been subsumed into one ***residual*** code (e.g. S09.9 *Head injury, unspecified*). The insights gained from the linked data suggest that, because hospital separations information is not available to coders, they are presented with a challenging task when assigning codes to the death record. The absence of this information has the potential to affect the accuracy of the codes that are assigned (particularly the UCoD) in reflecting morbid train of events that lead to the death. A study by Johansson et al. found that, when all of the conditions listed in hospital discharge records were added to the death certificate, this resulted in a 58% increase in the number of cases that had an accidental fall as the Underlying cause of death (Johansson & Westerling 2002).

The presence of more numerous and more specific codes in hospital records does not guarantee that they are more reliable than the less numerous and more general codes typical of death records. Indeed, when death certification is based on information from formal post-mortem examination, then it may be more reliable than an assessment based on clinical findings before death. Nevertheless, hospital discharge data clearly have potential to improve understanding of causes of death, without requiring additional primary data collection. For example, users of linked hospital and death data can examine sets of records for similarity or difference between the final separation records of people who died in hospital and the death records for the same individuals. Congruent codes might be taken as confirmatory and divergent codes might prompt further investigation. Conceivably, ABS staff responsible for cause of death coding could be allowed access to such sources for use, much as they now use data from the NCIS.

4.1.4 Data systems and sources

4.1.4.1 ABS data

ABS data are the source for routine reporting of Australian injury mortality. This source is excellent in that it represents complete coverage of all deaths that have been registered. Addition of MCoDs has added to its value. A weakness, however, is the fact that coders must rely on the accuracy of the death records furnished by certifiers who are sometimes unfamiliar with the correct procedures to be followed, have a poor understanding of causality in relation to documenting a death, or base their choice of Underlying cause of death on a desire to avoid an autopsy being conducted. ABS coders are highly skilled in the use and application of the ICD-10 codes, but their skill can not always overcome flaws in the death certification process.

4.1.4.2 NCIS data

Coroners' data provide the richest source of information about deaths and the circumstances that surrounded them, and the NCIS has greatly simplified access to these records at national level (Driscoll et al. 2003). Sudden and unexpected deaths are generally meant to be reported to a coroner. Since most injury deaths are sudden or unexpected, most injury deaths are referred to a coroner. Access to post mortem and autopsy results, and police reports, often makes it possible to reconstruct the chain of events that lead to a death and to obtain detailed information about the physiological damage that occurred.

Some classes of unintentional death are seldom referred to a coroner—e.g. people aged 75 years and over who died as the result of a fractured neck of femur caused by a fall. Falls were the major category of *Additional* injury deaths identified in this study and fractures of the femur made up a major proportion of this group (73%).

Although not tested in this study, NCIS data could provide a useful tool for better understanding the nature of some other types of deaths. For example, 90% of the 144 Additional deaths identified in the ABS data, where one or more of the MCoDs was a code indicating that death had resulted from unintentional poisoning by drugs, were certified by a coroner. Case-level linkage of the NCIS data with that received from the ABS—something for which operational and administrative arrangements did not exist when this project was undertaken—would enable research that would provide greater insight into the nature of the coroner-certified deaths included in the ABS dataset.

4.1.4.3 Western Australian linked data

Many older people who are injured die while in hospital. The linked hospital and deaths data obtained from Western Australia has helped to shed light on the provenance of deaths data for injury cases, especially fatal falls, that occurred in a hospital setting.

The poor correlation between the hospital and death records is a source of concern for injury surveillance. Logic would suggest that, in general, when no post mortem has been conducted, the range of conditions present on the hospital separation record that is completed subsequent to a death occurring would also appear on the death certificate. Yet this study has shown that death records contain fewer and less specific codes than do hospital records, and quite often include no mention at all of a major injury that was the Principal Diagnosis for the hospital episode during which the person died. More widespread linkage of records, such as that undertaken in Western Australia, could assist greatly in gaining a better understanding of the nature and reasons for differences between *Additional* and *Conventional* deaths.

4.2 Potential for using MCoD information

4.2.1 Falls

Based on the findings of this study, there are compelling reasons for including the *Additional* ABS falls cases for routine reporting purposes.

90% of the ABS *Additional* falls cases examined in this study were certified by medical practitioners (most of these involved a fracture of the femur). Although the extent is impossible to ascertain, the literature suggests that, in at least some cases, the fall has not been designated as the UCoD through a desire, on the part of the doctor, to spare the family the distress associated with an autopsy (Pemberton 1988).

While the death rates for 2002 *Additional* fall-related cases were similar for most of the states and territories, there were two exceptions. South Australia reported a lower rate and the Northern Territory a much higher rate, both at statistically significant levels. One can speculate as to the reasons for this. A possible explanation is the existence of systemic jurisdictional variation in the death certification process (ABS 2007).

Related studies

The findings that less than half of the fractured femur cases identified in the Western Australian linked dataset of injury deaths in hospital had a fall-related UCoD and that 47 (39%) had diseases of the circulatory or respiratory systems coded as the Underlying cause of death accord, in general terms—although not in degree—with the results of British studies published in 1993 and 2002. Although conducted in a different country and, in one case, about a decade ago, the circumstances surrounding death certification are thought to be similar to contemporary Australian practice (Goldacre et al. 2002; Goldacre 1993).

Goldacre et al. followed the progress of 8,148 emergency department admissions of people aged 65 years and over, whose principal diagnosis was a fractured neck of femur. On the death certificates issued for those patients in the study population who died within one month of having sustained the injury, a fractured femur was listed as the Underlying cause in only 16% of cases and as a cause anywhere on the death certificate

in 43%. The author concluded that this major fracture is commonly not recorded on the death certificate even when the death occurs soon after (Goldacre et al. 2002).

The earlier British study observed that, in the process of death certification, there is a convergence towards common causes of death, in particular cardiovascular and respiratory causes (Goldacre 1993). This concurs with our findings. Analyses undertaken of fall-related cases from ABS and NCIS data, showed that Diseases of the circulatory and respiratory systems were assigned as the Underlying cause of death in 60% and 58% of instances respectively. Goldacre suggests that this choice of UCoD often reflects a level of confusion about causality on the part of the certifier (Goldacre 1993).

Our analyses of the Western Australian data found a poor correlation between the information contained in hospitalisation and deaths data. This lack of correlation was apparent in relation to the relative numbers of conditions coded, their specificity, and the conceptual concordance between codes in the two subsets.

These findings are consistent with those from a Swedish study by Johansson et al. which compared hospital discharge records with death certificates, thereby gaining some important insights into the validity of the UCoD codes that had been assigned (Johansson & Westerling 2002). The aims of the Johansson study were twofold: to quantify the compatibility between the original Underlying cause of death and the principal diagnosis; and to explore the importance of hospital discharge data that do not appear on the death certificate.

In the first part of the study, a test certificate was devised, on which only two conditions were listed: the principal diagnosis from the hospital discharge record on the top line, and the original cause of death on the following line. This arrangement is equivalent to a statement that the principal diagnosis is caused by the original Underlying cause of death. The test certificate was then run through ACME software (also used by the ABS in coding deaths) to establish whether the software would accept that stated relationship. If the relationship was accepted by the software, the Principal diagnosis and the Underlying cause of death were deemed to be medically compatible. The results of the test showed that around half of the cases where the UCoD was an external cause of death were found to be incompatible by the ACME software.

A second test certificate was created that retained all conditions reported on the original death certificate, but also added all conditions listed in the hospital discharge register to Part 2 of the certificate. The hospital discharge records were searched for any mention of recent surgery or injuries which were, in turn, added to Part 2. This test certificate was then processed by ACME. Among the things being looked for was the number of instances in which ACME considered the original Underlying cause of death to be a consequence of another condition, resulting in the assignment of a new UCoD. The second test certificate was only used for deaths that had occurred in hospital (n=39,872).

After all conditions were added to Part 2 of the death certificate, a new Underlying cause of death was assigned in 199 (10%) of 1,176 deaths from external causes. The number of cases where the Underlying cause of death was an accidental fall rose steeply from 667 to 1,051 (a 57.6% relative change).

Johansson et al.'s work, and NISU's own, lend weight to the belief that the incidence of fall-related deaths is grossly underestimated if one relies solely on Underlying cause in routine deaths data. Johansson et al.'s study found that, adding all of the conditions that appeared in hospital records to the death certificate resulted in the identification of a 58% increase in fall-related deaths.

Life expectancy

Elderly people, who comprised the vast majority of the cases of fall-related cases examined in this study are less able to weather the effects of sudden physical trauma than are younger people. Having said this, however, an apparently well, community-dwelling older person has a relatively high life expectancy. For example, in 2003, the life expectancy of Australians at 75 years of age was 13 years for females and 11 years for males. At age 85, the life expectancy for females was 7 years and for males it was 6 years (ABS 2004b). In 2000, the probability of surviving from 75–85 years was estimated as being 65% and from 85–90 years as 58% (Booth & Tickle 2004). Yet when an older person enters hospital after a fracture to their neck of femur (as was the case in 74% of the fall-related cases in the ABS dataset), their risk of dying within the next year increases greatly. Goldacre cites the following case fatality rates: 3.5 per 100 admissions during the first 4 weeks in hospital; 6.9 per 100 within 90 days; and 7.7 per 100 within 180 days (Goldacre 1993). There is, thus, a credible argument for regarding the event that triggered the injury (usually a fall) as the Underlying cause of death, and both this event and the fracture certainly warrant inclusion among the causes recorded in death records. If the fracture had not been sustained, one would reasonably expect that the person would not have died at that particular juncture. Even if a fall is not deemed to have been the direct or sole cause of a death, the fact that it has made an older person more vulnerable to conditions that can end their life confirms that all deaths preceded by a fall are of interest for people concerned with falls prevention.

4.2.2 Unintentional poisoning by drugs

There are sound reasons for subsuming the cases of unintentional poisoning by drugs that were examined in this study into the broad category of such deaths that is currently reported on, and this approach has already been adopted by NISU in its reporting of mortality (Kreisfeld et al. 2004). As mentioned earlier, previous exploration, by NISU, of the coding of this group of deaths has established that there is no clear demarcation between cases that have a drug-related external cause as the UCoD and those whose UCoD refers to these same drugs as part of a dependence syndrome drawn from ICD-10 Chapter V: *Mental and behaviour disorders*. NISU has already taken the step of incorporating the relevant Chapter V codes into its routine mortality reports. Canada has also adopted this approach (Fingerhut et al. 2004). Since nearly all of these records include a poisoning code (T36–T50) as a MCoD, an approximately equivalent approach is to use these codes to select poisoning cases and categorise them by type of substance using external cause codes and relevant Chapter VI codes mainly to assign intent.

There remain some problems in the coding of drug related deaths, some of which have been referred to in a report of deaths related to drug poisoning in England and Wales (Office for National Statistics 2004). Specifically, the report mentions that, in around 10% of deaths, only a general description such as ‘drug overdose’ is recorded on the death certificate by coroners and, therefore, these deaths do not contribute to the count of specific substances. Secondly, where more than one drug is mentioned on the death certificate, it is not always possible to tell which of them was primarily responsible for the death.

The WHO's ICD-10 Update Reference Committee (URC) has endeavoured to address some of these issues in its Cumulative Official Updates to ICD-10 (Walker 2007). Among their recommended changes are the abandonment of codes drawn from ICD-10 Chapter VI Mental and behavioural disorders due to psychoactive substance use in favour of the adoption of codes in the accidental poisoning range X40–X49 (effective January 2006) and guidelines for coding deaths where combinations of medicinal agents were involved.

4.2.3 Unintentional poisoning by other substances

While less clear cut than the argument made for drug-related poisoning deaths, there are also good reasons to consider adding the *Additional* cases of unintentional poisoning by other substances to the cases selected using conventional criteria. As for drug poisoning, the presence of MCoD codes in the range T51–T65 can be used to identify cases involving poisoning substances other than drugs, though these codes do not assign intent.

The majority of cases of Unintentional poisoning by other substances had been assigned codes which indicated that alcohol as the primary poisoning agent. It was, however, also evident that a high proportion of the deaths involved the use of multiple drugs.

A study by Lahti et al., which compared officially compiled statistics on fatal alcohol poisoning in Finland with medico-legal statements based on forensic toxicological examination, found that such deaths were under-represented by 31.4% in 1997 (Lahti & Vuori 2002). Lahti et al. have concluded, on the basis of their research, that this under-representation is explained, in about two-thirds of cases, by a preference for using alcoholism (F102) rather than acute alcohol poisoning (X45) as the UCoD. In around a third of cases, in deaths due to acute combined poisoning, preference was given to the drug component over alcohol. The latter conclusion suggests that there are grounds for suspecting that a clear separation between this category and that of poisoning by drugs may not exist. The association between drugs and alcohol was also apparent in Table 16 which showed frequencies in relation to the categories used by the ABS's *Drugs flag*: 20% of the cases flagged showed that death had been due to a combination of alcohol and other drugs.

4.2.4 Inhalations

There was insufficient information derived from this study to make a decision as to whether this type of case would generally be a good candidate for inclusion in injury reporting. The type of anecdotal information received from the ABS does enable some speculation that these cases are commonly associated with medical procedures. Given the comparatively large number of cases, it is an issue that warrants further investigation

4.2.5 Sequelae of external causes

Under ICD-10, sequelae of external causes "include those specified as such, or occurring as 'late effects' one year or more after the originating event." (WHO 1992). 80 *Additional* cases were identified. Most involved elderly people and over three-quarters were certified by a medical practitioner. In over half of the cases, death was attributed to *Diseases of the circulatory or respiratory systems*. The inclusion of *Sequelae of External Causes* in the *Operational Definition of Injury* would not always be appropriate. *Sequelae of External Causes* can occur some time after the actual injury event that caused them. On occasions, this interval can be a matter of years. For this reason, the inclusion of this category of cases will distort estimates of mortality incidence arrived at by using

the 'Definition' as it was specified for this study, since its focus is injury events occurring in a defined period. Information about *Sequelae of External Causes* may be useful for some specific purposes (e.g. assessing the long-term outcomes of injury events or the total burden of mortality attributable to injury). Unfortunately, the available sub-categories for *Sequelae* are fairly coarse and do not provide much scope for detail about the nature of the injuries being described.

5 Conclusions

This study has demonstrated the advantages of making use of Multiple causes of death for the purposes of identifying and reporting injury mortality in Australia. In particular, the study has:

1. Identified a substantial number of injury deaths that are currently not categorised as such; and
2. Provided evidence of limitations in the quality and completeness of information on injuries and external causes in Australian mortality data.

The main factors that contribute to these shortcomings, and some possible ways to respond to them, are outlined below.

The use, in this study, of the *Operational Definition of Injury* resulted in the identification of many additional injury deaths. In particular, application of the new *Operational Definition* doubled the number of fall-related deaths identified by the use of conventional selection criteria. Available literature also suggests that deaths resulting from falls are grossly underestimated. Injury research, prevention and policy development require the most realistic picture of the burden that falls present and the greatest level of information for framing interventions.

The investigations undertaken for this report show that the additional deaths identified are very similar in nature to those selected by conventional methods. Linked data from Western Australia, in particular, illustrates this. Whereas injury codes are often present in hospital records, it is not uncommon for these to have been omitted from the corresponding death record. There is also a tendency for the choice of UCoD to be restricted to terminal conditions (e.g. a post-operative myocardial infarction subsequent to a fractured femur caused by a fall). Thus, records pertaining to deaths where an injury has been a major contributing factor, may show no indication that an injury was involved.

Application of the *Operational Definition of Injury* is a straightforward response to the debate surrounding the concept of an 'injury' and offers other advantages such as greater specificity through the use of codes from ICD-10 Chapter XIX. Although the *Operational Definition of Injury* has adhered to the STIPDA scheme's practice of excluding the codes T78.8 *Other adverse effects, not elsewhere classified* and T79 *Certain early complications of trauma, not elsewhere classified* for the purposes of this study, subsequent consideration suggests that these codes should be included in the *Definition.* Similarly, the routine inclusion of *Sequelae of External Causes* in the *Definition* should be reviewed. *Sequelae of External Causes* can occur some time after the actual injury event that caused them. On occasions, this interval can be a matter of years. For this reason, the inclusion of this category of cases will distort estimates of mortality incidence arrived at by using the *Operational Definition of Injury* as it is currently specified. Information about *Sequelae of External Causes* may be valuable for some specific purposes (e.g. assessing the long-term outcomes of injury events). Unfortunately, the available sub-categories for *Sequelae* are fairly coarse and do not provide much scope for detail about the nature of the injuries being described.

The accumulated evidence surrounding the poor quality of death certificates also suggests that current arrangements for managing this process are inadequate to provide good insight into the contribution of injury to mortality in Australia. Most cases of *Additional* unintentional falls examined in this study involved older people,

who tend to have multiple health problems. This report looked at some of the difficulties surrounding the certification of such deaths: For example, poor compliance with guidelines for death certification (Smith & Hutchins 2001); the high rate of certification by medical practitioners which, literature suggests, may be associated with a higher level of inaccuracy in completion of death certificates (Swift & West 2002; Peach & Brumley 1998).

In addition to their administrative functions, mortality datasets are an important research tool and are expensive to collect and compile. Their value for research is directly dependent on the quality of the information they contain, and its coding. It is therefore desirable that attention be given to exploring and identifying the kinds of evidence-based intervention that will improve these processes and ensure that the faith placed in the reliability of mortality data for purposes such as monitoring progress in relation to the National Health Priority Areas is justified. Several possible paths for intervention have been suggested in the literature cited in this paper. However, a more systematic review of literature could underpin a sound basis for proceeding. Consultation with key informants such as ABS coding staff, pathologists, hospital and non-hospital medical practitioners and researchers, could also serve to highlight some of the specific problems that should be taken account of.

A large, and growing, proportion of injury deaths are of people aged 75 years and over who fall and fracture their femur. This group was over-represented among the *Additional* injury deaths that were analysed in this report. The current practice of treating the certification of these deaths differently by allowing medical practitioners to exercise their judgement with respect to whether or not they will be referred to a coroner, may have a significant impact on the way in which the deaths are certified when compared with other types of fall-related deaths. An appropriately designed research study could help to determine if this is the case, and provide evidence to guide the choice of corrective measures.

A serious fall can precipitate an acute medical event associated with another condition such as *Ischaemic heart disease* which may otherwise not have proved life threatening in the short term. In such an eventuality, it could be argued that it was the fall that set in train the events which led to death. Under the rules of the ICD-10, following this logic would require that the fall be regarded as the Underlying cause of death. This logic is, however, contrary to practice. This study suggests that there is a strong element of chance involved in whether a fall-related death joins the *Conventional* category or the *Additional* one. For this reason, in particular, the case for including the *Additional* fall-related deaths for purposes of routine reporting is a compelling one.

Because there is reason to suspect that medical practitioners, in particular, are not always sufficiently skilled in the completion of death certificates, consideration should be given to improving this situation by routes such as introducing education in this task as part of medical training. The quality of information concerning the same case in hospital discharge data and deaths data differs strikingly. Yet the two sources are based on information received at much the same time, quite likely by the same medical practitioner. More precise and complete death certification would go far towards underpinning mortality data that are of use to researchers and policy makers. Augmenting this with greater access to linked hospital and death data from states and territories, and case-level linkage between the NCIS and ABS mortality data, would also be a useful tool for researchers.

Pending further research into the nature and quality of mortality data, consideration should be given to selecting 'injury' deaths on the basis of the presence, in a record, of a Chapter XIX code in the range specified by the *Operational Definition of Injury* (or a similar definition of 'injury').

The inclusion, in reports of injury statistics, of the additional deaths identified by this study is vital in order to redress what is currently an under-representation of the burden of injury mortality. This study has demonstrated that it is feasible to do so. NISU has already moved towards this in its report *Injury Deaths, Australia 2002* (Kreisfeld et al. 2004) through expansion of its definition of Unintentional poisoning by drugs to include cases where the UCoD is an unintentional poisoning code from ICD-10 Chapter V: Mental and Behavioural Disorders. The most recent routine report of mortality data, *Injury deaths, Australia 2003–04*, used the *Operational Definition of Injury* criteria for selecting the cases for inclusion.

Appendix 1: Data issues

Data sources

ABS deaths data

Routinely collected deaths data are from the ABS mortality unit record data collection, 2002. Population data were obtained from the ABS.

Coronial data

Coronial data were obtained from the NCIS.

Western Australian linked data

Datasets of injury-related hospitalisations and deaths that occurred in Western Australia during the period 1 July 2000 to 30 June 2001 were obtained by NISU from the Western Australian Data Linkage Unit. The Data Linkage Unit is a collaboration between the Information Collection and Management Branch at the Department of Health Western Australia, the Centre for Health Services Research at the University of Western Australia, the Division of Health Sciences at Curtin University of Technology, and the Telethon Institute for Child Health Research. The datasets were obtained for the purpose of undertaking a set of studies related to the validity of injury indicators based on deaths data and hospital separations data. The studies were designed to investigate and, where possible, reduce problems identified by previous NISU work (Harrison & Steenkamp 2002). Permission to undertake the studies, which form part of a project entitled *Threats to reliability and validity of NHPA Indicators*, was given by the Social and Behavioural Research Ethics Committee of the Flinders University.

Hospital and deaths data were combined using an encrypted person identifier code.

The analysis reported here implements one of the studies for which NISU obtained access to the linked data: assessment of the relationship between injury deaths data and injury hospitalisations data. A subset of the linked dataset was constructed by selecting all cases where the principal diagnosis was a code in the range ICD-10 S00–T98, and where the mode of separation from hospital was death.

Age adjustment

Most all-ages rates have been adjusted for age to overcome the effect of differences in the proportions of people of different ages (and different injury risks) in the populations that are compared. Direct standardisation was employed, taking the Australian population in 2001 as the standard. Changes in age composition are small within narrow age bands (e.g. 65–69 years) and adjustment has not been applied to five year age groups.

Confidence intervals

ABS deaths data

Nearly all deaths are believed to be included in ABS deaths data used in this report, so sampling errors do not apply to these data. However, the time periods used to group the cases (e.g. calendar years) are arbitrary. Use of another period (e.g. April to March would result in different rates. The 95% confidence intervals of these rates are based on a Poisson assumption about the number of cases in a time period. Hence, variation alone would be expected to lead to a rate outside the 95% confidence interval on 5% of occasions. Confidence intervals were calculated using the methods described Anderson and Rosenberg (Anderson & Rosenberg 1998). Asymmetric confidence intervals were calculated for case numbers up to 100. Symmetrical intervals, based on a normal approximation, were calculated where case numbers exceed 100.

Case definition

ABS deaths data

Deaths with the designation *Conventional* have been selected on the basis of having an Underlying cause of death in the range V01–Y98. The Underlying cause of each death (UCoD) in Australia is classified by the ABS according to the International Classification of Diseases (ICD). The 9th Revision (ICD-9) was used for death registrations between 1979 and 1998 (WHO 1977). The 10th Revision (ICD-10) was used for deaths registered from 1999 onward (WHO 1992). All deaths given an ICD-9 External Cause code or an ICD-10 External Cause code (Registrations by the ABS) are included in this report.

Deaths designated *Additional* were selected if they had one or more Multiple causes of death codes specified for inclusion under the *Operational Definition of Injury* which appears in Appendix 3 (summarised in Table 1). Until the end of 1996, the ABS coded only one cause of each death. This is the Underlying cause (UCoD) which the Bureau defines as being 'the disease or injury which initiated the train of morbid events leading directly to death' (in keeping with WHO rules). The Underlying cause is derived from information on the death certificate according to rules that form part of the International Classification of Diseases.

Beginning with deaths registered in 1997, other morbid conditions, diseases and injuries entered on the death certificate were also coded, as Multiple Causes of Death (MCoDs). Currently, up to 20 MCoDs may be recorded for each death, with one of the MCoDs being a duplicate of the UCoD for that death.

Data are presented according to the year in which deaths occurred. Information on some cases which occurred during the years examined in this report will not become available until those deaths are registered. State-specific data are presented on the basis of the state or territory in which death was registered. This is normally the one in which death occurred.

A comprehensive overview of issues surrounding the acquisition and coding of deaths data is provided in a recent Information Paper published by the ABS (ABS 2007).

Data quality

ABS data

The reliability of information about cause of death depends on the reliability of ICD codes provided by the ABS. This depends largely on the adequacy of the information provided to the ABS through Registrars of Births, Deaths and Marriages, and originating from coroners and medical practitioners. Little published information is available on the quality of the data resulting from this process, particularly as it applies to injury deaths. Centralisation of mortality coding in the Brisbane office of the ABS since the mid 1990s has reduced the potential for variation due to local differences in coding practice. However, factors affecting information recording, provision, or coding could affect data in different ways for different jurisdictions, periods or population groups. Hence apparent differences should be interpreted with caution.

National Coroners Information System

A study undertaken by NISU evaluated the quality of the NCIS data (Driscoll et al. 2003). Since its inception, NCIS has provided very good coverage of all injury deaths with the exception of those that occur in Western Australia and Queensland. There was a delay in Queensland joining the System, and there is apparent under-reporting in Western Australia, which appears to arise because of a backlog of entering Western Australian data into the system.

Apart from the problems with coverage, the specific analyses undertaken by Driscoll et al., identified some data quality issues within the NCIS. Work-related cases are clearly not being adequately identified currently. The specific sub-analyses identified errors in the codes applied for most variables. Although there was no comprehensive validation or crosschecking of variables, these errors seemed relatively minor. Identification and correction of the errors require significant resources to be applied to quality control and checking of the coding, with feedback of information to coders regarding areas of concern and areas that are being coded well. This should occur on an on-going basis, looking for logical inconsistencies, and also by focusing on particular areas. As well as having on-going and random checks of data validity, the use of the data by outside parties should be encouraged, as this is likely to highlight many important data quality problems. However, it should be emphasised that the overall assignment of the main codes appears to have been done comprehensively, with key variables such as Age, Sex, Mechanism, Object, Cause of Death, Case Type at Completion and Intent at Completion coded or recorded for over 99% of all Closed cases.

Attention also needs to be paid to the presence of text documents and the quality of the information in them. The presence of text documents, and the detail and relevance of information in them, varied considerably between, and sometimes within, states and territories. The text documents are an extremely important component of the NCIS from the point of view of injury prevention, and the documents have the potential to significantly improve the capabilities of the NCIS as a source of information for both Coroners and public health practitioners. It is important that efforts continue to improve the proportion of cases for which all relevant text documents are available, and that the systems administrator encourage improvements in the standard and standardisation of the text documents.

The timing of data entry in the NCIS also needs to be considered. The NCIS was designed to allow key classification data (Case Type and Intent) to be entered at the time the case was first entered into the system, and then to be modified in light of any new information that might become available during the coronial investigation and deliberation process. Separate variables to cover the classification at notification and case closure were included. This allows recording of the correct information at the time of case closure, without losing the information about how a case was viewed at the time of notification. It also should allow Open cases to be stratified by case type and intent.

The notification variables are not supposed to be re-coded on the basis of information that becomes available at a later time. However, the results of the current analysis (Intent at Notification missing for 67% of Open cases) suggest that the Intent at Notification variable is commonly not being completed until well into the coronial investigation process, and possibly not until the case is Closed. This may have arisen at least partly because of ambiguous coding instructions.

Drugs flag

The ABS introduced a *Drugs flag* in 1999 in order to increase the level of detailed information about the role played by drugs in Australian deaths. The flag was used for deaths registered to the end of 2002, but not thereafter. The sub-categories employed are:

1 Smoking related death

2 Alcohol related death

3 Drug other than alcohol or Tobacco

4 Combination of 1 and 2 (i.e. Tobacco *plus* Alcohol)

5 Combination of 1 and 3 (i.e. Tobacco *plus* Drug other than alcohol)

6 Combination of 2 and 3 (i.e. Alcohol *plus* Drug other than alcohol)

7 Combination of 1, 2 and 3 (i.e. Tobacco *plus* Alcohol *plus* Drug other than alcohol)

Caution should be exercised in interpreting data grouped according to this flag because coding criteria have not been specified and NISU are not aware of published validation.

Appendix 2: Falls data extracted from NCIS

ID no: _____	
Age: ☐☐	
Sex: ☐	Male Female
Case type at completion: ☐	Natural causes External causes Open case
Autopsy report available: ☐	Yes No
Police report available: ☐	Yes No
Objection to autopsy: ☐	Yes No
Doctor refused to sign medical certificate: ☐	Yes No
Where condition of interest appeared on death certificate: ☐	Part 1 Part 2 Did not appear
UCoD on death certificate: _____	
ICD-10 code for Underlying cause of death: ☐☐☐☐	
Conditions on Part 2 of death certificate: (1) _____ (2) _____ (3) _____	
Fractured femur or hip: ☐	Insufficient or no information Yes No
Head injury: ☐	Insufficient or no information Yes No

Incident profile:	
☐ Morbid event immediately preceding fall (e.g. stroke, cardiac arrest)	Insufficient or no information Yes No Probably
☐ Fall	Insufficient or no information Identified fall Probable fall Fall while in hospital
☐ Significant injury consistent with falling	Insufficient or no information Yes No
☐ Admission to hospital	Insufficient or no information Yes, post fall Yes, prior to fall No
☐ Surgery	Insufficient or no information Yes No
☐ Circumstances of death	Insufficient or no information Died in hospital—during or soon after surgery (i.e. within 24 hrs) Died in hospital—up to 7 days after surgery Died in hospital—non-operative treatment (condition deteriorated and patient died) Died after release from hospital Found dead Other or unknown circumstances

Appendix 3: Operational definition of injury coding scheme showing mapping from STIPDA* coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
800–909.2	800–829	Fractures	S02	Fracture of skull and facial bones	
			S12	Fracture of neck	
			S22	Fracture of ribs, sternum and thoracic spine	
			S32	Fracture of lumbar spine and pelvis	
			S42	Fracture of shoulder and upper arm	
			S52	Fracture of forearm	
			S62	Fracture of wrist and hand	
			S72	Fracture of femur	
			S82	Fracture of lower leg, including ankle	
			S92	Fracture of foot, except ankle	
			T02	Fracture of multiple body regions	
			T08	Fracture of spine, level unspecified	
			T10	Fracture of upper limb, level unspecified	
			T12	Fracture of lower limb, level unspecified	
			T14.2	Fracture of unspecified body region	

* State and Territory Injury Prevention Directors Association (United States)

(*continued*)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	830–839	Dislocations	S03	Dislocation, sprain and strain of joints and ligaments of head	
			S05.7	Avulsion of eye	
			S13	Dislocation, sprain and strain of neck, including cervical spine	
			S23	Dislocation, sprain and strain of thorax	
			S33	Dislocation, sprain and strain of lumbar spine and pelvis	
			S43	Dislocation, sprain and strain of shoulder girdle	
			S53	Dislocation, sprain and strain of elbow	
			S63	Dislocation, sprain and strain of wrist and hand	
			S73	Dislocation, sprain and strain of hip	
			S83	Dislocation, sprain and strain of knee	
			S93	Dislocation, sprain and strain of ankle and foot	
			T03	Dislocation, sprain and strain of multiple body regions	
			T09.2	Dislocation, sprain and strain of unspecified joint and ligament of trunk	
			T14.3	Dislocation, sprain and strain of unspecified body regions	
	840–848	Sprains and strains of joints and adjacent muscles	S09.1	Injury of muscle and tendon of head	**See also 'Dislocations' above for injury to joints**
			S16	Injury of muscle and tendon at neck level	
			S39.0	Injury of muscle and tendon, abdomen, lower back and pelvis	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	840–848	Sprains and strains of joints and adjacent muscles	S46	Injury of muscle and tendon, shoulder and upper arm	
		(continued from previous page)	S56	Injury of muscle and tendon, forearm	
			S66	Injury of muscle and tendon, wrist and hand	
			S76	Injury of muscle and tendon, hip and thigh	
			S86	Injury of muscle and tendon, lower leg	
			S96	Injury of muscle and tendon, ankle and foot	
			T09.5	Injury of unspecified muscle and tendon of trunk	
			T14.6	Injury of muscle and tendon, unspecified body regions	
	840–854	Intracranial injury, excluding those with skull fracture	S06	Intracranial injury	
	860–869	Internal injury of chest, abdomen and pelvis	S26	Injury of heart	
			S27	Injury of other and unspecified intrathoracic organs	
			S36	Injury of intra-abdominal organs	
			S37	Injury of pelvic organs	
			S39.6	Injury of intra-abdominal organs with pelvic organs	
	870–879	Open wound of head, neck and trunk	S01	Open wound, head	
	880–887	Open wound of upper limb	S05.2	Ocular laceration and rupture with prolapse or loss of intraocular tissue	
	890–897	Open wound of lower limb	S05.3	Ocular laceration without prolapse or loss of intraocular tissue	
			S05.4	Penetrating wound of orbit with or without foreign body	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	890–897	Open wound of lower limb	S05.5	Penetrating wound of eyeball with foreign body	
		(continued from previous page)	S05.6	Penetrating wound of eyeball without foreign body	
			S11	Open wound, neck	
			S21	Open wound, thorax	
			S31	Open wound, abdomen, lower back and pelvis	
			S41	Open wound, shoulder and upper arm	
			S51	Open wound, forearm	
			S61	Open wound, wrist and hand	
			S71	Open wound, hip and thigh	
			S81	Open wound, lower leg	
			S91	Open wound, ankle and foot	
			T01	Open wound, multiple body regions*	
			T09.1	Open wound of trunk, level unspecified	
			T14.1	Open wound, unspecified body region	
			S08	Traumatic amputation, part of head	**In ICD-9-CM 'traumatic amputation' is included under 'open wounds'**
			S18	Traumatic amputation, neck	
			S28.1	Traumatic amputation, part of thorax	
			S38.2	Traumatic amputation, genital organs	
			S38.3	Traumatic amputation, other and unspecified parts of abdomen, lower back and pelvis	
			S48	Traumatic amputation, should and upper arm	

* ICD-9-CM code

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

	ICD-9		ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	890–897	Open wound of lower limb	S58	Traumatic amputation, forearm	
		(continued from previous page)	S68	Traumatic amputation, wrist and hand	
			S78	Traumatic amputation, hip and thigh	
			S88	Traumatic amputation, lower leg	
			S98	Traumatic amputation, ankle and foot	
			T05	Traumatic amputation, multiple body regions	
			T09.6	Traumatic amputation of trunk, level unspecified	
	900–904	Injury to blood vessels	S09.0	Injury to blood vessels, not elsewhere classified	
			S15	Injury to blood vessels of neck	
			S25	Injury to blood vessels of thorax	
			S35	Injury to blood vessels of abdomen, lower back and pelvis	
			S45	Injury to blood vessels of shoulder and upper arm	
			S55	Injury to blood vessels of forearm	
			S65	Injury to blood vessels of wrist and hand	
			S75	Injury to blood vessels of hip and thigh	
			S85	Injury to blood vessels of lower leg	
			S95	Injury to blood vessels of ankle and foot	
			T06.3	Injury to blood vessels of multiple body regions	
			T14.5	Injury to blood vessels of unspecified body region	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	905–909.2	Late effects of injuries, poisonings, toxic effects, and other external causes. *(excluding late effect of complications of surgical and medical care; certain other external cause; or adverse effect of drug, medicinal or biological substance)*	T90.1	Sequelae of open wound of head	
			T90.2	Sequelae of superficial injury of skull and facial bones	
			T90.3	Sequelae of injury of cranial nerves	
			T90.4	Sequelae of injury of eye and orbit	
			T90.5	Sequelae of intracranial injury	
			T90.8	Sequelae of other specified injuries of head	
			T90.9	Sequelae of unspecified injuries of head	
			T91.0	Sequelae of superficial injury and open wound of neck and trunk	
			T91.1	Sequelae of fracture of spine	
			T91.2	Sequelae of other fracture of thorax and pelvis	
			T91.3	Sequelae of injury of spinal cord	
			T91.4	Sequelae of injury to intrathoracic organs	
			T91.5	Sequelae of injury of intra-abdominal and pelvic organs	
			T91.8	Sequelae of injury of other specified injuries of neck and trunk	
			T91.9	Sequelae of unspecified injury of neck and trunk	
			T92.0	Sequelae of open wound of upper limb	
			T92.1	Sequelae of fracture of arm	
			T92.2	Sequelae of fracture at wrist and hand level	
			T92.3	Sequelae of dislocation, sprain and strain of upper limb	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	905–909.2	Late effects of injuries, poisonings, toxic effects, and other external causes. *(continued from previous page)*	T92.4	Sequelae of injury of nerve of upper limb	
			T92.5	Sequelae of injury of muscle and tendon of upper limb	
			T92.6	Sequelae of crushing injury and traumatic amputation of upper limb	
			T92.8	Sequelae of other specified injury of upper limb	
			T92.9	Sequelae of unspecified injury of upper limb	
			T93.0	Sequelae of open wound of lower limb	
			T93.1	Sequelae of fracture of femur	
			T93.2	Sequelae of other fractures of lower limb	
			T93.3	Sequelae of dislocation, sprain and strain of lower limb	
			T93.4	Sequelae of injury of nerve of lower limb	
			T93.5	Sequelae of injury of muscle and tendon of lower limb	
			T93.6	Sequelae of crushing injury and traumatic amputation of lower limb	
			T93.8	Sequelae of other specified injuries of lower limb	
			T93.9	Sequelae of unspecified injury of lower limb	
			T94.0	Sequelae of injuries involving multiple body regions	
			T94.1	Sequelae of injuries, not specified by body region	
			T95.0	Sequelae of burn, corrosion and frostbite of head and neck	
			T95.1	Sequelae of burn, corrosion and frostbite of trunk	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	905–909.2	Late effects of injuries, poisonings, toxic effects, and other external causes.	T95.2	Sequelae of burn corrosion and frostbite of upper limb	
		(continued from previous page)	T95.3	Sequelae of burn, corrosion and frostbite of lower limb	
			T95.4	Sequelae of burn and corrosion classifiable only according to extent of body surface involved	
			T95.8	Sequelae of other specified burn, corrosion and frostbite	
			T95.9	Sequelae of unspecified burn, corrosion and frostbite	
			T96	Sequelae of poisoning by drugs, medicaments and biological substances	
			T97	Sequelae of toxic effects of substances chiefly nonmedicinal as to source	
			T98.0	Sequelae of effects of foreign body entering through natural orifice	
			T98.2	Sequelae of certain early complications of trauma	**T98.2 includes late effects of radiation**

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
909.4		Late effect of certain other external causes: *(Late effect of conditions classifiable to 991–994)* [991–994 includes: Late effects of reduced temperature (i.e. frostbite, immersion foot, chilblains, hypothermia, other specified effects of reduced temperature, unspecified effects of reduced temperature); Late effects of heat and light (i.e. heatstroke and sunstroke, heat syncope, heat cramps, anhydrotic heat exhaustion, heat exhaustion due to salt depletion, unspecified heat exhaustion, transient heat fatigue, heat oedema, other specified heat effects, unspecified heat effects); Effects of air pressure (i.e. otitic barotrauma, sinus barotrauma, other and unspecified effects of high altitude, Caisson Disease, effects of air pressure caused by explosion, other specified effects, unspecified effects), effects of other external causes (i.e. effects of lightning, drowning and nonfatal submersion, effects of hunger, effects of thirst, exhaustion due to exposure, exhaustion due to excessive exertion, motion sickness, asphyxiation and strangulation, electrocution and nonfatal effects of electric current, other effects of external cause).]	T98.1	Sequelae of other and unspecified effects of external causes *(Late effect of conditions classifiable to T66–T78)* [T66–T78 includes: Unspecified effects of radiation; Effects of heat and light (i.e. heatstroke and sunstroke, heat syncope, heat cramp, anhydrotic heat exhaustion, heat exhaustion due to salt depletion, unspecified heat exhaustion, transient heat fatigue, heat oedema, other effects of heat and light, unspecified effect of heat and light); Hypothermia; Other effects of reduced temperature (i.e. immersion hand and foot, chilblains, other specified effects of reduced temperature, unspecified effect of reduced temperature); Effects of air pressure and water pressure (i.e. otitic barotrauma, sinus barotrauma, other and unspecified effects of high altitude, Caisson disease, effects of high-pressure fluids, other effects of air pressure and water pressure, unspecified effect of air pressure and water pressure); Asphyxiation; Effects of other deprivation (i.e. effects of hunger, effects of thirst, exhaustion due to exposure, exhaustion due to excessive exertion, other effects of deprivation, unspecified effect of deprivation); Maltreatment syndromes (i.e. neglect or abandonment, physical abuse, sexual abuse, psychological abuse, other maltreatment syndromes, unspecified maltreatment syndrome); Effects of other external causes (i.e. effects of lightning, drowning and nonfatal submersion, effects of vibration, motion sickness, effects of electric current, other specified effects of external causes); Adverse effects, not elsewhere classified (i.e. anaphylactic shock due to adverse food reaction, other adverse food reactions, not elsewhere classified, unspecified anaphylactic shock, angioneurotic oedema, unspecified allergy, other adverse effect, not elsewhere classified, unspecified adverse effect.]	**Sequelae of frostbite included under T95 sequelae of burns**

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
909.9		Late effect of other and unspecified external causes *(Late effect of conditions classifiable to 995)* [995 includes anaphylactic shock; angioneurotic oedema; unspecified adverse effect of drug, medicament and biological substance; unspecified allergy; shock due to anaesthesia (correctly administered); child maltreatment syndrome; other specified adverse effects, not elsewhere classified.]			**All anaphylactic shock codes appear on exclusions list (i.e. T78.0–.2)**
910–994.9	910–919	Superficial injury	S05.0	Injury of conjunctiva and corneal abrasion without mention of foreign body	
			S05.1	Contusion of eyeball and orbital tissues;	
			S00	Superficial injury, head	
			S10	Superficial injury, neck	
			S20	Superficial injury, thorax	
			S30	Superficial injury, abdomen, lower back and pelvis	
			S40	Superficial injury, shoulder and upper arm	
			S50	Superficial injury, forearm	
			S60	Superficial injury, wrist and hand	
			S70	Superficial injury, hip and thigh	
			S80	Superficial injury, lower leg	
			S90	Superficial injury, ankle and foot	
			T00	Superficial injury, multiple body regions	
			T09.0	Superficial injury of trunk, level unspecified	
			T14.0	Superficial injury, unspecified body region	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	920–924	Contusion with intact skin surface			**Note: 'Contusion' is included under 'Superficial injury' in ICD-10**
	925–929	Crushing injury	S07	Crushing injury, head	
			S17	Crushing injury, neck	
			S28.0	Crushing injury, chest	
			S38.0	Crushing injury, external genital organs	
			S38.1	Crushing injury, other and unspecified parts of abdomen, lower back and pelvis	
			S47	Crushing injury shoulder and upper arm	
			S57	Crushing injury, forearm (includes elbow)	
			S67	Crushing injury, wrist and hand (includes fingers	
			S77	Crushing injury, hip and thigh	
			S87	Crushing injury, lower leg (includes knee)	
			S97	Crushing injury, ankle and foot (includes toes)	
			T04	Crushing injury, multiple body regions	
			T14.7	Crushing injury and traumatic amputation of unspecified body region	
	930–939	Effects of foreign body entering through orifice	T15	Effects of foreign body entering through natural orifice	
			T16	Foreign body in ear	
			T17	Foreign body in respiratory tract	
			T18	Foreign body in alimentary tract	
			T19	Foreign body in genitourinary tract	
	940–949	Burns	T20	Burn and corrosion of head and neck	
			T21	Burn and corrosion of trunk	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	940–949	Burns	T22	Burn and corrosion of shoulder and upper limb	
		(continued from previous page)	T23	Burn and corrosion of wrist and hand	
			T24	Burn and corrosion of hip and lower limb	
			T25	Burn and corrosion of ankle and foot	
			T26	Burn and corrosion confined to eye and adnexa	
			T27	Burn and corrosion of respiratory tract	
			T28	Burn and corrosion of other internal organs	
			T29	Burns and corrosion of multiple body regions	
			T30	Burn and corrosion, body region unspecified	
			T31	Burns classified according to extent of body surface involved	
			T32	Corrosions classified according to extent of body surface involved	
	950–957	Injury to nerves and spinal cord	S04	Injury of cranial nerves	
			S14	Injury of nerves and spinal cord at neck level	
			S24	Injury of nerves and spinal cord at thorax level	
			S34	Injury of nerves and lumbar spinal cord at abdomen, lower back and pelvis level	
			S44	Injury of nerves, shoulder and upper arm	
			S54	Injury of nerves, forearm	
			S64	Injury of nerves, wrist and hand	
			S74	Injury of nerves, hip and thigh	
			S84	Injury of nerves, lower leg	
			S94	Injury of nerves, ankle and foot	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

	ICD-9		ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	950–957	Injury to nerves and spinal cord	T09.3	Injury of spinal cord, level unspecified	
		(continued from previous page)	T09.4	Injury of unspecified nerve, spinal nerve root and plexus of trunk	
			T14.4	Injury of nerves, unspecified body region	
	958–959	Certain traumatic complications and unspecified injuries	S05.8	Other injuries of eye and orbit	
			S05.9	Unspecified injuries of eye and orbit	
			S09.2	Traumatic rupture of eardrum	
			S09.7	Multiple injuries of head	
			S09.8	Other specified injuries of head	
			S09.9	Unspecified injuries of head	
			S19	Other and unspecified injuries of neck	
			S29	Other and unspecified injuries of thorax	
			S39.7	Multiple injuries of abdomen, lower back and pelvis	
			S39.8	Other injuries of abdomen, lower back and pelvis	
			S39.9	Unspecified injuries of abdomen, lower back and pelvis	
			S49	Other and unspecified injuries, shoulder and upper arm	
			S59	Other and unspecified injuries, forearm	
			S69	Other and unspecified injuries, wrist and hand	
			S79	Other and unspecified injuries, hip and thigh	
			S89	Other and unspecified injuries, lower leg	
			S99	Other and unspecified injuries, ankle and foot	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	958–959	Certain traumatic complications and unspecified injuries	T06	Other injuries, multiple body regions, not elsewhere classified	
		(continued from previous page)	T07	Unspecified injuries, multiple body regions	
			T09.8	Other specified injuries of trunk, level unspecified	
			T09.9	Unspecified injury of trunk, level unspecified	
			T11	Other injuries, upper limb, level unspecified	
			T13	Other injuries, lower limb, level unspecified	
			T14.8	Other injuries, unspecified body region	
			T14.9	Injury, unspecified	
			T79	Certain early complications of trauma	
	960–979	Poisoning by drugs, medicinal and biological substances	T36	Poisoning by drugs, medicaments and biological substances	
			T37	Poisoning by other systemic antiinfectives and antiparasitics	
			T38	Poisoning by hormones and their synthetic substitutes and antagonists, not elsewhere classified	
			T39	Poisoning by non-opioid analgesics, antipyretics and antirheumatics	
			T40	Poisoning by narcotics and psychodysleptics	
			T41	Poisoning by anaesthetics and therapeutic causes	
			T42	Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs	
			T43	Poisoning by psychotropic drugs, not elsewhere classified	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	960–979	Poisoning by drugs, medicinal and biological substances	T44	Poisoning by drugs primarily affecting the autonomic nervous system	
		(continued from previous page)	T45	Poisoning by primary systemic and haematological agents, not elsewhere classified	
			T46	Poisoning by agents primarily affecting the cardiovascular system	
			T47	Poisoning by agents primarily affecting the gastrointestinal system	
			T48	Poisoning by agents primarily acting on smooth and skeletal muscles and the respiratory system	
			T49	Poisoning by topical agents	
			T50	Poisoning by diuretics and other and unspecified drugs	
	980–989	Toxic effects of substances chiefly non-medicinal as to source	T51	Toxic effect of alcohol	
			T52	Toxic effect of organic solvents	
			T53	Toxic effect of halogen derivatives	
			T54	Toxic effect of corrosive substances	
			T55	Toxic effect of soaps and detergents	
			T56	Toxic effect of metals	
			T57	Toxic effect of other inorganic substances	
			T58	Toxic effect of carbon monoxide	
			T59	Toxic effect of other gases, fumes and vapours	
			T60	Toxic effect of pesticides	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
	980–989	Toxic effects of substances chiefly non-medicinal as to source	T61	Toxic effect of noxious substances eaten as seafood	
		(continued from previous page)	T62	Toxic effect of other noxious substances eaten as food	
			T63	Toxic effect of contact with venomous animals	
			T64	Toxic effect of aflatoxin	
			T65	Toxic effect of other and unspecified substances	
	990	Effects of radiation, unspecified	T66	Unspecified effects of radiation	
	991	Effects of reduced temperature	T68	Hypothermia	
			T69	Other effects of reduced temperature	
			T33	Superficial frostbite	
			T34	Frostbite with tissue necrosis	
			T35	Frostbite involving multiple body regions and unspecified frostbite	
	992	Effects of heat and light	T67	Effects of heat and light	
	993	Effects of air pressure	T70	Effects of air pressure and water pressure	
	994	Effects of other external causes	T71	Asphyxiation	
			T73	Effects of other deprivation (including hunger, thirst, exposure, excessive exertion, other effect of deprivation, effect of deprivation, unspecified)	
			T75	Effects of other external causes (including lightning, drowning, vibration, motion sickness, electric current, other specified effects of external causes)	

(continued)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Inclusions:					
995.5–995.59		Child maltreatment syndrome	T74	Maltreatment syndromes (including neglect or abandonment, physical abuse, sexual abuse, psychological abuse, other maltreatment syndromes, maltreatment syndrome, unspecified)	
995.80–995.85		Other specified adverse effects, not elsewhere classified	T78.8	Other adverse effects, not elsewhere classified	
	995.81	Adult maltreatment syndrome		See child maltreatment above	**Included under T74 Maltreatment syndromes (see above)**
Exclusions:					
<800		Non-injury codes	A00–R99	Non-injury codes	
909.3		Late effect of complications of surgical and medical care	T98.3	Sequelae of complications of surgical and medical care, not elsewhere classified	
		Late effect of conditions classifiable to 996–999		*Late effect of conditions classifiable to T80–T88*	
909.5*		Late effect of adverse effect of drug, medicinal or biological substance			**Included in T98.3 Sequelae of complications of surgical and medical care, not elsewhere classified (see above)**
995.0–995.4		Certain adverse events not elsewhere classified	T78.2	Anaphylactic shock, unspecified	
		Anaphylactic shock; angioneurotic oedema; unspecified adverse effect of drug, medicament and biological substance; unspecified allergy; shock due to anaesthesia.	T78.3	Angioneurotic oedema	
			T78.4	Allergy, unspecified	
			T88.7	Unspecified adverse effect of drug or medicament	**T88.7 is included below**
995.6–995.7		Anaphylactic shock due to adverse food reaction	T78.0	Anaphylactic shock due to adverse food reaction	
			T78.1	Other adverse food reactions, not elsewhere classified	

* ICD-9-CM code.

(*continued*)

Appendix 3 (continued): Operational definition of injury coding scheme showing mapping from STIPDA coding scheme

ICD-9			ICD-10		
STIPDA range	**STIPDA sub-ranges**	**STIPDA descriptors**	**ICD-10 codes**	**ICD-10 descriptors**	**Notes:**
Exclusions:					
996–999		Complications of surgical and medical care, not elsewhere classified	T80	Complications following infusion, transfusion and therapeutic injection	
			T81	Complications of procedures, not elsewhere classified	
			T82	Complications of cardiac and vascular prosthetic devices, implants and grafts	
			T83	Complications of genitourinary prosthetic devices, implants and grafts	
			T84	Complications of internal orthopaedic prosthetic devices, implants and grafts	
			T85	Complications of other internal prosthetic devices, implants and grafts	
			T86	Failure and rejection of transplanted organs and tissues	
			T87	Complications peculiar to reattachment and amputation	
			T88	Other complications of surgical and medical care, not elsewhere classified	**Includes T88.7 Unspecified adverse effect of drug or medicament**

Appendix 4: Case scenarios coded by the Australian Bureau of Statistics

The following scenarios have been constructed from cases contained in the National Coroners Information System (NCIS). Identifying information such as time and place have been excluded to preserve confidentiality. The scenarios have been reviewed by NCIS and approval has been given to reproduce them in this report .

Scenario 1

Death certificate:	
1(a)	Ischaemic heart disease
1(b)	Coronary atherosclerosis
Case description: Fell while exiting a taxi, hit her head. Observed to be having trouble speaking. Her family put her to bed. When they checked on her later she was found to be pale with a weak pulse. CPR was commenced. Ambulance was called and resuscitation attempts continued. Died shortly after arriving at hospital. Autopsy showed haematoma surround scalp laceration. Another haematoma on inner aspect of aponeurosis over right occipital area. No skull fracture.	
ABS coding: Underlying cause of death following normal coding process:	I251 Atherosclerotic heart disease
Underlying cause of death after having taken account of case description:	I251 Atherosclerotic heart disease
Do you consider this case to have a well completed death certificate? **Comments?**	Yes

Scenario 2

Death certificate:	
1(a)	Myocardial ischaemia, left ventricule recent infarct
1(b)	Generalised atherosclerotic cardiovascular disease
2(a)	Recent fracture repair (pinning) of femur
Case description: Fell at her residence. Fractured her neck of femur. Taken to hospital. Underwent surgery to repair fracture. Post-operatively, patient was in a highly agitated state. Patient then suffered cardiac problems. Resuscitation was unsuccessful. Death occurred two days after the fall.	
ABS coding: Underlying cause of death following normal process:	I219 Acute myocardial infarction, unspecified
Underlying cause of death having taken account of case description	I219 Acute myocardial infarction, unspecified
Do you consider this case to have a well completed death certificate?	Yes
Comments:	Myocardial ischaemia due to atherosclerotic heart disease is the first sequence.

Scenario 3

Death certificate:	
1(a)	Myocardial infarction
1(b)	Ischaemic heart disease
2	Congestive cardiac failure, chronic obstructive airways disease
Case description: Deceased found lying on her side. She was conscious. She said she had lost her balance and fallen. Ambulance was called. She was taken to hospital. Deceased was diagnosed with a broken hip. Two days after her fall, the patient was found unconscious. CPR was commenced, but was unsuccessful. Patient died of a heart attack.	
ABS coding: Underlying cause of death following normal process:	I219 Acute myocardial infarction, unspecified
Underlying cause of death having taken account of case description:	I219 Acute myocardial infarction, unspecified
Do you consider this case to have a well completed death certificate?	Yes
Comments:	Myocardial infarction due to Ischaemic heart disease is the first sequence.

Scenario 4

Death certificate:	
1(a)	Corpulmonale
1(b)	Left sided flail chest, subsequent secondary splenic bleed
1(c)	Bronchopneumonia, clinical history of multiple infarcts
2(a)	Dementia, osteoporosis, triple vessel coronary artery disease
Case description: Deceased found collapsed at bottom of stairwell in nursing home. Had sustained fractured ribs as the result of a fall. Was admitted to hospital. About five days after the fall, the patient was observed drifting in and out of consciousness. Died the same day.	
ABS coding: Underlying cause of death following normal coding process:	X59 Exposure to unspecified factor OR W10 Fall on and from stairs and steps, depending on resources.
Underlying cause of death having taken account of case description:	W10 Fall on and from stairs and steps
Do you consider this case to have a well completed death certificate?	No
Comments:	Cause of flail chest should have been in Part 1.

Scenario 5

Death certificate: **1(a)** **2(a)**	 Pneumonia Osteoporosis, recent fractured neck of femur (surgically repaired)
Case description: No documents provided on NCIS. This case had been given a mechanism code for falls.	
ABS coding: Underlying cause of death following normal coding process:	 M809 Unspecified osteoporosis with pathological fracture
Underlying cause of death having taken account of case description:	M809 Unspecified osteoporosis with pathological fracture
Do you consider this case to have a well completed death certificate? **Comments?**	Yes Generally well filled out yet no information regarding the role played by the fall.

Scenario 6

Death certificate: **1(a)** **2(a)**	 Ischaemic heart disease Hypertension, osteoarthritis, fractured left neck of femur
Case description: Admitted to hospital as the result of a fall. Had fractured her neck of femur. Surgery was performed the same day. The patient suffered a cardiac arrest three days later. Resuscitation attempts failed. Only an external examination was undertaken.	
ABS coding: Underlying cause of death following normal coding process:	 I259 Chronic ischaemic heart disease
Underlying cause of death having taken account of case description:	I259 Chronic ischaemic heart disease
Do you consider this case to have a well completed death certificate? **Comments?**	Yes We assume Ischaemic heart disease to be a long-term disease. If the certificate had said acute ischaemia, we would then have looked at conditions in Part 2.

Scenario 7

Death certificate: **1(a)**	Massive bilateral pulmonary emboli secondary to immobilisation following a fall at home.
Case description: There was no useful information to be gleaned from the documents in NCIS.	
ABS coding: Underlying cause of death following normal coding process:	W19 Unspecified fall
Underlying cause of death having taken account of case description:	W19 Unspecified fall
Do you consider this case to have a well completed death certificate? **Comments:**	Yes

Scenario 8

Death certificate:	
1(a)	Aortic stenosis
1(b)	Following surgical repair of fractured left hip
2(a)	Pulmonary infarct, ischaemic heart disease
Case description: Fell in nursing home and required treatment for a hip fracture. Was assessed as being a high risk patient. However, it was decided to proceed with the surgery. The operation was uneventful. However, the deceased showed decreasing saturation toward the end of the procedure and had a cardiac arrest during closure. Autopsy found that death seems to be the result of combined stress of anaesthetic procedure and pre-existing heart condition.	
ABS coding:	
Underlying cause of death following normal coding process:	X59 Exposure to unspecified factor OR W19 Unspecified fall, depending on resources
Underlying cause of death having taken account of case description:	W19 Unspecified fall
Do you consider this case to have a well completed death certificate?	No
Comments?	We would like to see fall mentioned so that we don't have to look any further.

Scenario 9

Death certificate:	
1(a)	Pulmonary embolism
1(b)	Deep vein thrombosis
2(a)	Ischaemic heart disease, previous surgery for fractured neck of femur, bronchitis
Case description: Autopsy finding: Died of multiple pulmonary emboli 10 days after surgical repair of fractured femur following a fall at home. Had advanced ischaemic heart disease and had previously had an aortic aneurysm grafted. Police: Admitted to hospital after a fall. Had pneumonia. Made a good recovery from this and underwent surgery 10 days after admission. Was making good recovery until he was found dead in bed nine days after the surgery. Patient was thought to have fallen as a result of acute myocardial infarction.	
ABS coding:	
Underlying cause of death following normal coding process:	W19 Unspecified fall OR X59 Exposure to unspecified factor, depending on resources.
Underlying cause of death having taken account of case description:	W19 Unspecified fall.
Do you consider this case to have a well completed death certificate?	No
Comments?	We would assume that the surgery for the fracture was the cause of the Deep vein thrombosis so the fracture should be in Part 1.

Scenario 10

Death certificate: **2(a)**	Sepsis Injuries sustained in a fall, recent gall bladder surgery
Case description: Police report: Possibly struck by a train immediately prior to falling down a steep embankment. Taken to hospital and treated for a fractured elbow and leg. Patient developed pneumonia and possibly other complications leading to septic shock. Died eleven days after the fall.	
ABS coding: Underlying cause of death following normal coding process:	V051 Pedestrian injured in collision with railway train or railway vehicle (traffic accident)
Underlying cause of death having taken account of case description:	V051 Pedestrian injured in collision with railway train or railway vehicle (traffic accident)
Do you consider this case to have a well completed death certificate?	No
Comments:	Would consider sepsis to be post treatment from fracture or gallbladder, but fracture sounds more serious—it should be in Part 1. Reference in the description to the incident being traffic based is debatable.

Scenario 11

Death certificate: **1(a)** **2(a)**	 Congestive heart failure Peripheral vascular disease, supra ventricular tachycardia, arthritis, recent fractured neck of femur (surgically repaired)
Case description: Police: Fell on way to bathroom at aged care centre. Was admitted to hospital. Had fractured right hip. Underwent surgery to repair hip three days later. Patient was placed in ICU. She became hypertensive and suffered low blood pressure. Acute renal failure and pulmonary embolism. Died of apparent heart failure. Autopsy: Deceased was wheelchair bound. She fell from a chair. Died five days after the fall.	
ABS coding: Underlying cause of death following normal coding process:	 I500 Congestive heart failure
Underlying cause of death having taken account of case description:	I500 Congestive heart failure
Do you consider this case to have a well completed death certificate? **Comments?**	Yes and No Suspect that the condition in Part 1 is due to the conditions listed in Part 2, but because the person was over 74, we would not query in this circumstance.

Scenario 12

Causes of death: **1(a)** **1(b)** **1(c)** **1(d)**	 Hypostatic pneumonia Recent myocardia infarction Fractured left hip Accidental fall
Case description: Police: Fractured her hip in a fall at the hostel where she lives. Was admitted to hospital and had surgery to repair her fracture seven days later. During the operation, the patient suffered a heart attack and stroke.	
ABS coding: Underlying cause of death following normal coding process:	 W19 Unspecified fall
Underlying cause of death having taken account of case description:	W19 Unspecified fall
Do you consider this case to have a well completed death certificate? **Comments?**	Yes

Scenario 13

Death certificate: **1(a)** **2(a)**	 Cardiac ischaemia as a result of hypotension after hypertension Minor subdural haematoma and cerebral contusions
Case description: No accompanying documents on NCIS. Assigned a mechanism code for falls.	
ABS coding: Underlying cause of death following normal coding process:	 I248 Other forms of acute ischaemic heart disease
Underlying cause of death having taken account of case description:	I248 Other forms of acute ischaemic heart disease
Do you consider this case to have a well completed death certificate? **Comments:**	Yes The mechanism was a fall, but there is no accompanying information. This is still a well filled out certificate.

Scenario 14

Death certificate:	
1(a)	Bronchopneumonia
1(b)	Intracranial haemorrhage (mixed traumatic and non-traumatic)
1(c)	Chronic alcoholism
2(a)	Cirrhosis of liver, generalised atherosclerosis
Case description: Police: Taken to hospital for treatment after falling while intoxicated. A CT scan showed multiple intracerebral contusions. Was kept in overnight for observation. Status was reviewed on the following day. Level of consciousness had decreased. Was found dead in his bed a couple of days later.	
ABS coding: Underlying cause of death following normal process:	W19 Unspecified fall
Underlying cause of death having taken account of case description:	W19 Unspecified fall
Do you consider this case to have a well completed death certificate?	No
Comments	Would like the fall placed in Part 1 of the certificate.

Scenario 15

Death certificate:	
1(a)	Intracerebral haemorrhage
1(b)	Recent fall, atrial fibrillation with anti-coagulent therapy
Case description: Autopsy: Suffered recurrent falls. Presented following most recent of these and was diagnosed with acute subdural haematoma. This was treated surgically. Suffered another fall post-operatively, bruising his hip. Patient's condition deteriorated. Probable further intracerebral bleeding. Only an external examination was undertaken. Police: Presented at hospital following a fall. Transferred to another hospital for surgery. Fell out of bed post-operatively. A CT scan showed a large intracerebral haemorrhage. Died four days after surgery.	
ABS coding: Underlying cause of death following normal process:	W19 Unspecified fall
Underlying cause of death having taken account of case description:	W06 Unspecified fall
Do you consider this case to have a well completed death certificate?	No
Comments:	We ask doctors to put the Underlying cause of death in Part 1 as that is better than having to decide which condition in Part 2 caused the haemorrhage.

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