Australian Government
Australian Institute of Health and Welfare

Injury deaths data, Australia

Technical report on issues associated with reporting for reference years 1999–2010

Flinders UNIVERSITY

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Authoritative information and statistics to promote better health and wellbeing

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Contents

Acknowledgments ..... **iv**
Abbreviations ..... **v**
Summary ..... **vi**
1 Introduction **1**
2 Cause of death data in Australia **3**
3 Issues for analysis and reporting of data on injury deaths **15**
4 Assessment of injury deaths data **24**
4.1 Introduction 24
4.2 Injury deaths overall 25
4.3 Transport crashes 28
4.4 Immersion and drowning 32
4.5 Poisoning by pharmaceuticals 37
4.6 Poisoning by other substances 41
4.7 Injurious falls 44
4.8 Thermal injury 53
4.9 Other unintentional injury 55
4.10 Intentional self-harm 62
4.11 Homicide 67
4.12 Other injury-related deaths 69
Appendix A: Selection criteria for NCIS-based estimates **73**
Glossary **74**
References **75**
List of tables **80**
List of figures **80**
List of boxes **81**

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Abbreviations

ABDD	Australian Border Deaths Database
ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CODURF	cause of death unit record file
DFAT	Department of Foreigh Affairs and Trade
ICD-8	International classification of diseases and releated health problems - 8th revision
ICD-9	International classification of diseases and related health problems - 9th revision
ICD-10	International classification of diseases and related health problems - 10th revision
ICD-11	International classification of diseases and related health problems - 11th revision
ICECI	International Classification of External Causes of Injury
MCOD	multiple cause of death
NCIS	National Coronial Information System
NHMP	National Homicide Monitoring Program
RLSS	Royal Life Saving Society Australia
UCOD	underlying cause of death

Summary

This technical report is a companion to the statistical report *Trends in injury deaths, Australia 1999–00 to 2009–10.* The technical report provides additional information on data sources and methods.

The primary source for the surveillance of injury mortality in Australia is the series of cause of death unit record files (CODURFs), produced by the Australian Bureau of Statistics (ABS) on the basis of data from registries of births, deaths and marriages and from the coronial system. Supplementary sources also exist for injury deaths due to some external causes. These sources were used to assess the completeness and consistency over time of estimates based on the CODURFs, particularly during a period in which methods for producing and releasing the CODURFs changed considerably. This is relevant to injury surveillance because the changes mainly affected deaths certified by coroners. These deaths include nearly all injury deaths, except most of those due to falls by older people. The changes included increasing reliance, from 2003 to 2006, on the National Coronial Information System (NCIS) as the source for information on causes of injury deaths, followed by changes to methods for processing and releasing the CODURFs when problems became apparent. The most notable change was the adoption of a program of multiple releases (normally three) for data in each reference year.

The enumeration of injury deaths in the CODURF overall in reference years 1999 to 2010 appears to have been fairly constant, except for two upward steps. The first of these was about 1% in 2006 (revised) data, when ABS methods changed in a way that reduced the number of deaths that remained with unspecified cause (ICD-10 code R99). The second—of about 8% in the reference year 2008—coincided with the introduction by the ABS of changes in methods that increased scrutiny of attachments to records in the NCIS and of Part II of death certificates if a specific cause was not provided by Part I.

With some exceptions, CODURF-based estimates of injury deaths due to particular major external causes were consistent with estimates based on supplementary sources for several reference years before 2003 and from 2006 (revised release) onwards; however, they differ to a noteworthy extent for several external causes from 2003 to 2006 (first release). CODURF-based estimates were low in the intervening period for transport injury, poisoning by non-pharmaceutical substances, intentional self-harm (suicide) and homicide. Conversely, they were high for cases assigned to categories in the unintentional causes block that involved mechanisms commonly used in suicide and homicide (for example, shooting, hanging and strangulation) and injury cases for which an external cause was not specified.

Deaths due to fall-related injury are a special case, being the only type of injury death in which most cases are certified by a medical practitioner. Very large rises occurred in the numbers of deaths assigned underlying cause codes for unintentional falls yet the numbers of such deaths underestimate fall-injury mortality. Neither trends nor rates of cases assigned underlying cause codes in this range are a reliable guide to mortality from this cause. Evidence from Victoria (where administrative changes in 2003 caused nearly all cases of this type to be registered by coroners), as well as research based on linked data, and supplementary estimates based on deaths of hospitalised fall injury cases (which include most of the deaths) all favour estimates that are obtained from CODURF data using multiple cause codes as well as underlying cause codes to identify fall injury deaths.

1 Introduction

Injury is an important cause of death in Australia and in the world. In Australia, 6.2% per cent of deaths occurring in 2009–10 were assigned an external cause of injury code as the underlying cause of death (UCOD) and 7.6% of deaths in that year meet the definition of injury death applied here. Injury is the main cause of death for children and young adults in Australia, accounting, in 2009–10, for 56% of all deaths at ages 1 to less than 40.

Injury surveillance is an important foundation for effective injury prevention and control. The essential properties of public health surveillance are '(1) the systematic collection of pertinent data, (2) the orderly consolidation and evaluation of those data, and (3) the prompt dissemination of results to those who need to know—particularly those in a position to take action' (Thacker & Stroup 2013). The focus of public health surveillance is on describing diseases in populations, rather than on follow-up of individual cases or on etiological research.

Surveillance of injury mortality based on data from vital registers occurs widely, often as part of surveillance of deaths from all causes (Lozano et al. 2012). Injury mortality surveillance in some places also makes use of mortuary data (Bartolomeos et al. 2012). While injury mortality surveillance is widespread, it has not often been the focus of specific reviews of quality (Bhalla et al. 2010) or consideration of desirable attributes (Mitchell et al. 2009). In Australia, data based on state and territory vital registration systems have been used for injury surveillance conducted by the Australian Institute of Health and Welfare (AIHW) National Injury Surveillance Unit since 1990.

This technical report is a companion to *Trends in injury deaths, Australia 1999–00 to 2009–10* (Henley & Harrison 2015). That report covers a period for which statistical assessment of trends in injury mortality is complicated by changes in data sources and methods, which affected the data to a substantial extent. Production of AIHW reports on injury mortality for the period since the mid-2000s has been impeded by these data issues. It has also been delayed by a period during which arrangements for providing access to unit record causes of death data have been reviewed and revised, with access to recent data being delayed while that was done.

Some information on data issues is given in the trends report, but full treatment of them there would have interfered with its main purpose: to provide statistical information on trends in injury mortality. The primary purpose of this technical report is to consider those data issues.

Broadly, three eras are represented in the data considered here:

- The first is from the adoption of the ICD-10 as the classification for causes of death in Australia (and the adoption of an associated auto-coding software system) to just before the Australian Bureau of Statistics (ABS) began to use the National Coronial Information System (NCIS) to obtain information to code the causes of coroner-certified deaths (data years 1999 to 2002).
- The second covers the early phase of the use by the ABS of the NCIS (2003 to the initial release of data for 2006).
- The third began with the introduction, for the 2007 data year, of a revision process and important coding changes for coroner-certified deaths.

The new methods were later applied to 2006 data, and the revised version of the data file for that year also belongs in the third era.

The technical report describes the methods used in the three eras, concerns and problems that accompanied them, and reasons for making changes (Chapter 2) and the issues that must be dealt with when undertaking statistical reporting of injury deaths data (Chapter 3). The report also presents and assesses data based on the ABS causes of death collection for injury overall and for major external causes of injury for the three eras (Chapter 4). For most causes, data from 1 or more supplementary sources have been used to provide a basis for assessing whether changes in CODURF-based case counts that coincided with changes in sources or methods are likely to be due to these factors, or are due to changes in the incidence of injury deaths.

The report also describes and explains technical aspects of the methods used in *Trends in injury deaths, Australia 1999–00 to 2009–10* (Henley & Harrison 2015). Data changes introduced during the period, notably the revision process, have necessitated changes to methods used in previous AIHW reports on injury mortality (Henley & Harrison 2009; Henley et al. 2007).

While attention focuses mainly on the data issues concerning coroner-certified deaths, some other developments also require attention. The most prominent of these concerns injury deaths involving falls. Administrative changes, especially in Victoria, have resulted in large changes over time in the reporting and coding of fall-related injury deaths, which must be accounted for if valid rates and trends are to be estimated.

Box 1: Three eras of CODURF data

The first era, including ABS reference years 1999 to 2002, covers the period from the first year in which the ICD-10 was the primary basis for coding causes of death in Australia. In figures, this era is labelled *ABS: pre-NCIS.*

The second era is the period during which the ABS made the transition to relying on NCIS as the source of information when cause coding coroner-certified deaths. This era is labelled *ABS: transition to NCIS.* It extends from reference year 2003 to the initial release of data for 2006.

The third era is labelled *ABS: NCIS & multiple releases*. This title summarises the key features of the process in this era: the ABS has continued to rely on the NCIS when cause coding coroner-certified deaths, has adopted a revision process and has made the other changes described in Chapter 2. The era began with the final release of data for 2006.

2 Cause of death data in Australia

Background

Official statistics on deaths and their causes have been the main basis for measuring and describing fatal injury in Australia for more than a century. They have been produced by the ABS since 1956 (ABS 2005b) and its precursor, the Commonwealth Bureau of Census and Statistics from 1907 (CBCS 1908).

Production of the cause of death data depends on the existence of a universal register of deaths in each Australian jurisdiction. For several decades, Registrars of Births, Deaths and Marriages have provided data to the ABS in electronic form, as a by-product of their primary role of maintaining a state or territory death register. More recently, the ABS has also relied on information from coroners' systems.

The outputs of the process are reports published on the ABS web site, and annual cause of death unit record files (CODURFs). Permission to use the CODURFs for statistical purposes has been granted to the AIHW by Registrars of Births, Deaths and Marriages and by Coroners, under a recently established process. The CODURFs are the primary data source used for this report and the companion report *Trends in injury deaths, Australia 1999–00 to 2009–10*.

Operation of death registers and coronial services is a responsibility of states and territories. Hence, arrangements have been necessary to enable the ABS to access and use death registers and coroner records for the purpose of producing cause of death statistics. The nature of the arrangements has changed over time, reflecting technical and administrative developments (ABS 2009, 2010). Current arrangements for cause of death statistics are described by the ABS in notes and a diagram that accompany the annual releases (ABS 2012). A more detailed description is provided in an Information Paper (ABS 2008c).

The most important aspect of ABS processing—and the focus of this report—is the assignment of cause codes to each record of a death. Cause coding of deaths has a long history and widely accepted methods (Anderson 2011). Production of cause of death data in Australia was affected by three changes in the late 1990s and the 2000s, with substantial implications for injury deaths statistics. These are:

- the change from the ninth to the tenth revision of the *International Classification of Diseases and Related Health Problems* (ICD)
- the introduction of an automated coding system for causes of death
- development of the NCIS and its adoption by the ABS to provide information for coding causes of death.

Another noteworthy event has been the review and revision of arrangements under which cause of death data are made available for use for purposes such as statistical reporting. The process has involved the ABS; registrars of births, deaths and marriages; and coroners. This resulted in a pause in access to the CODURFs for several years. While the arrangements remain to be finalised, the AIHW has been given access to data as part of a pilot implementation of new arrangements.

The focus of this report is the period since the adoption of the tenth revision of the ICD (namely, ICD-10) to code causes of deaths in Australia (WHO 1992). The ICD-10 was introduced formally for deaths registered in 1999, but deaths in 1997 and 1998 were coded to

both the International Classification of Diseases – ninth edition (ICD-9) and ICD-10. The effects of the change of ICD revision have been assessed for deaths due to all causes (ABS 2000) and in greater depth for injury deaths (Kreisfeld & Harrison 2007). The most important effect of the change for injury deaths concerns unintentional falls (Kreisfeld & Harrison 2007).

The introduction and use of the automated coding system has been described by the ABS (ABS 2000). The most noteworthy point here is that while the system requires little manual intervention for most deaths due to natural causes, 'virtually all deaths from external causes' have required manual coding (ABS 2008b).

The third of these changes is the subject of the next part of this chapter.

Adoption of the National Coronial Information System as a source

The most important of these changes, for this report, was the adoption of the NCIS as a source of information on which the ABS relies when cause-coding deaths. That innovation and its early consequences are described briefly here. Later in this chapter, information is provided on the changes to cause of death processing and reporting methods that were introduced by the ABS, largely in response to problems that emerged in the early phase of its transition to reliance on the NCIS for information on causes of coroner-certified deaths.

This is essential background for the rest of the report, because the effects on injury mortality data that arose as the ABS came to rely on the NCIS, and the further effects on data that accompanied the subsequent changes in methods, must be recognised if trends in injury mortality in Australia during the 2000s are to be understood. This section provides background information to aid understanding of the data shown in Chapter 4 on injury mortality in the three eras implied by this sequence of events.

The primary source on which cause coding relies is information from death certificates, which is provided to the ABS on a monthly basis by Registrars of Births, Deaths and Marriages (ABS 2012). This information is sufficient to allow the cause coding of most deaths, but not all. It is often insufficient for coroner-certified deaths, which include most injury deaths (ABS 2008c).

Actions taken by the ABS when information from Registrars is not sufficient to fully code a case have varied over time. They have included 'an extensive query process involving liaison with Registrars' offices and Cancer Registries, query letters to doctors, further checking of the NCIS, as well as access to paper files in individual coroner's offices' (ABS 2008c). More recent ABS documents do not mention query letters to doctors, but provide much detail on processes that have been used to obtain and use information on causes of coroner-certified deaths. Use of the NCIS is the central feature of this.

Coroners and others saw potential value in a national, electronic database of coroner case information in the 1980s and early 1990s. A system was planned and developed during the 1990s to serve information needs of coroners and others (Moller 1994). The NCIS began operation in 2000, achieved national coverage in 2001 and now also includes data on cases in New Zealand (Driscoll et al. 2003; NCIS 2010). Use of the NCIS by the ABS was first mentioned for reference year 2003 (ABS 2005a). By reference year 2006, the NCIS was 'the only source of data used by the ABS for coroner certified deaths' (ABS 2008a).

Data in the NCIS

The NCIS provides data on the deceased person (age, sex and other demographic characteristics), coded data on the events leading to death, some information on the processing of the case (for example, date of case closure), and categorisation of cases into major types according to information available when the death is notified to a coroner (for example, *intent on notification*) and when consideration of the case has finished (for example, *intent on completion*) (NCIS 2010). There is provision for up to four documents to be made part of the electronic record: police report to the coroner, autopsy and toxicology reports and the coroner's findings. The provision of documents varies between jurisdictions and over time (summarised in 'Document Attachment Percentages' reports found under 'Data collection' followed by 'Operational statistics' tabs published at <www.ncis.org.au>; when accessed in August 2013, the latest report was for the period to April 2013).

Impact of time taken to complete NCIS records

A key distinction concerning NCIS records is whether a case is Open or Closed. Closed cases are those on which coroners are no longer working and for which a prescribed set of requirements for entry of data into the NCIS have been met (NCIS 2010). All other cases are Open. NCIS records for Open cases generally lack elements of data that are important for coding causes of death, having a higher likelihood than Closed cases of being incomplete or lacking specificity in cause of death coding (ABS 2008a).

Beginning with the report of deaths in reference year 2004 (ABS 2006), the ABS has issued cautionary notes with every release about the quality of cause coding of deaths due to external causes (most of which are coroner certified). An information paper goes into more depth (ABS 2007). The focus of the cautionary notes has been that information on many coroner-certified deaths was absent from the NCIS, or did not include final information on the case, when ABS officers consulted it. This reflects the long duration after death before some coroners' cases, and the associated records in the NCIS, are complete (Harrison et al. 2009). This duration is partly due to characteristics of cases and the administration of justice (for example, some homicide cases are not finalised for a long time), but backlogs in data entry for completed cases have also occurred: the ABS reported that 17% of coroner-certified deaths in reference year 2006 had Open status in the NCIS when ABS processing ended (ABS 2008a). The proportion varied by jurisdiction, from 10% in Victoria to 65% in Queensland. Enquiries by the ABS to coronial offices revealed that about 80% of the Open cases in Queensland and New South Wales had been finalised by coroners but the records had not been entered into the NCIS due to administrative backlogs.

When the ABS began to rely on the NCIS, its reports on deaths registered in a given calendar year were normally published a little less than 1 year after the end of the reference period (for example, the report for reference year 2002 was published in December 2003) (ABS 2003). Assessment by ABS officers of NCIS data for deaths in a given reference year had to finish long enough before publication to allow for data processing and report preparation; however, for some deaths, information required for good-quality coding of causes of death was not available in the NCIS by the ABS's annual deadline. Hence, there was a mismatch in terms of timing between the practice of the coronial system and the requirements of the ABS. This was all the more important because the ABS's process for producing causes of death data did not, at that time, allow for revision of the codes assigned to a death once reports and data files for the reference year to which it belonged had been published (ABS 2006).

Beginning with the reference year in which the ABS first made use of the NCIS, the publication dates for annual cause of death reports were put back from a little less than a year after the end of the reference year (for reference years up to 2002) to about 15 months (for 2003 and later years). This was one of several measures taken by the ABS with the aim of reducing the number of Open cases in the NCIS, which ABS coders encountered when assigning cause codes (ABS 2007).

Effects on classification of causes of death

The effect of this situation on cause coding of coroner-certified deaths was that some deaths were assigned cause codes other than those that would have been assigned if complete and final information had been available to ABS officers before their processing deadline. This is inherent in rules used by the ABS when coding cases for which incomplete information was available in the NCIS (ABS 2007). In outline, the rules were:

1. If available information reported that a death had an external cause and provided the mechanism of injury (for example, shooting) but did not specify intent, the cause would normally be coded as an accident due to the specified mechanism.
2. If information was also unavailable on mechanism, the case would normally be coded as an accident due to exposure to unspecified factor (X59).
3. If information was also unavailable on whether the death was due to an external cause, the case would normally be coded as a natural cause death due to ill-defined and unspecified causes of mortality (R99).

For users of the data, this constitutes misclassification, which exists '[w]hen a subject is falsely classified into a category in which the subject does not belong. It may result from misreporting by study subjects, from the use of less than optimal measurement devices, or from random error'(The International Statistical Institute 2003). The NCIS was a new 'device' that the ABS had begun to rely upon to provide information to allow cause coding, but it was not perfect for the purpose, particularly when used in conjunction with the ABS's processing deadline and policy of non-revision, mentioned above.

The likely effect on data was described in an ABS Information Paper: 'the proportions of deaths coded to different categories may change in relation to others as a result of the level of incomplete source information. This may be represented by increases or decreases in 1 category of intent (such as suicide, or assault) compared to another (such as accidents) if only the information about intent is missing, or from any category to 'exposure to unspecified category' (X59) if information on both intent and mechanism are missing' (ABS 2007). Effects on particular causes were also described: 'The number of deaths recorded as Intentional self-harm (suicide)…has decreased over the last 10 years…This decrease can be partly attributed to the variances in the way the ABS has coded coroner certified deaths over time' (ABS 2010).

Referring to the effect of this problem on the data as misclassification does not imply that the ABS officers who applied the codes made errors. Rather, they were operating in a situation that required them to assign codes to all deaths, by a fixed deadline, whether or not information in the source on which they had to rely was sufficient to allow good-quality coding. Nevertheless, the result was that some deaths were assigned to cause categories that did not reflect the actual cause.

Extent and pattern of misclassification

Reports by the ABS and others have shown divergences between CODURF data and other sources for certain causes. The ABS has presented comparison sources for road deaths and homicides in several annual causes of death reports, beginning with that for 2006 (ABS 2008a).

Analysis of the CODURF data for deaths to mid-2004 suggested that misclassification was affecting several major external causes of deaths (Henley et al. 2007). Further investigation (including deaths to mid-2005), in which much use was made of the NCIS and of other sources, confirmed the problem. These investigations provided estimates of its extent for some external causes (road injury, suicide, homicide), and demonstrated increases in deaths coded to other categories that appeared to account for much of the undercount of causes such as homicide (Henley & Harrison 2009).

The evidence of misclassification of some suicide deaths was of particular concern because:

(1) unlike road deaths and homicides, there was no published alternative source of national data

(2) suicide was a focus of public policy attention

(3) the large and accelerating decline in suicide mortality, according to the ABS statistics, was being welcomed as evidence of a declining problem and interpreted by some as perhaps providing evidence for the effectiveness against suicide of preventative programs or measures to improve access to psychiatric care (Large et al. 2009).

The ABS's cautionary notes in cause of death publications gave particular attention to suicide (ABS 2008a, 2009) but formal evidence of the extent and cause of the problem was lacking.

The Mental Health Branch of the Department of Health and Ageing provided funds to support an investigation of suicide statistics in Australia. The resulting report (Harrison et al. 2009) confirmed the presence of a non-trivial degree of misclassification of suicide deaths, to the extent of about 16% undercount of cases that occurred in 2004 (more, if allowance is made for cases that were still Open in the NCIS in 2008, when the study was conducted).

Most of the misclassification resulted in the use of 1 external cause code for the UCOD when another would have been better. This distorted the relative numbers of deaths assigned to particular external causes, but did not affect the overall number of injury deaths. The main exception to this concerns deaths assigned UCOD R99, *Ill-defined and unspecified causes of mortality*. Two different types of circumstance can result in the use of this code.

The first type is where information available to the ABS officer shows that the death was investigated, but a cause was not determined (for example, person found dead; no suspicious circumstances; forensic investigation undertaken but did not reveal a cause). Such deaths are unlikely to be due to an external cause and, in any case, there is little likelihood that further information on cause of death will emerge.

The second circumstance is where the ABS officer is unable to access any information, when needed for coding, concerning the cause of death. This is the situation to which the third of the rules stated in the previous section applies. The ABS has stated that if information is unavailable in the NCIS as to whether a coroner-certified death was due to an external cause, the case should normally be coded to R99 (ABS 2007). This type of R99 case is likely to include at least some injury deaths. Information on causes of death may eventually become available in the NCIS for the R99 cases that are coroner certified.

The process employed by the ABS in 2003 to 2005 for coroner-certified deaths is likely to have resulted in more of the second type of R99 case than the method employed more recently. This is because the NCIS was used by the ABS to obtain data to code the causes of these deaths, but the cut-off for processing for these reference years was at dates when considerable numbers of relevant NCIS records were incomplete, and a revision process had not yet been introduced.

The CODURF data for 2006 and 2007 illustrate this. The *Initial* release of 2006 data, which were processed in much the same way as reference years 2003 to 2005, included 930 coroner-certified deaths assigned UCOD R99. In the *Final* release of 2006 data, which was processed using methods like those used for data in 2007 and later reference years and had a much later cut-off date, this was reduced to 298 coroner-certified cases coded to R99. Almost one-quarter of the coroner-certified cases originally coded to R99 were reassigned UCODs in the range V01–Y36, bringing them in-scope as injury deaths. Similarly, the *Preliminary* release of 2007 data included 1,160 coroner-certified deaths assigned UCOD R99. In the *Final* release of 2007 data, this was reduced to 283 coroner-certified cases coded to R99.

ABS responses to issues regarding cause of death coding

The ABS has instituted changes that were designed to overcome the problems outlined above. These are the most important changes to the system for producing Australian cause of death statistics in many years. Most of the changes apply chiefly or solely to coroner-certified deaths and so they are particularly important for surveillance of injury deaths.

The changes are described here in order to provide background for the statistical descriptions of their effects presented later in the report. The changes have also necessitated alterations in how data on injury mortality are reported.

The ABS introduced an initial set of changes when processing deaths registered in 2007 (ABS 2009, 2010). The main features of these are:

(1) All coroner-certified deaths registered on or after 1 January 2007 have been subject to two rounds of revision. The *Preliminary* release, published about 15 months after the end of a reference year is followed 12 months later by a *Revised* release and 24 months later by a *Final* release. The extended duration between date of death and the ABS processing deadlines for the latter two releases allows time for more NCIS records to become sufficiently final and complete to allow good-quality cause coding.

(2) Criteria for assigning cases to the ICD-10 code block Undetermined intent were widened. Formerly, only cases where a coroner had concluded, at the end of investigation, that the intent of a case was undetermined were assigned these codes. The new criteria continued to include such cases, but also allowed coding to this block of the larger number of cases where the NCIS intent fields were blank, or contained values meaning 'could not be determined' or 'unlikely to be known' when an NCIS record was inspected by an ABS officer. This allowed cases where intent was not (yet) known to be assigned, for the time being, to Undetermined intent categories. It was expected that many of the cases assigned to this block in the *Preliminary* release would be reassigned to the appropriate specific category in later releases. This change also allowed cessation of the former practice of assigning such cases to an unintentional cause category (the ICD-10 *Accidents* block, V01–X59), where—in the absence of a revision process—they remained.

Further changes were introduced to processing coroner-certified deaths in the 2008 reference year (ABS 2010, 2011). The main features of the changes are:

(1) more time was spent considering information in Part II of the Medical Certificate of Death when a non-specific underlying cause was shown in Part I (see Box 2)

(2) more resources have been applied to investigating coroners' reports to identify specific causes of death, through increased use of police reports, toxicology reports, autopsy reports and coroners findings.

The changes introduced for reference year 2007, with further changes that were introduced for reference year 2008, continued to be applied with little change, at least to reference year 2011 (ABS 2013).

Deaths registered in 2006 were initially processed according to the method that predated these changes, and this release was published in 2008. The introductory note stated: 'The ABS currently does not revise Causes of Deaths death data, even if additional information becomes available' (ABS 2006). In 2012, however, the ABS released a second version of data for reference year 2006, the causes of death in which were coded according to the new method, although with unusually long periods between dates of death and the last date on which ABS officers could have inspected records in the NCIS. Hence, a particularly low proportion of Open cases and missing data would have been encountered. The ABS stated that this release was provided in order to improve the quality of historical data (ABS 2012).

First release 2006 data are referred to in this report as the *Initial* release. This is done to distinguish the data in it from first release data ('*Preliminary*') for later years, which were processed according to the changed method outlined above.

Box 2: Medical Certificate of Death

A form and procedure for medical certification of causes of death have been recommended by the World Health Organization and are used in all Australian states and territories, with some local variations. The form has two parts.

Part I has several lines, usually 4, on the first of which should be recorded the 'disease or condition leading directly to death'. The remaining lines in Part I should be used to record conditions (if any) to which the first-mentioned condition was due, ending with the 'underlying' condition to which death was due. If an injury is mentioned in the causal chain, the circumstances that led to the injury should also be mentioned.

Part II is provided to allow recording of 'Other significant conditions contributing to the death, but not related to the disease or condition causing it'. In the case of a death due to hip fracture due to a fall by an elderly person, 'general frailty' might be recorded in Part II.

Source: ABS 2008c.

Other relevant properties of the causes of death data collection

During the period from 1999 onwards, the ABS has provided an increasing amount of information on the scope, coverage and other technical aspects of the causes of deaths collection as part of the annual Causes of Death publications (e.g. ABS 2012) and in occasional reports (ABS 2008b). Certain aspects of these properties of the collection are relevant to this report, and they are mentioned here.

Scope

In outline, 'The ABS Causes of Death collection includes all deaths that occurred and were registered in Australia, including deaths of persons whose usual residence is overseas. Deaths of Australian residents that occurred outside Australia may be registered by individual Registrars, but are not included in ABS deaths or causes of death statistics' (ABS 2012). 'In Australia' includes the six states and two main territories, Christmas Island, Cocos (Keeling) Islands and Jervis Bay Territory and other external territories (but not Norfolk Island), and deaths 'occurring within Australian Territorial waters'. Certain other criteria apply (for example, to deaths on ships or planes in transit).

Coroners have scope of operation that is similar to, but not identical with, the scope of death registers and of the ABS cause of death collection. For example, coroners inquire into some deaths of Australians that occur outside Australia (certain of the deaths that occurred in Indonesia due to the Bali bombing, for example).

Understanding the scope of coroners' practice is particularly relevant when using the NCIS as a supplementary source and for certain causes, such as drowning.

Published data on deaths of Australian citizens or usual residents while overseas are limited. Annual reports of the Department of Foreign Affairs and Trade (DFAT) state the annual number of 'Cases of next of kin of Australians who died overseas given guidance or assistance with disposal of remains'—1143 in 2009–10 and similar in the next two years. However, the number of consular services may be larger than the number of deaths.

Published data attributed to DFAT report that 904 overseas deaths of Australians occurred in 2012 (SMH 2013). Broad types of cause were reported for some deaths but the data are not sufficient to assess the number of injury deaths.

Neither the DFAT publications nor CODURF data include deaths overseas of members of the Australian Defence Force. Forty-one (41) Australian service personnel deployed to Afghanistan were killed in action in the period 2002 to 2014, 39 since 2007 (Department of Defence 2015) and another Australian was killed while serving with the British Army <en.wikipedia.org/wiki/Australian_Defence_Force_casualties_in_Afghanistan>, accessed 3 January 2015. Information was not found on other recent deaths overseas of service personnel.

Completeness

Australia's death registration system is considered to include nearly all deaths, but exceptions occur. Some deaths may be overlooked (for example, of a socially isolated person in a remote place) or secreted. Records of deaths are occasionally found to have been omitted; current ABS operating rules allow such cases to be included in the next reference year of data (ABS 2008c).

Dates

The ABS processes deaths in annual batches, largely according to the calendar year in which they were registered by a state or territory Registrar of Births, Deaths and Marriages. Beginning with reference year 2007, each annual batch includes records for all deaths registered in a particular calendar year—provided that they were received by the ABS within three months after the end of that year—plus records for any deaths (typically very few) that were registered in any earlier year and have not already been processed by the ABS (ABS 2008c). The scope was slightly narrower before reference year 2007, inclusion of late cases being restricted to deaths registered in the 2 years before the reference year. This left some registered deaths permanently out of scope, which were included by the changed criteria.

The term 'ABS reference year' can be used to refer to each annual batch processed by the agency, which comprises the records included in a particular CODURF file. Two other groupings of deaths data by year are more common and familiar: year of death and year of death registration. Starting with the report for reference year 2001, the ABS has published summary data on causes of death by calendar year of death (ABS 2002).

As the phrase suggests, *Year of registration* is the calendar year during which each death was entered into a state or territory deaths register. Year of registration is the same as reference year for over 99.9% of deaths and, for most purposes, the set of deaths in an ABS reference year set can be regarded as equivalent to the deaths registered in the named year.

Year of death differs from the other two types for a substantial proportion of injury deaths (the proportion varies by external cause and other factors), and the distinction is an important one. As explained in Chapter 3, year of death is used as the basis for presenting data in the companion report, *Trends in injury deaths, Australia 1999–00 to 2009–10*.

Multiple causes of death

Deaths generally have multiple causes. Analysis based only on underlying cause is unsatisfactory when coding deaths of people with multiple, concurrent chronic problems (Anderson 2011). This situation applies to the large and growing number of deaths in Australia following unintentional falls by older people. It is also unsatisfactory for analyses of injury deaths in general, for reasons given below.

Until reference year 1997, Australian mortality data were assigned a single UCOD code. For most deaths, this is the disease '…which initiated the chain of morbid events that led directly to death' (ABS 2008c). If an injury is assessed as satisfying this definition, in accordance with ICD rules, the external cause of the injury should be coded as the UCOD (see below for the limited exceptions). The external cause is '…the circumstances of the accident or violence which produced the fatal injury' (ABS 2008c).

Notable advantages of taking account of multiple causes when analysing and reporting in jury deaths include the following:

- First, it allows cause to be considered in terms of pathology (for example, injury, or particular types of injury, such as traumatic brain injury or hip fracture) and in terms of potentially preventable 'external causes' that can result in injury (for example, an unintentional car crash or intentional shooting of one person by another). Awareness of this important distinction prompted the provision of separate chapters in the ICD for injuries and for external causes beginning with the sixth revision, in 1948. As ICD injury codes are not permitted to be used for UCOD, consideration of injury as a cause of death

using CODURF mortality data necessarily involves use of an approach that takes account of multiple causes of death (MCOD) data.

- Second, a case may involve more than one injury (for example, traumatic brain injury and hip fracture) or more than one external cause (for example, car crash and immersion; poisoning by oxycodone with morphine and alcohol). While rules can be applied to select one cause, that tends to oversimplify events and applies rather arbitrary judgements of priority among external causes (Lahti et al. 2011). In addition, some MCOD codes further specify the cause given in the UCOD. For example, the UCOD may refer to poisoning by a broad class of drugs, while MCODs refer to a specific drug or drugs.
- Third, CODURF records for many deaths include injury and/or external cause codes and also codes for conditions other than injuries. That is to be expected, given the nature and purpose of the cause certification processes (Anderson 2011). In some of these cases, an external cause is not reported as the UCOD, yet the injury or injuries coded in MCOD fields are likely to have contributed to the death.

Methods can be used to formally assess the relative contributions of various causal factors to mortality. This can be done statistically, assessing strengths of association between factors in large groups of cases. It can also be done case by case, typically by having at least two independent observers assess each case against specific criteria. Routine vital registration of causes of death applies neither of these approaches. The great majority of deaths are certified by a doctor. The usual method involves a single practitioner making an assessment of causes, based on very variable knowledge of the deceased person and their history and usually without the benefit of formal post-mortem examination and investigation. Most injury deaths are certified by a coroner, a specialist in cause of death investigation who can draw on the expertise of police, forensic pathology services and others.

All information from death certificates in Australia has been put into an electronic form for several decades. The automated coding system used by the ABS since reference year 1997 has the effect of making available coded data corresponding to some or all of the conditions written onto the death certificate (ABS 2000). From 1999, up to 20 MCOD codes could be allocated to any death record (up to 13 in 1997 and 1998). These MCODs represent the information about cause of death that appeared on the death certificate, supplemented for some deaths by information from other sources.

As noted above, ICD rules require that (with the exceptions summarised below) deaths found to be due to injury should have an external cause code as the UCOD. This implies that deaths with an external cause code as the UCOD should have at least one injury code as an MCOD. Considering the CODURF data used for *Trends in injury deaths, Australia 1999–00 to 2009–10*, 99.3% of the records with UCOD in the range V01 to Y36 have at least one injury code as an MCOD. External cause codes also appear among MCODs. About 8% of deaths with an external cause as the UCOD and about 4% of the larger number of deaths with a disease condition as the UCOD have one or more external cause codes as MCODs.

Multiple cause information on injury deaths has been investigated (Kreisfeld & Harrison 2007) and has subsequently been used in reports on injury mortality in Australia in the period for which multiple cause information has been available (Henley & Harrison 2009; Henley et al. 2007; Kreisfeld & Harrison 2007).

Taking account of multiple causes requires the use of different methods to those used when reporting data that have been reduced to a single cause. The main difference is that cases

considered in terms of multiple causes can be in more than one category of interest. For example, a death involving immersion and a car crash will be included in both the unintentional transport injuries section of the trends report and the unintentional drowning section. Each death is, of course, counted only once when reporting injury deaths overall.

Deaths involving injury but not as the underlying cause of death

As noted above, most deaths resulting from injury have the external cause of that injury recorded as the UCOD. The limited exceptions to this ICD-10 coding rule are outlined here:

- Epilepsy can be the cause of an external event resulting in injury. In this case, epilepsy can be recorded as the UCOD.
- For falls, a bone density disorder is a valid UCOD if reported in a legitimate sequence.
- An injury reported only in Part II of the death certificate will not be regarded as having 'caused' the death, in which case the external cause of that injury will not be coded as the UCOD.

Changes in coding rules

Internationally agreed changes are sometimes made to the ICD coding rules. The change in the period considered here with most relevance to injury causes concerns certain deaths due to poisoning by dependence-producing psychoactive substances. Before the 2006 edition of the ICD-10, such deaths could be assigned certain codes from the 'Mental and behavioural disorders' chapter of the ICD-10 as the UCOD. From 2006, such deaths are coded to the appropriate 'Accidental poisoning' category in the 'External causes' chapter (WHO 2006).

Sensitivity of cause coding to type of certifier

Most deaths due to injury must be reported to a coroner. The main exception is that deaths due to fall-related injury in old age may, under certain circumstances, be certified by a medical practitioner. That exception applied in all jurisdictions until 2003, when changes in administration of the certification of deaths in Victoria required all injury deaths to be reported to a coroner (ABS 2006; Neate et al. 2013). The effects of this on the cause coding of injury deaths during the period relevant to this report are large enough to require use of special methods to avoid confusing effects of the administrative change with changes in injury incidence. This episode demonstrates the sensitivity of cause coding to type of certifier and certification method.

The effects are most important for surveillance of injury mortality due to unintentional falls. However, the insights that the changes provide are of more general importance, and so initial consideration of the issue is placed here. Details of the implications of the changes for fall injury deaths are presented in Section 4.7.

Since the changes in 2003, all injury deaths have been reportable in Victoria. Coroners Court instructions to medical practitioners on determining whether a death is reportable include, as one of four categories of reportable death, those 'Where the death appears to have been unexpected, unnatural or violent or to have resulted, directly or indirectly, from accident or injury' (Coroners Court of Victoria 2014).

This increased the proportion of injury deaths in Victoria that were certified by coroners, particularly affecting deaths after falls and fractures (because nearly all injury cases of other types were already reportable to coroners). Coroners and associated forensic sciences services have resources relevant to ascertaining cause of death that are not normally

available to a medical practitioner who certifies a death. This can be expected to have resulted in more reliable determination of causes.

The administrative change in 2003 increased the proportion of injury deaths in Victoria with a record in the NCIS. This provided ABS officers who code causes of death with a readily accessible source that is designed to provide good information on causes, especially external causes. In contrast, if a similar case is certified by a medical practitioner (as remains usual in other jurisdictions), the information available to the ABS officer responsible for coding cause is likely to provide little information on external cause.

Also contributing to the increase in identification of deaths as being due to injury is a process in which the Victorian Registry of Births, Deaths and Marriages refers to the Coroners Court death certificates, initially certified by a medical practitioner, which appear to have been reportable to a coroner. (Similar arrangements are in place in at least some other jurisdictions). A total of 4,283 deaths were referred in the 9 years from 2003 (Neate et al. 2013).

An investigation of the 656 deaths referred by the Registry in the year starting 1 July 2010 found that 320 (49%) should have been reported to a coroner rather than certified by a medical practitioner (Neate et al. 2013). Of these 320 deaths, 307 (96%) were found to be due to fall-related injury, and the remainder were due to other external causes. The review resulted in major changes to the previously stated causes of death in 146 of the 320 cases.

The review by Neate and colleagues (2013) revealed unreliability of causes given in medical certificates of many such deaths, and confirms that assignment of causes to deaths after injury is sensitive to whether the cases are certified by a medical practitioner or a coroner.

3 Issues for analysis and reporting of data on injury deaths

This chapter deals with issues that apply to analysing and reporting on deaths in Australia for the purpose of injury surveillance. These are issues that apply to the use of injury deaths data overall, and are not specific to particular types of injury or external cause. Issues that apply mainly to injury deaths involving a particular type of external cause are considered in Chapter 4.

The issues considered here are:

- primary and supplementary sources of data
- dates and durations
- specification of injury death
- unintentional injury
- undetermined intent
- multiple releases of cause of death data.

Primary and supplementary sources of data

The primary source used in reporting injury mortality in Australia is the series of CODURFs produced by the ABS using data from Registrars of Births, Deaths and Marriages, and information from coroners, normally accessed via the NCIS. Relevant aspects of this source were described in Chapter 2.

While uniquely important and used for official purposes, the CODURFs and publications based on them are not the only sources of quantitative information on injury deaths in Australia. Other sources, mostly more specialised, can provide supplementary information on injury deaths due to particular external causes of injury (see Chapter 4). The ABS has cited additional sources in some of its reports on causes of deaths (ABS 2008a, 2009, 2010) and additional data can also be obtained from the NCIS.

No other source has more complete coverage of injury deaths overall than the CODURFs. The NCIS comes closest, but it does not include injury deaths certified by doctors, and so omits most fall injury deaths (except in Victoria). The NCIS is, however, a useful supplementary source for all other types of injury deaths, which are nearly always referred to a coroner.

The NCIS can be used as a supplementary source, even though it has been the sole basis for ABS coding of coroner-certified deaths since 2006 reference year (ABS 2008a). First, the NCIS can be used to look at data for deaths in 2001 and 2002, when it was in operation nationwide, but the ABS had not begun to rely upon it. The NCIS records for injury can also be examined at times longer after death than the cut-off for processing the *Final* ABS release, allowing assessment of cases that had not been finalised at that time. In addition, the more detailed case information in the NCIS than in the CODURFs enables assessment of types of case that cannot be distinguished in terms of the ICD-10 cause codes in the CODURF data (for example, cases involving particular drugs). It also allows re-coding of cases using different methods or criteria, which is useful for some purposes (for example, applying criteria to

identify types of intentional self-harm cases in ways that are relevant to understanding the topic but cannot be distinguished using ICD-10 coded data).

As the term suggests, supplementary sources do not displace the CODURFs as the primary source of data on injury deaths in Australia. They provide a basis for assessing attributes of the CODURF, such as completeness of ascertainment of injury deaths due to particular types of external cause. The ABS has used supplementary sources, including road safety agency data on road deaths and police data on homicides to assess the quality of the CODURF (ABS 2007). Supplementary sources also enable better use to be made of CODURF data for particular purposes (for example, deaths after injurious falls).

Depending on details of sources, methods and availability, supplementary sources can serve the following purposes:

- confirm counts or rates for a period
- confirm trends over time
- estimate case types that may be seen as relevant to injury surveillance, but are out of scope for the CODURF data (for example, Australians who died overseas)
- provide more recent data than have been released in the CODURFs
- provide more complete cause of death data than the *Final* release CODURF. (The NCIS can provide this if it is inspected later than the cut-off date for processing the *Final* release CODURF for the reference year in which a death is included.)

It should be recognised that supplementary sources may differ from the CODURFs in terms of the phenomena that they are designed to record, how dates are framed, or in other ways. For example, CODURF data on deaths due to interpersonal violence focus on the number of deceased persons who have this cause of death. Some justice system data focus, instead, on numbers of homicide offences reported or detected, or on convictions. Exactly identical case counts should not be expected in this situation. Such collections can, however, be useful supplementary sources if their conceptual scope is similar to that of CODURF data.

Dates and durations

Cases are presented according to year of death in the companion report, *Trends in injury deaths, Australia 1999–00 to 2009–10*, and in previous reports on injury mortality, using years ending 30 June (Henley & Harrison 2009, 2015; Henley et al. 2007).

Several types of date might, in principle, be made the basis for injury surveillance reporting, notably date of injury, date of death and the dates of various administrative events (for example, date of death registration and dates related to coronial investigations).

For the purpose of public health surveillance, date (and time) of injury is the most desirable. The occurrence of injury due to some external causes varies by day of week or by characteristics of weather, and understanding these—and some other cases—benefits from knowing exactly when injury occurred (ideally also time of occurrence). Date of injury is not included in records in the CODURFs, though it is provided in the NCIS.

Three other dates are provided in the CODURFs: date of death, date of death registration and ABS reference year. Date of death is the most similar to date of injury. It is closest in time: many injury deaths occur on the same day as injury. Only date of death is provided to a resolution of exact day in the CODURFs, allowing assessment in terms such as day of week. Use of date of death is also convenient when comparing case counts from various

sources because it is commonly found in information systems that may be used as supplementary sources. Dates of administrative events, such as date of death registration, are less likely to be available in supplementary sources.

Date of registration is susceptible to variation in lag after date of death, introducing an additional component of variation of estimates, which is largely avoided if date of death is used. A recent example is the late identification of a batch of deaths from Queensland (ABS 2013). If data are presented in terms of date of registration, applying a weighing method has been advised, to avoid giving users a false impression that the artefact that would otherwise appear reflects a change in incidence. There is no need for this adjustment when data are organised by date of death.

In Chapter 4 of this report, much attention is given to the effect of changes that were applied by the ABS to data for particular reference years. Most of the analyses are presented with data grouped according to ABS reference years, because that best reveals variations in data that are due to changes in ABS sources and methods. Date of death is used where comparisons are made between sources that have this type of date. The closer correspondence of trends when both sources are organised in terms of date of death is sometimes marked (for example, compare Figure 4.7 with Figure 4.8).

Lags between the dates of death and death registration also vary by type of injury case and jurisdiction. While most deaths are registered fairly soon after death, some are not, and injury deaths are overrepresented among the latter. Of all deaths in reference year 2010 that meet the criteria for injury death, 8.7% occurred before 2010, compared with 5.5% of deaths from other causes. There is also considerable variation by external cause. For example, while 7.1% of fall injury deaths in reference year 2010 occurred in an earlier year, the proportion was 16.8% for homicides.

Some injuries result in death immediately, or after a short time (minutes to hours). In other cases, death follows injury by a longer period, but is attributed to the injury. Mortality risk remains elevated for months or years after some injuries, though the likelihood that the UCOD will reflect the injury decreases (Hindmarsh et al. 2012). Documentation of the ABS cause of death coding process does not specify a fixed limit on the duration between injury and death beyond which a case should not be coded as being due to the injury. Neither does the ICD-10 impose a specific time limit; however, if death is due to a condition that arises (as a consequence of an injury) one year or more after the originating event, this is considered to be a 'late effect' of the original event, which should be coded to a special block of codes entitled *Sequelae of external causes of morbidity and mortality*. A similar block of codes in the ICD-10 'Injury' chapter allows indication that an injury was the cause of a late effect (or 'sequela'), which is itself coded to any appropriate ICD-10 category.

In keeping with the practice in previous injury mortality reports, cases coded as injury sequelae were not included in *Trends in injury deaths, Australia 1999–00 to 2009–10*. Deaths due to sequelae (that is, late effects) are omitted because the injury that eventually resulted in the fatal sequela may have occurred long before death, and the duration is not available. Including cases with ill-defined and potentially very long durations between injury and death complicates interpretation of deaths data in estimating the fatal injuries that occurred in a particular period. Also, the categories provided in the ICD-10 specify the type of external cause involved in some deaths due to sequelae reported (for example, transportation) but not others (for example, drowning or thermal injuries), which complicates consistent handling of external causes.

Specification of injury death

The background to the specification of injury-related deaths has been given elsewhere (Henley et al. 2007; Kreisfeld & Harrison 2005, 2007; Kreisfeld et al. 2004; Langley & Brenner 2004). Conceptually, the intention is to enumerate deaths that would not have occurred when they did were it not for injury (Cryer et al. 2011).

The specification of injury death used in *Trends in injury deaths, Australia 1999–00 to 2009–10* and in this report is similar to that used for the two previous AIHW reports focusing on injury mortality (Henley & Harrison 2009; Henley et al. 2007), but with a minor change. The change is explained below.

This specification of injury has been used for most reports in the Injury research and statistics series that are based on admitted patient data for data years 2001–02 and later, and for injury mortality reports starting with deaths that occurred in 2003–04. Use of the same injury specification for mortality and morbidity reports contributes to comparability of the reports. In particular, *Trends in injury deaths, Australia 1999–00 to 2009–10* was designed to be a companion report to the report *Trends in hospitalised injury, Australia 1999–00 to 2010–11* (Pointer 2013).

The specification includes the deaths that have an ICD-10 code in the range that has been used for purposes of public health reporting of injury: S00–T75 and T79. This range includes most, but not all, of the range that is included in ICD-10 Chapter 19, 'Injury, poisoning and certain other consequences of external causes'. It includes physical injuries such as fractures, dislocations, open wounds and burns to any part of the body. Poisoning and toxic effects of substances are also included, as are injurious effects of radiation, vibration, extremes of pressure and lack of essentials such as breathable air.

Some causes of death that may be referred to as injury are coded to categories that are not in the injury and external causes chapters of the ICD (for example, injury of mother or infant during labour or delivery). They are included here only if their cause codes satisfy the specification described here.

For reasons given in Chapter 2, it is desirable to take account of both multiple causes information, and of UCOD codes in CODURF files as well as MCOD codes. This requires specification in terms of a range of ICD-10 external cause codes as well as injury codes. Three rules are applied to the inclusion of records on the basis of external cause codes.

1. Deaths assigned a UCOD in the range Y40 to Y84 (*Complications of medical and surgical care*) and Y85 to Y89 (*Sequelae of external causes*) are omitted unless their MCODs, alone, satisfy the inclusion specification. This maintains consistency of scope between the parts of the inclusion criteria that are based on injury codes and on external cause codes.
2. Deaths with a UCOD in the range V01 to Y36 are included, even if no in-scope injury code is present among their MCODs. The rationale is that assigning an ICD-10 external cause code in this range as the UCOD implies the presence of an injury. Only a very small proportion of records used in the trends report lacked an injury code: 99.3% of the records with a UCOD code in the range V01 to Y36 also had at least one in-scope injury code as a MCOD.
3. Cases that have an in-scope injury MCOD code and do not have an in-scope UCOD were included only if they also have a MCOD in the range V01 to Y36. This helps to ensure that the same inclusions and exclusions apply to cases included on the basis of MCODs and those included on the basis of UCODs.

The inclusion specification can be summarised as follows:

- The UCOD was an external cause code in the range V01–Y36.

  or

- At least one MCOD code was an external cause in the range V01–Y36 and at least one other MCOD was a code for injury (S00–T75 or T79).

This specification is a little narrower than that used in the two previous reports of injury mortality (Henley & Harrison 2009; Henley et al. 2007), in two respects.

The first harmonises the way sequelae (late effects) codes are handled. The old specification omitted 'Injury' chapter sequelae codes from the inclusion criteria (that is, ICD-10 T80–T88), but included most of the sequelae codes from the 'External causes' chapter in the criteria that operated on UCOD codes (that is, Y85–Y87; Y89). The change harmonises these two aspects of the specification by also omitting sequelae codes from the UCOD-based criteria.

The second tightens the criteria for including a death on the basis of MCOD codes. Formerly, the specification required the presence of at least one injury code in MCOD fields (that is, S00–T75 or T79). That requirement remains, but it is now also required that at least one other code in the MCOD fields is in the range V01–Y36. The first MCOD field in CODURF files nearly always contains a copy of the UCOD code and this requirement is applied to the second and subsequent MCOD fields when that is so.

The overall effect of the changes is to select 1,837 (1.6%) fewer deaths over the 11-year period than if the old specification had been used.

Unintentional injury

The use of the term 'accident' in the context of injury research and prevention has long been criticised for imprecision and implied fatalism (Doege 1978; Langley 1988; Loimer & Guarnieri 1996). By the mid-1990s, the National Center for Injury Prevention and Control (part of the United States Centers for Disease Control and Prevention) had replaced 'accident' with 'unintentional' in reports and other contexts (Lewitt & Baker 1995). The WHO Division of Violence and Injury Prevention has avoided the term, though using it when quoting other sources and sometimes as a secondary synonym (for example, Unintentional [or 'accidental']). In the WHO World Report on Child Injury Prevention, for example, the word 'unintentional' occurs more than 25 times in the body of the first chapter, while 'accident' appears only once, when quoting a paper published in 1955 (Peden 2008).

The ICD-10 code range V01 to X59 has the heading 'accidents', a term continued from earlier revisions. The ICD-10 'External causes' chapter was developed between 1986 and 1989 (L'Hours 1994). This was shortly before a period of international activity on the classification of external causes, a prominent outcome of which was the International Classification of External Causes of Injury (ICECI), which was adopted as a related classification of the WHO Family of International Classifications in 2004 (McKenzie et al. 2012). In keeping with the developments referred to above, the ICECI uses the term 'unintentional' in place of 'accidental' and defines an unintentional injury event as 'an unforseen incident where there was no intent by a person to cause harm, injury or death, but which resulted in injury'(ICECI Coordination and Maintenance Group 2004). The ICD-10-CM, the US clinical modification of the ICD-10, adds the word 'unintentional' as a synonym for accidental throughout (ICD-10-CM) <ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications

/ICD10CM/2015/>. 'Unintentional' has been recommended for use in ICD-11 (McKenzie et al. 2012) and is the term used in drafts of that revision (WHO 2014).

Accident is not defined in the ICD-10. The scope of the 'accidents' block is chiefly limited by the inclusion and exclusion terms for the other code blocks in the 'External causes' chapter: Intentional self-harm, Assault, Event of undetermined intent, Legal intervention and operations of war, and Complications of medical and surgical care. In other words, a case to which an external cause code should be assigned defaults to a code in the 'accidents' block, unless the case satisfies the criteria for inclusion in one of the other code blocks. Since most of the other blocks refer to intentional injury, block V01 to X59 can be said to refer to injury that is not intentional, or is 'unintentional'.

'Unintentional injuries' is the term used in this report to refer to cases that have been assigned ICD codes from the ICD-10 block V01 to X59. This practice is the same as, for example, that of the United States National Center for Injury Prevention and Control, which has for many years titled reporting categories as 'unintentional ' which are defined in terms of categories from the 'accidents' block of the ICD-10 (Thomas & Johnson 2014).

Undetermined intent

The ICD-10 includes a block of codes designed to allow coding of cases where 'available information is insufficient to enable a medical or legal authority to make a distinction between accident, self-harm and assault' (Y10–Y34). Similar Undetermined intent blocks were provided in the ICD-8 and the ICD-9. Relevant authorities can take considerable time to finalise the assessment of deaths cases. Until they have finished, it is not resolved whether information available about the causes of a death will turn out to be sufficient to allow a decision to be made on intent. Indeed, the information available may change over time.

As reported in Chapter 2, one of the main responses by the ABS to issues regarding cause of death coding in the mid-2000s was to widen the criteria for assigning cases to the Undetermined intent block. Another was to introduce a revision process. These changes resulted in a large increase in the number of coroner-certified deaths that were coded to the Undetermined intent block, and to large changes in the number of such cases between revisions of a CODURF file. These changes must be taken into account when undertaking statistical reporting on injury deaths.

The number of cases coded to the Undetermined intent block of the ICD-10 is much larger for ABS reference years in the third era (that is, revised CODURF for 2006 reference year and later) than formerly. This block accounted for well under 1% of cases included in *Trends in injury deaths, Australia 1999–00 to 2009–10* for reference years to 2004. Since then, the proportion has risen steeply, reaching 4.5% for *Final* release 2008 data. (The still higher proportions seen in *Revised* and *Preliminary* release data for later reference years can be expected to decline somewhat by the time they reach the *Final* release.)

Intent is eventually determined for many of the deaths initially coded to the Undetermined intent block. If that occurs before the cut-off date for processing the *Final* release of data for the relevant reference year, the cause code can be reviewed. This typically results in its replacement by a more specific ICD-10 category. Likely effects on case counts of the deaths with undetermined intent are discussed in the parts of Chapter 4 that deal with cases involving the mechanisms of injury that are distinguishable in terms of Undetermined intent codes (for example, drowning with undetermined intent is considered in the section on drowning deaths). The issue is discussed generally in the final part of Chapter 4.

Multiple releases of cause of death data

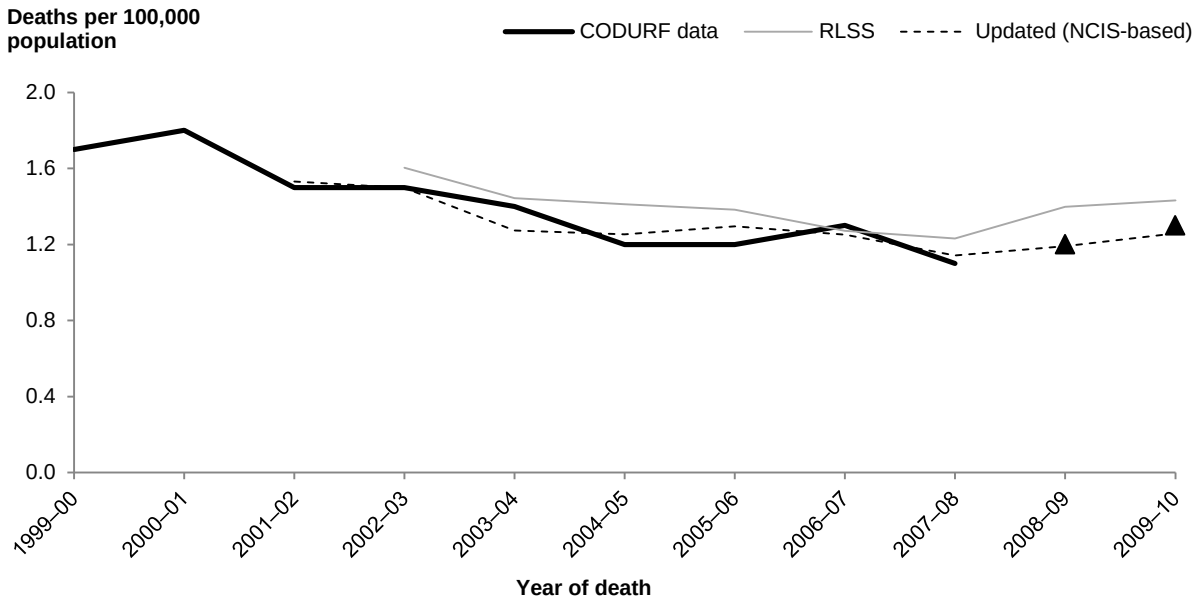
Australian cause of death data for reference years up to and including 2005 were released in only one version. As described in Chapter 2, data for later reference years have been revised, each version corresponding to a distinct CODURF. Three releases are planned for reference years 2007 and later: *Preliminary*, *Revised* and *Final*. Two releases were made of 2006 data. The main difference between releases is that cause-codes for coroner-certified deaths can be revised, based on later and more complete information that may be available in the NCIS by the ABS cut-off date for a later release than was available at the cut-off data for an earlier release.

The multiple release approach has the great benefit that the cause coding can use information that enters the NCIS as late as about three years after the end of a reference year (which is up to about four years after death for deaths that occur early in a calendar year).

The approach requires changes to methods used to report the data. This section describes the approach taken in *Trends in injury deaths, Australia 1999–00 to 2009–10.* Methods used with multiple release data should:

- note that some of the data are subject to revision
- be presented in a way that allows for updating as further releases are made.

In the era of multiple releases, the ABS has normally released three sets of data each March: the *Preliminary* release for the reference year that ended about 15 months earlier, the *Revised* release for the reference year before that, and the *Final* release for the reference year before that. When the companion trends report was prepared, the latest files that had been received were the *Preliminary* release for 2010, the *Revised* release for 2009, and the *Final* release for 2008. Earlier data on hand were the *Preliminary* and *Final* releases for 2007, the *Initial* and *Final* releases for 2006, and the sole releases for years before 2006.



Notes

1. Values for the last 2 years of CODURF-based rates, shown as symbols (▲), could change due to later revisions of cause of deaths data by the ABS. See Appendix A, 'Data Issues' in *Trends in injury deaths, Australia 1999–00 to 2009–10.*
2. Estimates based on Royal Life Saving Society Australia (RLSS) and NCIS data are crude rates.

Figure 3.1: Age-standardised rates of unintentional drowning deaths, Australia, 1999–00 to 2009–10

Figure 3.1 is an example taken from *Trends in injury deaths, Australia 1999–00 to 2009–10* (where it is Figure 4.3); relevant features of this figure are described here.

Horizontal axis

As explained above (Dates and durations), *Trends in injury deaths, Australia 1999–00 to 2009–10* follows the practice in previous reports on this subject by presenting data in terms of year of death, framed as years to 30 June. The latest CODURF used (here that for reference year 2010) provides an underestimate of deaths that occurred in the same-named calendar year because of lag between date of death and date of death registration. That is allowed for here; data for the second half of reference year 2010 (to which nearly all of the undercount due to lag applies) are not shown.

Assessment of data for earlier years shows that undercount due to lag in registration is small when this method is used. For example, considering injury deaths that occurred in the first six months of 2008 and had been registered by the end of 2010, 99.5% had been registered by the end of 2008. (In contrast, only 85.7% of injury deaths that occurred in the second half of 2008 had been registered by the end of that calendar year.) Similar patterns apply to deaths in previous years.

The disadvantage of this method is that the most recent six months of data based on reference year are not presented. However, the data for that period are *Preliminary*, and subject to two rounds of revision, so the omitted data have uncertain values, and the period affected is a small part of the total period covered by the trends report.

Final data (thick black line; CODURF data in the legend)

The cause codes for 99.9% or more of the deaths that occurred in the years before 2008–09, and were in reference years up to and including 2010, are *Final*, as they are included in ABS reference years 2008 or earlier, for which no planned revision process remains to be conducted. Data for deaths in that period are nearly final, but not quite, for three reasons:

1. A small proportion of these are coroner-certified cases registered in 2009 or 2010 (n = 116), and these may be subject to revision.
2. It is likely that a very small number of deaths that occurred on or before 30 June 2008 had not been registered by 31 December 2010 (the end of the inclusion period for the latest CODURF used for this project) but were, or will be, registered at some later date, in which case they will appear in the CODURFs for a future ABS reference year.
3. NCIS data for some deaths are not complete and final by the ABS cut-off date for processing the third, *Final*, release of data for a reference year. Further information about them may be added to the NCIS after that but, under current ABS revision arrangements, this will never be reflected in CODURF data.

CODURF data subject to revision (dark triangles)

Most of the records underlying the last 2 years of death data points are in ABS reference years 2009 and 2010. The CODURFs for those years that were used here were subject, respectively, to one and two more rounds of revision. About 53% of cases with year of death 2008–09 were subject to at least one revision as were all the cases with year of death 2009–10. The less final status of these data has been indicated by displaying them as points that are not connected to the part of the CODURF series that is based almost entirely on final data.

Supplementary sources

Data from supplementary sources are presented in most figures in Chapter 4. We have used the latest supplementary data available when analysis was conducted for this project; supplementary analyses based on the NCIS were conducted in July and August 2013. In Figure 3.1, the thin grey line represents data obtained from annual drowning reports as published by the RLSS.

4 Assessment of injury deaths data

4.1 Introduction

This chapter evaluates injury deaths data and considers issues that apply to analysing and reporting on particular types of injury deaths for the purpose of injury surveillance.

The main part of this chapter is organised into sections that correspond to the chapters in *Trends in injury deaths, Australia 1999–00 to 2009–10*. The first section includes all injury deaths and the next 9 each deal with one of the major types of external cause that are distinguished in the report. A final section on other injury-related deaths considers those coded to the Undetermined intent block or to R99 (unknown cause). The issues considered in the sections vary from topic to topic but generally include:

- inclusion criteria
- supplementary data sources
- effects of changes in ABS sources and methods
- Undetermined intent cases and their possible importance for the topic
- notes on other matters relevant to the topic
- a summary assessment.

Presentation of data

In each part of Chapter 4, a figure is provided to show trends in the number of deaths that were assigned cause codes in the range that corresponds to the topic of the section (for example, Figure 4.5 presents data on unintentional drowning). These figures differ in several respects from superficially similar figures in the equivalent sections of *Trends in injury deaths, Australia 1999–00 to 2009–10*, as described here.

First, the unit of measurement in most of these figures is number of deaths, not population-based rates. Since the main purpose of the figures in this section is comparison of case numbers between data sources and with different methods, population-based rates and age adjustment are not necessary.

Second, the time intervals into which the CODURF data are grouped are calendar years that correspond to ABS reference years. This is the most suitable unit for these figures, because a primary purpose is to provide insight into effects of changes in ABS sources and methods on injury deaths data. These changes are largely specific to reference years.

Supplementary sources generally cannot be organised by ABS reference year, and so there is imperfect correspondence between series in the time dimension. In these instances, the horizontal axis is labelled 'Year' and the way year is specified for each series is stated in a footnote. The effects of this are sometimes small enough not to interfere with the comparisons being made. Where the effect is notable, additional figures are provided in which CODURF data and supplementary data are both organised by year of death (as they are in *Trends in injury deaths, Australia 1999–00 to 2009–10*). This improves correspondence in the time dimension but has other disadvantages. (For example, the effects of ABS changes are blurred; lag between death and death registration results in noticeable undercount of deaths in the most recent year of death.)

In figures of the first type, the CODURF data are presented as three series, one for each of the eras that were introduced in Chapter 1. As the eras are defined in terms of changes in ABS practice, the legend entries refer to that agency.

Figures in Chapter 4 are based on the latest release of CODURF data that were available for each reference year when the companion trends report was produced: *Final* for 2006 to 2008, *Revised* for 2009 and *Preliminary* for 2010. The exception to this is that for reference year 2006 both *Initial* and *Final* release data have been presented. This is because the *Initial* release of 2006 data was based on the methods employed during the *ABS transition to NCIS* and the *Final* release was based on the methods of the *ABS: NCIS & multiple releases* era. Differences between cause codes in these two releases are uniquely instructive about the effects of the change in ABS methods for processing and releasing cause of death data, and are important for understanding its effects. For no other year were data produced and released according to both methods.

Markers are used to indicate the values based on *Preliminary* and *Revised* releases, to alert readers that these counts may change by the time *Final* release data are available.

Where a suitable supplementary source of data was available on the type of deaths represented in a figure, case counts based on that source are also charted. More than one supplementary source was used for some external causes. This provides a basis for assessing changes in the CODURF data.

If both CODURF data and supplementary sources show similar variations over time, that tends to support the inference that the CODURF data provide a reliable indication of change in the incidence of the type of deaths over time. If the sources show different variations over time, this suggests weaknesses of one or both sources. Interpretation of some such differences is straightforward (for example, differences between *Initial* and *Final* CODURFs for reference year 2006 provide a strong basis for assessing certain changes at that point), but that is not always so. These issues are discussed in sections in which they arise.

4.2 Injury deaths overall

Inclusion criteria

The definition of injury deaths used in *Trends in injury deaths, Australia 1999–00 to 2009–10* and this report is as follows:

- The UCOD was an external cause code in the range V01–Y36.

  or

- At least one MCOD code was an external cause in the range V01–Y36 and at least one other MCOD was a code for injury (S00–T75 or T79).

Using these criteria, 10,668 deaths were identified for 2009–10. The great majority of these deaths (94%) are included in one or more of the topic-specific chapters—chapters 3 to 11—of *Trends in injury deaths, Australia 1999–00 to 2009–10*. Nearly all the other deaths are in the ICD-10 code block Undetermined intent, which, as noted above, is included in the overall injury estimate in the trends report, but not in the sections on deaths due to particular types of external cause.

Of injury deaths that occurred in 2009–10, 2,373 (22%) have in-scope MCODs, but a UCOD that is not in the range V01–Y36. Compared with the cases with UCOD in the range V01–Y36, these

deaths were more likely to have been certified by a doctor (76% compared with 15%), to be female (53% compared with 34%) and to be of people aged over 65 (85% compared with 35%). These cases are mainly in the major groups Unintentional falls, Poisoning and the residual category 'Other unintentional injury'. They are discussed further in the parts of this chapter on those topics.

Supplementary data sources

No supplementary data source is suitable for use in relation to injury deaths overall.

Effects of changes in ABS sources and methods

Just over one-quarter of the coroner-certified cases originally coded to R99 were later assigned UCODs in the range V01–Y36, bringing them in-scope as injury deaths.

Figure 4.1 presents case counts of injury deaths for all the ABS reference years that contributed data to *Trends in injury deaths, Australia 1999–00 to 2009–10*. The CODURF data are presented in the three eras described in Section 4.1.

The most noteworthy feature of Figure 4.1 is the absence of large changes in case numbers between eras. That is, the changes in ABS sources and methods relevant to the reporting of injury deaths largely affected the allocation of UCOD codes to injury deaths and had a smaller impact on the number of deaths identified as being due to injury (see Chapter 2). The case count for 2003 is slightly lower than that for 2002, and the *Revised* data for 2006 reveal a few more deaths as being due to injury than the *Initial* release data for that year, but neither change is as large as many of the changes at these time points for particular external causes. The rise from the *Initial* to the *Final* release of 2006 data is largely accounted for by the extra injury deaths identified when most of the cases coded R99 in the *Initial* release of 2006 data were assigned more specific codes in the *Final* release.

Figure 4.1 also shows a rise in case numbers between 2007 and 2008. This 8% rise is almost entirely due to an increase in deaths that were assigned UCOD codes in the range V01 to Y36, largely cases coded as due to unintentional falls. This rise coincides with the introduction by the ABS of the modified version of the era three method, in which more time was spent investigating Part II of death certificates and the attachments to NCIS records. It is plausible, though not certain, that the increase is due to this change in methods.

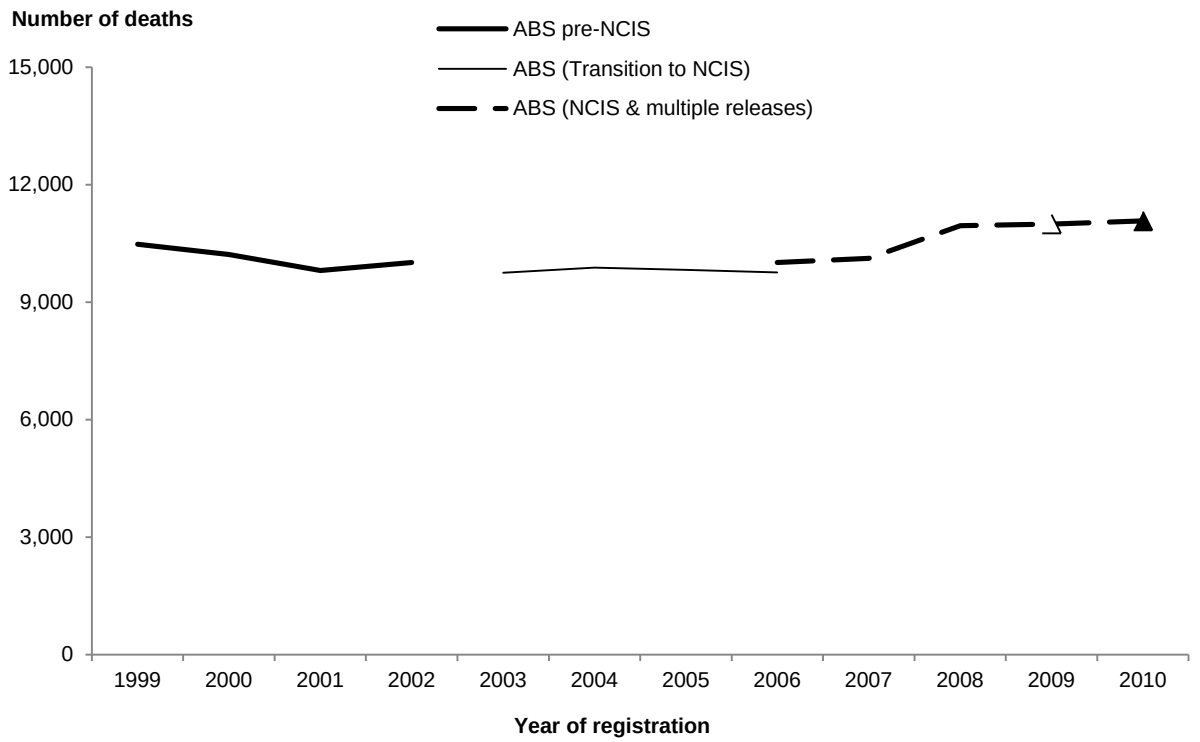
Other notes

Age adjusted rates of injury deaths in Australia, as presented in *Trends in injury deaths, Australia 1999–00 to 2009–10,* are shown in Figure 4.2. This figure is provided here to illustrate the relationship between figures based on case-counts by year of registration and the way data are presented in the trends report (age-adjusted rates by year of death).

Rates declined to 2004–05 and changed little afterwards. Notably, there are not marked steps at about 2003–04 (when the ABS began relying on the NCIS) or at about 2006–07 (by when revised methods had been put in place).

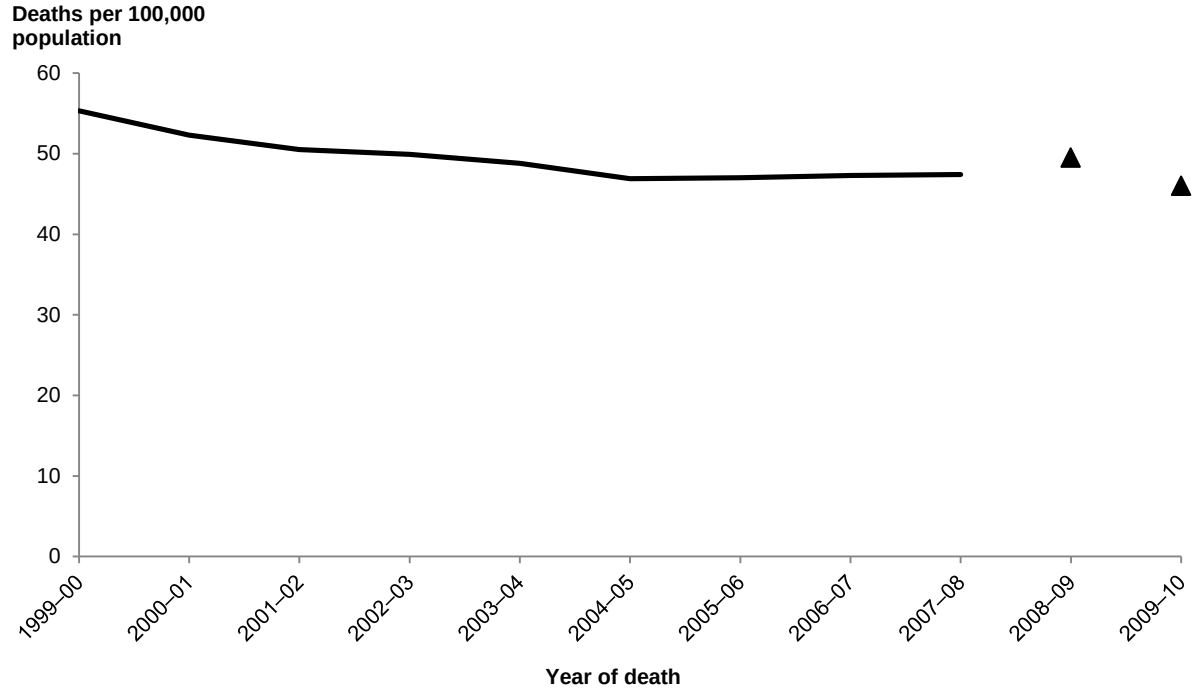
Assessment

The ascertainment of injury deaths overall in the period 1999 to 2010 appears to have been fairly constant. The lack of a suitable supplementary source limits the basis for assessment.



Note: Periods are ABS reference years. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.1: Counts of all injury deaths, Australia, 1999 to 2010



Note: Periods are years of death (years ending 30 June). Values for the last 2 years, shown as symbols (▲), could change due to later revisions of cause of death data by the ABS. See Appendix A, 'Data Issues' in *Trends in injury deaths, Australia 1999–00 to 2009–10*.

Figure 4.2: Age-standardised rates for all injury deaths, Australia, 1999–00 to 2009–10

4.3 Transport crashes

Inclusion criteria

Deaths that included the following ICD-10 codes were included in this section:

- The UCOD was from the unintentional transport injury block (V01–V99).

  or

- The MCODs included codes from both the unintentional transport injury block (V01–V99) and injury range (S00–T75 or T79).

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

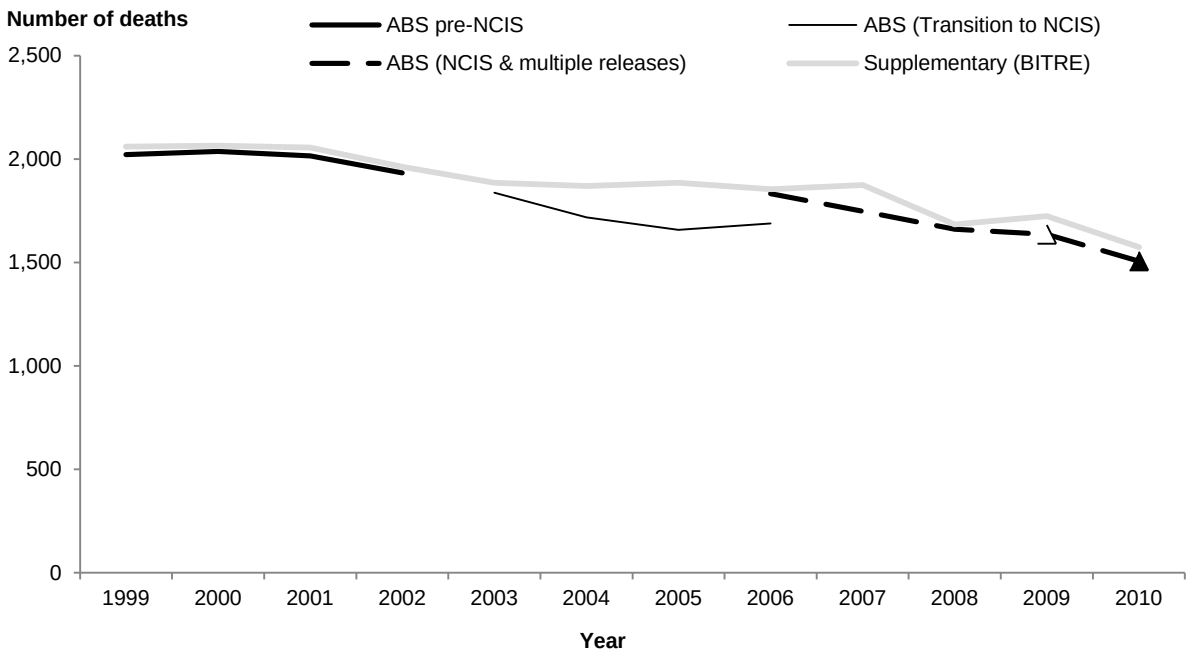
A total of 98.6% of 1,498 deaths occurring in 2009–10 in the 'Transport' chapter of the trends report were included on the basis of the first criterion (UCOD = V01–V99). In part, this high proportion reflects prioritisation of transport over other mechanisms of injury in the unintentional injuries code block of the ICD-10 (V01–X59). For example, over 99.5% of injury death records including external cause codes for transport and for thermal events have the transport event as the UCOD.

Road deaths, which comprised about 90% of transport injury deaths in 2010, are the subject of intense scrutiny and monitoring (BITRE 2014).

Supplementary data source

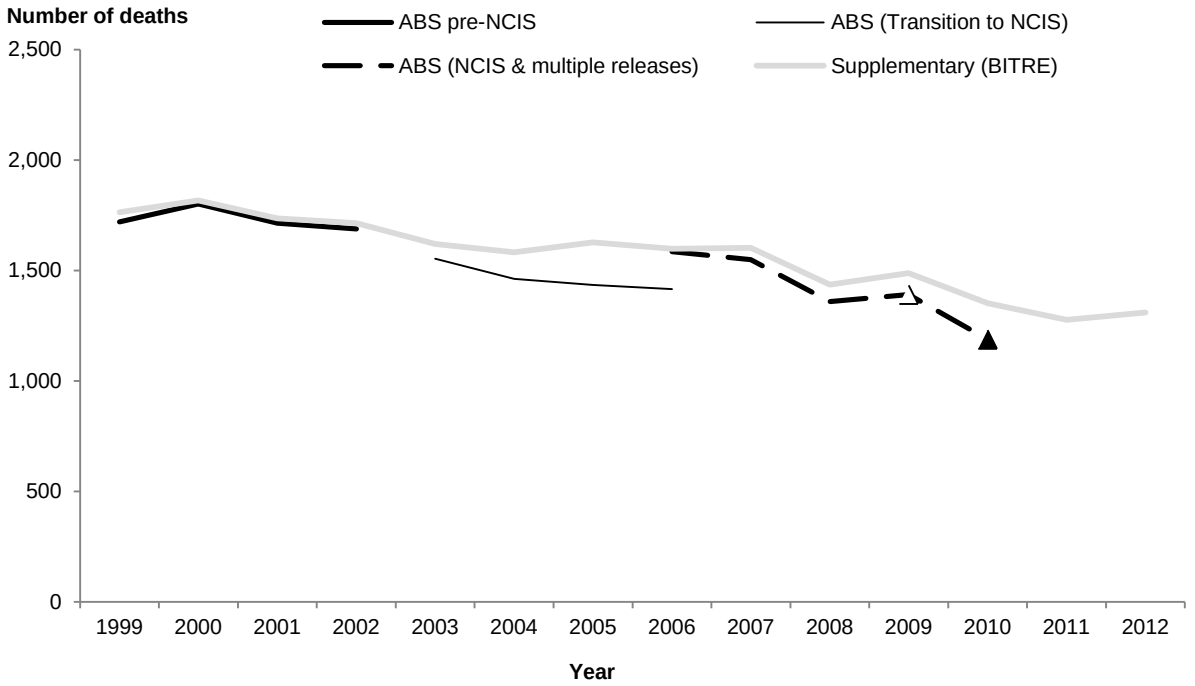
Agencies of the Australian Government have published data on road deaths in the period covered by the trends report. The ABS has compared its data on road deaths with data from the Australian Transport Safety Bureau (ABS 2007).

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) series *Road deaths, Australia: monthly and annual bulletins* is the current continuation of the Australian Transport Safety Bureau data <www.bitre.gov.au>. Data derived from published BITRE road injury counts have been used here as a supplementary source.



Note: Years are ABS reference years for CODURF data and year of crash for adjusted BITRE data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.3: Unintentional transport injury deaths, Australia, 1999 to 2010



Note: Years are of death for CODURF and of crash for BITRE data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.4: Unintentional motor vehicle traffic injury deaths, Australia, 1999 to 2012

The BITRE provides data on road deaths but not on otherwise similar deaths where injury occurred off-road. For Figure 4.3, and in the transport injury section of the trends report, the BITRE data have been scaled to provide an estimate of transport-related deaths by multiplying the BITRE case counts by an adjustment factor. This was obtained from the CODURF data by dividing the total number of transport-related deaths for each year by the number of transport-related deaths due to events that occurred 'in traffic', the closest equivalent to 'road deaths' that can be derived from ICD-coded data. (Very similar results, not shown here, were obtained by comparing 'in traffic' injury deaths from CODURF with unadjusted BITRE data.)

Figure 4.4 is similar to the preceding figure except that CODURF records are restricted to cases that occurred 'in traffic' and are organised according to year of death, rather than year of death registration, and BITRE data are not adjusted. Presentation of CODURF cases by year of death shows year-to-year variation that is more similar to that for the BITRE data. The divergence of the two sets of estimates towards the end of the CODURF-based series is largely due to the fact that a considerable number of road deaths that occurred in 2010 (and perhaps a few that occurred before 2010) had not been registered by the end of 2010.

Effects of changes in ABS sources and methods

There is very close correspondence of the CODURF data and the BITRE data in the first era and close correspondence in the third era (figures 4.3 and 4.4). In the second era, the sources diverged, the CODURF-based estimate of road deaths dropping to 88% of the BITRE values for 2005. *Initial* CODURF data for 2006 were low to a similar extent (89% of BITRE). The difference was largely eliminated in the *Final* release of data for 2006 and was small thereafter.

The last two data points in the CODURF series for the third era are based on data that are subject to review and revision. Any change is likely to be upward.

Factors that might result in lower CODURF counts in comparison with BITRE counts are:

1. cases for which records in the NCIS were incomplete or missing when last inspected by ABS officers. This applies mainly to the second era, as explained in Chapter 2, when such cases are likely to have been coded to X59 or R99
2. injury deaths due to unintentionally crashing a motor vehicle in traffic but which had been coded as having undetermined intent. This applies mainly to the third era, in which the ABS' changed method assigned many more cases to the Undetermined intent block than previously
3. deaths from this cause that occurred in the study period, but were not registered until 2011 or later.

A small number of deaths after road crashes might be included in CODURF data but excluded from BITRE counts in accordance with the restriction of that agency's case definition to deaths within 30 days of a crash.

Undetermined intent

An overview of injury deaths for which intent is undetermined is given in the last part of this chapter. The potential effect of undetermined intent cases on transport injury deaths is considered here.

The number of undetermined intent cases with codes that refer to motor vehicle crashes (ICD-10 Y32) was low in reference years to 2005 (0 to 9 cases per year). For reference years 2006 and later, the annual number of these cases ranges from 20 to 49. Some of these deaths might be found to be unintentional, in which case they would be appropriately included here. If all of these Undetermined intent (Y32) deaths in the CODURFs are added to the unintentional traffic injury deaths shown in Figure 4.4, the small difference shown there between CODURF and BITRE values is almost eliminated in the first and third eras (except for the last 2 years of CODURF data, which were subject to revision).

Other notes

The under-enumeration of road deaths in *Initial* release CODURF data for 2006 was mainly due to backlogs in entry of data on Closed cases into the NCIS in New South Wales and Queensland (ABS 2008a). Delayed data entry appears to have been more important in this instance than time to completion of cases by coroners. New South Wales contributed most of the undercount for transport-related deaths in 2004–05 (Henley & Harrison 2009).

The supplementary source used here has much better timeliness than the CODURF values and those based on the NCIS. Essentially, final counts are published within 1 month of the end of each reference month. For example, the report on deaths to the end of July 2014 was published during January 2015.

The remaining downward divergence of CODURF data from BITRE data seen for year of death 2010 is largely because deaths that occurred in 2010 but were not registered until after that year are not included in the CODURF for reference year 2010, the last used for this report (Figure 4.4).

Assessment

The transition to reliance on NCIS data reduced estimates for transport injury deaths by up to about 10%, which was largely corrected by the subsequent changes introduced by the ABS. This is a non-trivial variation, especially for road deaths, a cause that is the focus of major concern for road safety policy and programs and the subject of indicators and targets.

In the first and third eras, there is good agreement between the sources. Agreement in the third era is very good if time is framed in the same way for both sources (year of death). The remaining difference between the supplementary source and the CODURF-based estimates are likely to be accounted for by (i) some of the deaths coded in the CODURF data as involving a motor vehicle crash and having undetermined intent being included in the supplementary source estimate and (ii) deaths in the study period which were not registered until a later reference year. In addition, perhaps records for some deaths due to this cause had not been entered into the NCIS when last inspected by ABS officers preparing the CODURFs used here.

Road death reports published by the BITRE are an example of injury mortality surveillance data with good timeliness, and apparently good sensitivity and specificity.

4.4 Immersion and drowning

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was unintentional drowning and submersion (W65–W74).

  or

- The MCODs included codes for unintentional drowning and submersion (W65–W74) and for injury (S00–T75 or T79).

  or

- The MCODs included codes for drowning (T75.1) and for an unintentional external cause of injury (V01–X59).

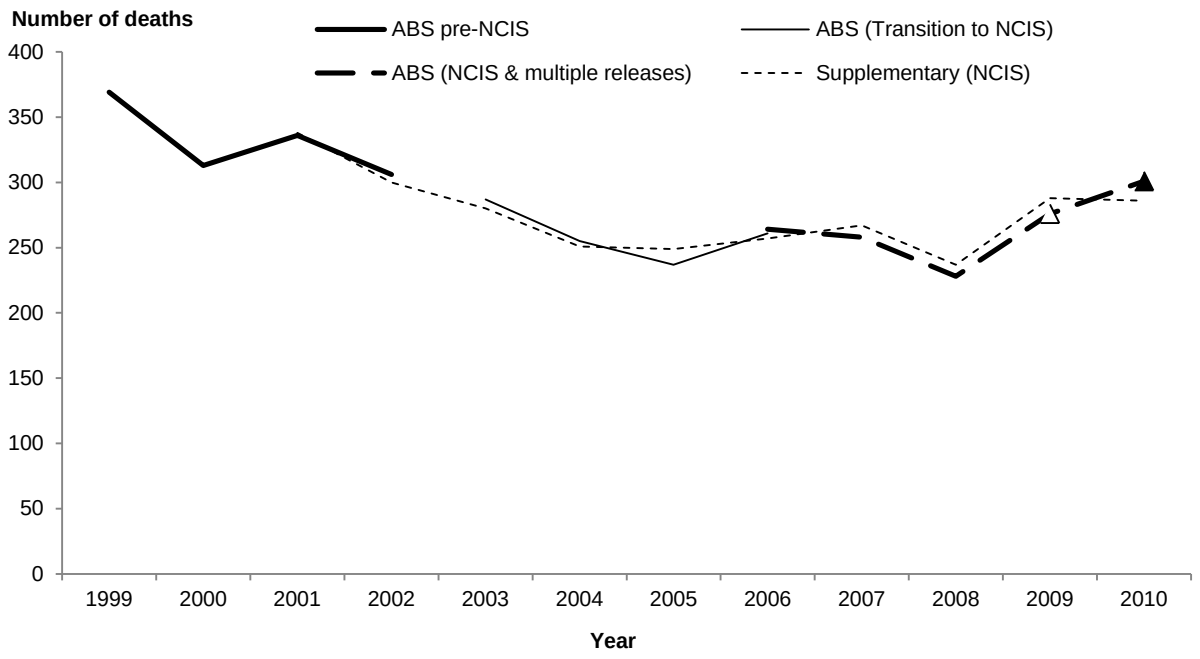
Suicide and homicide deaths (UCOD X60–Y09) were excluded.

All but 9% of the 290 deaths included by the criteria have a UCOD from the 'External causes' chapter. Of the remaining 9%, almost half had a UCOD code for epilepsy.

Drowning is a mechanism that quite commonly occurs in conjunction with other external causes of death. In particular:

- deaths involving water transportation commonly, but not always, are by drowning. Single-cause use of the ICD 'External causes' chapter, based on UCOD codes alone, place these deaths with other transport injury deaths, rather than with other unintentional drowning deaths (that is, the ICD gives higher priority to unintentional transport-related deaths than it does to unintentional drowning deaths)
- drowning is involved in a non-trivial number of deaths that are assigned a UCOD from the land transportation block (ICD-10 codes V01 to V89; n = 124 deaths with UCOD in this range are included in the 'Drowning' chapter of the trends report). An example of a situation in which this might occur is a car crash that ends with a vehicle submerged in a body of water
- Drowning is the means of 2–3% of deaths by suicide (n = 53 in 2009–10) and a small number of homicide deaths. Intentional drowning deaths are not included in this section. (The accompanying trends report provides a table summarising all identifiable drowning deaths, including intentional deaths.)

Drowning, more than most other causes of death, sometimes occurs in circumstances that result in the body of the deceased person not being found. Where circumstances, or the evidence of witnesses, suggest that death by drowning has occurred, but a body has not been found, a coroner may find that this is what occurred. In some other cases of this type, doubts may arise as to whether death truly occurred, or whether the person may not have died, but wanted to give the appearance that this had occurred.



Note: Years are reference year for CODURF data, reporting year for RLSS and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.5: Counts of unintentional drowning deaths, Australia, 1999 to 2010

Supplementary data sources

Two supplementary sources were used.

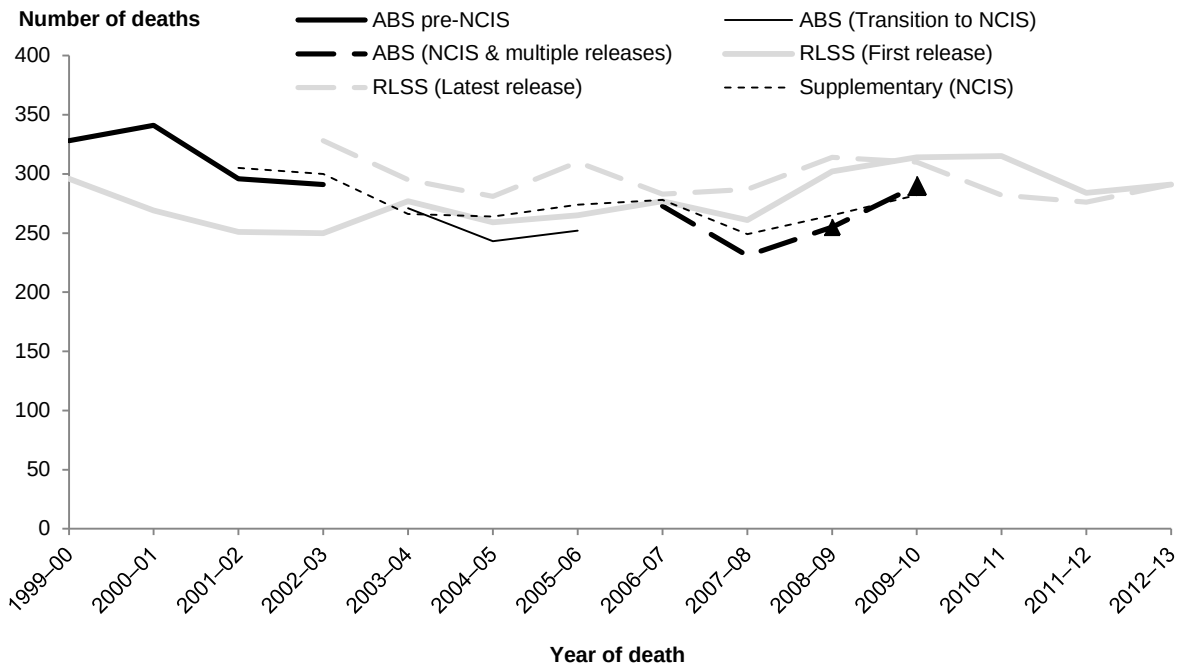
NCIS data were accessed in August 2013 using the selection criteria stated in Appendix A. Case counts from this supplementary source differ little from CODURF values in all three periods (Figure 4.5).

The RLSS publishes reports on unintentional drowning <http://www.royallifesaving.com.au/facts-and-figures/research-and-reports/drowning-reports>. The RLSS estimates are based on various sources, including NCIS data and media reports. The estimates are for years ending 30 June, and years framed in that way have been used here when comparing values from this source with other sources (Figure 4.6).

Reports have been published by the RLSS for years starting 1994–95, though with some changes over time. The data used here are the annual total numbers of drowning deaths for the latest year reported in the editions focusing on 1999–00 and later years. Cut-off dates for case inclusion are provided in editions from 2002–03 and these ranged from 19 August to 15 September (that is, about 7 to 10 weeks after the end of the reference period). Starting with the report for 2006–07, the proportion of NCIS records that were still Open when this source was consulted is stated in the RLSS reports, and ranged from 78% to 86%.

RLSS reports starting with the one covering 2002–03 also provide annual case counts for the previous 9 or 10 years. The methods sections of recent editions state that the counts are revised to take account of closure of coroner cases. Previously reported counts for reference years 2003–04 are later changed in the reports for 2007–08 and for 2011–12. Differences in the information provided in various editions limits the identification of the points at which revisions occurred, but the initial count for 2002–03 had been revised by 2007–08 and was revised again for the 2011–12 edition.

For the years to and including 2005–06, revision resulted in higher counts, most markedly for 2002–03. For later years, revision has had smaller effects, generally downwards. The authors have presented both initially reported counts (these indicate drownings identifiable soon after the end of each reference year) and latest revised counts as at September 2013 (Figure 4.6). Latest counts, compared with initial counts, show the effect on identification of deaths due to this cause of allowing a longer period for completion and closure of coroner cases.



Note: Values for the last 2 years, shown as symbols (▲), could change due to later revisions of cause of death data by the ABS.

Figure 4.6: Counts of unintentional drowning deaths, Australia, 1999–00 to 2012–13

Effects of changes in ABS sources and methods

CODURF and NCIS

Similar trends are shown by both sources. There are no noteworthy steps between CODURF counts at the end of one era and the start of the next (Figure 4.5).

CODURF and RLSS

First release RLSS estimates were lower than those based on the CODURFs in the pre-NCIS period, similar in the transitional period and higher in the last period. Latest case counts estimated by the RLSS are higher than the other sources for all years. The reason for the differences is not certain, but the factors described below might contribute to them.

RLSS first-release estimates are based on cut-off dates that are much sooner after the end of a reference period than the other sources. For example, the RLSS report for drowning deaths occurring during 2009–10 states that it contains information on cases identified by 20 August 2010, less than 2 months after the end of the reference period and 14 months after its start. The RLSS reports have good timeliness, but this may have a cost in terms of case identification. It is noted in the RLSS report for 2009–10 that 80% of included cases were still

the subject of open coronial investigations at the date of inclusion. It is possible that some cases that may have appeared to be unintentional drowning when the RLSS report was compiled may subsequently have been coded as intentional self-harm, assault, or undetermined intent in CODURF data, particularly in *Revised* or *Final* releases and in NCIS data when assessed for this report.

In contrast, *Final* release CODURF data have cut-offs at least 39 months after date of death registration and, for the *Preliminary* release, at least 15 months (ABS 2012). At that stage, a much higher proportion of coronial investigations relating to drowning deaths would have been Closed than at the RLSS's cut-off date. In addition, the ABS has full access to NCIS data on Open cases.

Another characteristic of the RLSS method that might contribute to a larger estimate is the use of media reports as a source. While valuable for timeliness, some cases included as unintentional drowning on the basis of media reports that made no mention of suicide (or homicide) might have been found by a coroner to have an intentional cause, or to have occurred in circumstances such that intent could not be determined. Identity is not always stated in media reports, adding to the potential for miscounting.

CODURF-based age-standardised rates of death involving unintentional drowning, as presented in *Trends in injury deaths, Australia 1999–00 to 2009–10,* declined by an average of 5.5% per year from 1999–00 to 2007–08. Estimates based on NCIS data as at August 2013 indicate an average annual decrease of 4.3% per year between 2001–02 (the first full year for which national NCIS data were available) and 2007–08.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on drowning deaths is considered here. The most relevant ICD-10 category is Y21, *Drowning and submersion, undetermined intent*.

Only in recent years has the number of cases coded to Y21 been sufficient to have more than a small effect on estimates of unintentional drowning mortality. The mean annual number of deaths with this UCOD in reference years 2001 to 2005 was 11, rising to an average of 30 per year in the 4 reference years from 2007. In the unlikely event that all were found to be unintentional, they would increase estimated mortality from unintentional drowning by about 3% in the earlier period and by about 11% in the later period.

Other notes

The trends report covers a period during which some asylum seekers who attempted to reach Australia by boat died by drowning. Such deaths would be in-scope for the CODURFs if they were registered in Australia and occurred 'within Australian Territorial waters' (ABS 2012). It is not clear how many were included.

The Border Crossing Observatory at Monash University maintains the Australian Border Deaths Database (ABDD), which is '…a record of all known deaths associated with Australia's borders since 1 January 2000' (ABDD 2013). The events described in this ABDD source resulted in some deaths that are highly unlikely to meet the inclusion criteria for the CODURFs (for example, boats that sank close to the Indonesian coast), others that might meet them (for example, those that occurred close to Christmas Island) and others where information is too imprecise to know (for example, boats that were last seen when they left Indonesia, bound for Australia). The number of these deaths is large in relation to the

number of deaths shown in Figure 4.5, and it is important to know which, if any, have been included in sources used to assess drowning in Australia.

Some of the deaths and associated events have been the subject of coroner's inquests, notably in Western Australia. The Western Australian State Coroner held an inquest into 50 deaths that occurred off Christmas Island on 15 December 2010 when the vessel known as *SEIV 221* sank (Western Australian Coroner). The Coroner concluded that all deaths in this event were by drowning, although 20 of the bodies were not recovered.

Deaths investigated by a coroner are usually also included in a state or territory death register and in the CODURFs, but inclusions are not necessarily identical due to differences in jurisdiction and scope. It appears that these 50 deaths were registered, because the published ABS cause of death summary tables for reference year 2011 report 51 Western Australian deaths with ICD-10 UCOD V90, *Accident to watercraft causing drowning and submersion* (V90), more than 10 times the largest number of Western Australian deaths assigned this cause in any of the 10 previous years. It is not surprising that these deaths are in the 2011 ABS reference year, rather than the 2010 reference year, because they occurred near the end of 2010 and there is a lag between date of death and date of death registration. These deaths are outside the period covered by *Trends in injury deaths, Australia 1999–00 to 2009–10* but are in-scope for a report covering the next year and will have a substantial impact on case counts for unintentional drowning. Explanatory Note 83 of the ABS publication on causes of deaths in reference year 2011 states that: 'The number of deaths attributable to Accident to watercraft causing drowning and submersion (V90) increased from 26 in 2010 to 75 in 2011. This increase is primarily due to deaths resulting from an incident in December 2010 when a boat collided with cliffs on Christmas Island. These deaths were registered with the Western Australian Registry of Births, Deaths and Marriages in January 2011, resulting in an increase in the number of deaths coded to V90 in Western Australia' (ABS 2013).

It is less clear which, if any, other drowning deaths of intending asylum seekers have been included in the CODURF deaths data. The NCIS includes cases that occurred in relation to at least several other events that are recorded in the ABDD.

Assessment

Available data lead to the conclusion that identification of unintentional drowning deaths was affected to a small degree, at most, by the ABS's changes in sources and methods. Case numbers and trends are similar for the sources compared and do not show substantial changes coinciding with the changes in methods. The higher count for the RLSS than the other sources in most years has not been accounted for, but differences in data sources and methods may explain this. RLSS reports have good timeliness.

Undetermined intent drowning deaths are relatively numerous in recent CODURFs, amounting to about 11% of the number of unintentional drowning deaths for the last 3 years considered. While some of the undetermined intent cases may ultimately be assigned a UCOD for intentional self-harm or assault, some will probably be coded as unintentional, increasing the case count for this category and reducing the difference from the RLSS estimates. Comprehensive inclusion of such deaths would benefit from direct use of the NCIS to take account of cases finalised after the cut-off dates for *Final* release CODURFs.

Some drowning deaths of intending asylum seekers are included in the NCIS and CODURFs. The numbers of such cases is large in relation to total unintentional drowning in

at least 1 year (2010–11); proper reporting and interpretation of trends requires this to be recognised.

4.5 Poisoning by pharmaceuticals

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was unintentional poisoning by pharmaceuticals (X40–X44).

  or
- The MCODs include codes for unintentional poisoning by pharmaceuticals (X40–X44) and for injury (S00–T75 or T79).

  or
- The MCODs include codes for the toxic effects of pharmaceuticals (T36–T50) and for external causes of unintentional injury (V01–X59).

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

Early in the period of use of the ICD-10 to code deaths in Australia, many deaths involving poisoning were assigned UCODs from the 'Mental and behavioural disorders' chapter, while similar cases were assigned codes from the 'External causes' chapter (AIHW et al. 2007). Most of these records were assigned UCODs for dependence on opioids (F11.2) or on multiple drugs (F19.2) and included a MCOD for poisoning by narcotics, most often heroin (T40.1) or other opioids (T40.2). The number of poisoning cases assigned a UCOD from the 'Mental and behavioural disorders' chapter declined from several hundred per year before 2001 to 15 cases or fewer in the years starting 2005. Total pharmaceutical poisoning deaths declined after the peak in 1999, but by a much smaller proportion than the decline in poisoning cases with a UCOD from the 'Mental and behavioural disorders' chapter.

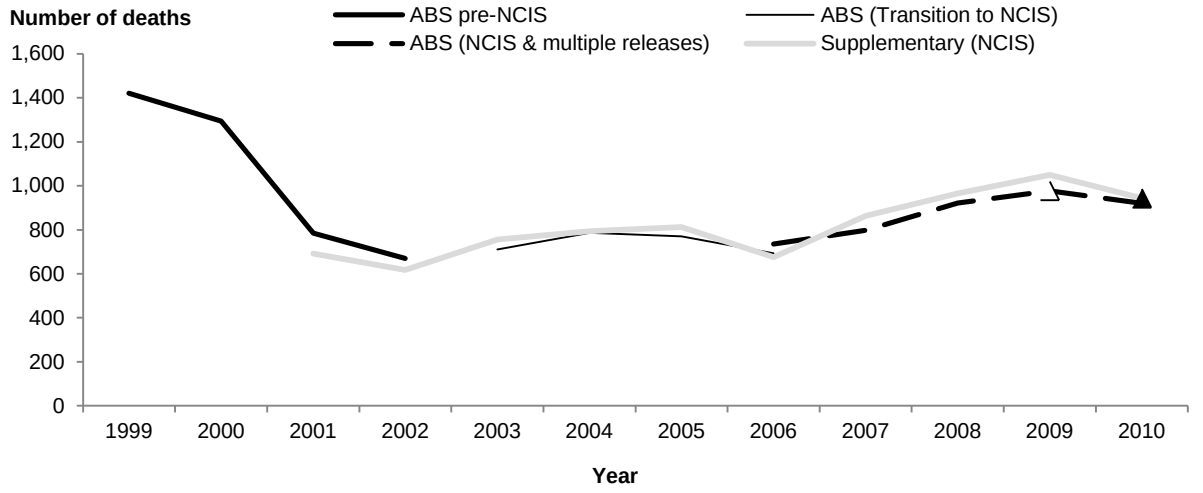
Due to this change in coding practice, specifying an inclusion criterion for unintentional poisoning due to pharmaceuticals only in terms of UCOD codes in the ICD-10 range X40–X44 would produce inflated upward trends early in the period. Previous investigation shows that including MCODs in the range T36–T50 could reduce this problem (AIHW et al. 2007).

A change in ICD-10 coding rules for 2006 and later prohibits assigning codes in the 'Mental and behavioural disorders' chapter of the ICD-10 to deaths due to poisoning by psychoactive drugs, requiring instead that they be coded to appropriate categories in the 'External causes' chapter . This rule change formalised a change in coding practice that had already taken place in Australian data. However, it remains necessary to specify case inclusion in a way that takes account of MCODs as well as UCODs, especially for the period before about 2005, if distortion of estimates due to changing coding practice is to be avoided.

Of the 917 deaths selected by these criteria and which occurred in 2009–10, 794 (87%) were included on the basis of the first part of the criteria. Another 32 deaths (3%) also have UCODs in the range V01–X59. Of the 794 deaths with UCOD X40–X44, 96% were coroner-certified, 68% were males and 67% were aged 25 to 49. MCOD codes occurring commonly in the 794 deaths are T40 *Poisoning by narcotics and psychodysleptics* (*n* = 571),

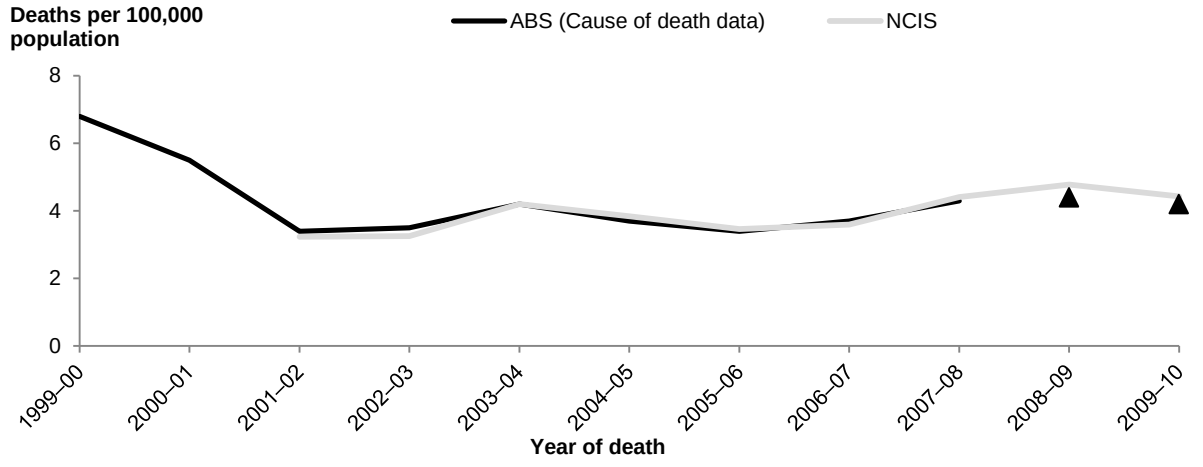
T42 *Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs* (*n* = 306) and T43 *Poisoning by psychotropic drugs, not elsewhere classified* (*n* = 246).

Of the other 123 deaths in 2009–10 that are included by the criteria, 84% had been certified by a coroner and most were also young and middle-aged males. Of these 123 deaths, 36% (*n* = 44) have MCOD code T40 *Poisoning by narcotics and psychodysleptics*; 29% (*n* = 35), MCOD code T43 *Poisoning by psychotropic drugs, not elsewhere classified*; and 23% (*n* = 28), MCOD code T42 *Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs*. For 38% (*n* = 47) of the 123 deaths, a disease of the circulatory system was recorded as the UCOD.



Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (Δ) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.7: Counts of unintentional pharmaceutical poisoning deaths, Australia, 1999 to 2010



Notes

1. Values for the last 2 years of ABS-based rates, shown as symbols (▲), could change due to later revisions of cause of death data by the ABS. See Appendix A, 'Data Issues' in *Trends in injury deaths, Australia 1999–00 to 2009–10*.
2. Estimates based on NCIS data are crude rates. See Appendix A for selection criteria.

Figure 4.8: Age-standardised rates of unintentional pharmaceutical poisoning deaths, Australia, 1999–00 to 2009–10

Poisoning by pharmaceutical substances is a fairly common means of suicide, accounting for about 12%–16% of deaths in recent years. Since suicide is a cause of death that was affected by increased misclassification during the ABS's transition to reliance on NCIS data, it was thought that estimates of deaths involving unintentional poisoning by pharmaceuticals might also have been affected.

Determining intent for poisoning deaths sometimes presents difficulties, especially for drug overdoses, in which it may be difficult to determine whether the person intended to take his or her own life.

Supplementary data source

The NCIS was interrogated in August 2013 to provide supplementary estimates. This differed from use of the NCIS by the ABS by starting with 2001 data (before the ABS began to use the NCIS) and had the benefit of longer durations between date of death and date of assessment than was the case when ABS last inspected these records. The ABS reference year is not available in the NCIS and the data from that source are presented according to NCIS case year in Figure 4.7. Data from both sources are organised by year of death in Figure 4.8, resulting in noticeably greater similarity of the estimates.

No other suitable supplementary source was identified for this topic.

Effects of changes in ABS sources and methods

A steep downward trend in annual case numbers changed to a gradual upward trend at about the end of the pre-NCIS era, raising the question of whether the change of method may have influenced case counts (Figure 4.7). The extension of NCIS-based case counts back to 2001 provides some evidence that it did not. The steeply declining annual case number in the pre-NCIS era CODURFs reflects the end of a period of high rates of opiate-related deaths in Australia (Degenhardt et al. 2014).

Both sources provide similar estimates for the rest of the period charted, showing a fairly steady rise in annual case counts.

The NCIS-based estimates made for this study appear to be a little higher than the CODURF estimates in most years when arranged as in Figure 4.7. When both series of data are analysed in terms of year of death, these small differences largely disappear (Figure 4.8).

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on pharmaceutical poisoning deaths is considered here, focusing on cases assigned ICD-10 codes Y10 to Y14, *Poisoning by and exposure to drugs, medicaments and biological substances, undetermined intent*.

Undetermined intent cases are more important for this cause of injury death than for most others. The mean annual number of pharmaceutical poisoning deaths with undetermined intent was 34 from 2001 to 2005, then rose to well over 100 in years starting 2007. The rise is an expected effect of the change in use by the ABS of the Undetermined intent codes from 2007 (and, retrospectively, for 2006 *Final* release). The prominence of drug poisoning among cases with undetermined intent may, in part, reflect the ambiguous nature of some poisoning

deaths: it is clear that the person took the substance and that it contributed to the fatal outcome, but it may be unclear whether the person intended the fatal outcome.

Of poisoning deaths in 2007 to 2010 with determined intent, almost 61% were unintentional and 39% were intentional self-harm. If a similar proportion of deaths in 2007 to 2010 with mechanism poisoning by pharmaceuticals and undetermined intent are truly unintentional, the counts for this cause would increase by about 16% in the period 2007 to 2010.

Other notes

Rates of deaths recorded as being due to poisoning by opioid analgesic drugs such as oxycodone (sometimes referred to as prescription painkillers) have increased rapidly in the United States of America (Paulozzi et al. 2012). Has there been a similar rise in Australia?

Population-based rates of oxycodone prescriptions increased in Australia from 35.3 per 1,000 population in 2002–03 to 89.2 per 1000 population in 2007–08, mainly relatively low-dose formulations prescribed to older people (Roxburgh et al. 2011). Rates of morphine prescriptions declined in the same period. These authors used the NCIS to assess deaths in Australia from 2001 to 2009 involving oxycodone. They found 465 deaths at ages 20 and older among Closed cases with potentially lethal blood levels of oxycodone, and very few deaths at younger ages. Of the 465, 53% had been prescribed oxycodone, 27% were people who were or had been injecting drug users and 73% were aged 30 to 59. A total of 27% of the deaths were by suicide. The annual number of deaths rose from 31 in 2002 to 94 in 2007, dropping to 59 in 2008. The death rate per million daily doses of oxycodone prescribed under the Pharmaceutical Benefits Scheme rose more steadily, from 4.26 in 2002 to 15.6 in 2008.

Oxycodone does not have a category in the ICD-10 but is included with morphine, codeine and similar drugs in the category *Other opioids* (T40.2). The number of records with that code was high in the late 1990s (n = 619 in 1998–99) then fell to 207 in 2002–03; since 2002–03, the annual number has fluctuated, though tending to rise, reaching about 400 in each of the 3 years to 2009–10. In the absence of specific ICD-10 categories for oxycodone and similar drugs, the NCIS provides a better basis than CODURFs to monitor these causes. The NCIS has produced fact sheets on deaths involving opioids generally and fentanyl (a synthetic opioid) in particular (NCIS 2012, 2014).

CODURF data and NCIS-based data show that many pharmaceutical-related deaths involve more than one drug, often with alcohol (see also Section 4.6, Poisoning by other substances).

Assessment

Data for this external cause do not appear to have been affected to a substantial extent by the problems described in Chapter 2. There is close correspondence between the estimates based on CODURFs and the NCIS (Figure 4.8). Both sources show a fluctuating gradual rise in case numbers and population-based rates after 2001–02.

Potential distortion of trends due to changes in ICD coding practice early in the period of use of the ICD-10 is minimised by the inclusion criteria employed here, which take account of MCODs as well as UCODs.

Deaths with mechanism poisoning by pharmaceutical substances and undetermined intent were numerous in the latter part of the reported period and it is probable that some of these were unintentional. If the proportion of unintentional poisoning is, in fact, the same among

undetermined intent cases as among poisoning cases with determined intent (61%), values for that period would be about 16% higher than those shown in figures 4.7 and 4.8.

Analyses based on NCIS data concerning all deaths identified as involving particular pharmaceutical substances can add materially to the value of surveillance based solely on CODURF data, particularly because of the greater specificity of the NCIS than the ICD-10 as applied in the CODURFs concerning the substances involved.

4.6 Poisoning by other substances

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was unintentional poisoning by substances other than pharmaceuticals (X45–X49).
  or
- The MCODs included codes for unintentional poisoning by substances other than pharmaceuticals (X45–X49) and for injury (S00–T75 or T79).
  or
- The MCODs included codes for the toxic effects of substances other than pharmaceuticals (T51–T65) and for external causes of unintentional injury (V01–X59).

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

These criteria included 366 deaths that occurred in 2009–10. Of these, 82 deaths (22%) had a UCOD in the range X45–X49, and a total of 328 deaths (90%) had a UCOD in the 'External causes' chapter of the ICD-10.

Over 81% of the 366 deaths (n = 299) had codes indicating that alcohol was involved, and the UCOD was unintentional poisoning by and exposure to alcohol (X45) in 67 deaths. The number of deaths with UCOD code X45 was fewer than 30 in years 1999–00 to 2003–04 and more than 60 in years from 2006–07 to 2009–10. This may partly reflect a change in ICD coding rules according to which F10.0 was no longer valid as a UCOD for poisoning deaths from 2006, meaning that deaths previously coded to F10.0 were subsequently coded to X45.

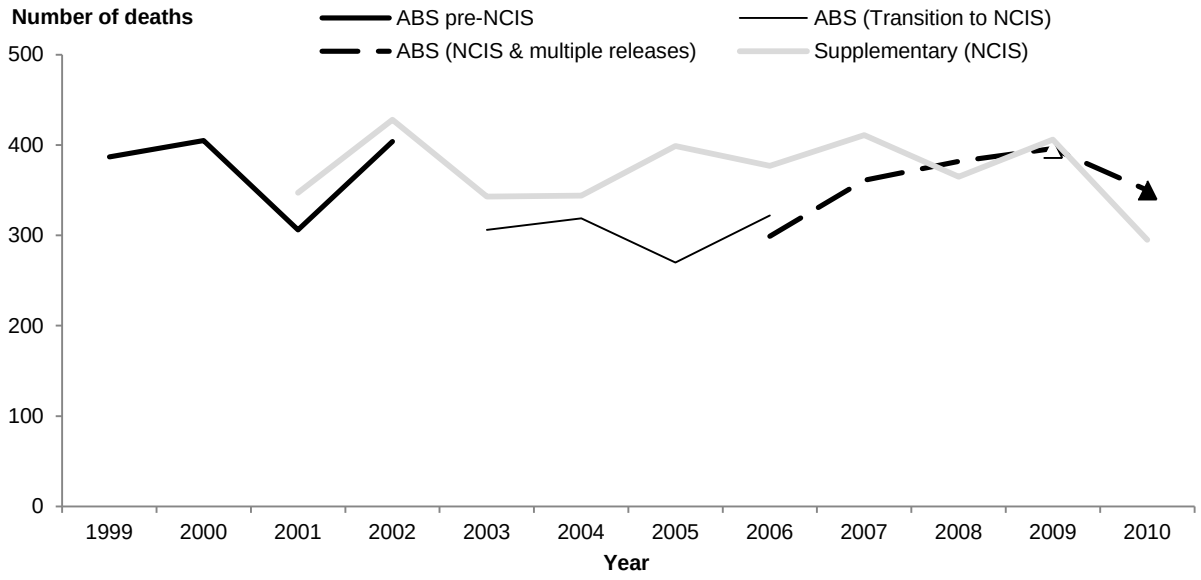
More than half of the 366 deaths (n = 203, 55%) also have codes for poisoning by pharmaceutical substances, as the UCOD in 179 (49%).

Like poisoning by pharmaceuticals, some deaths involving poisoning by non-pharmaceutical substances (particularly carbon monoxide) are suicides. Since identification of suicide was reduced during the ABS's transition to reliance on NCIS data, it was thought that estimates of deaths involving unintentional poisoning by pharmaceuticals might have been affected.

Supplementary data source

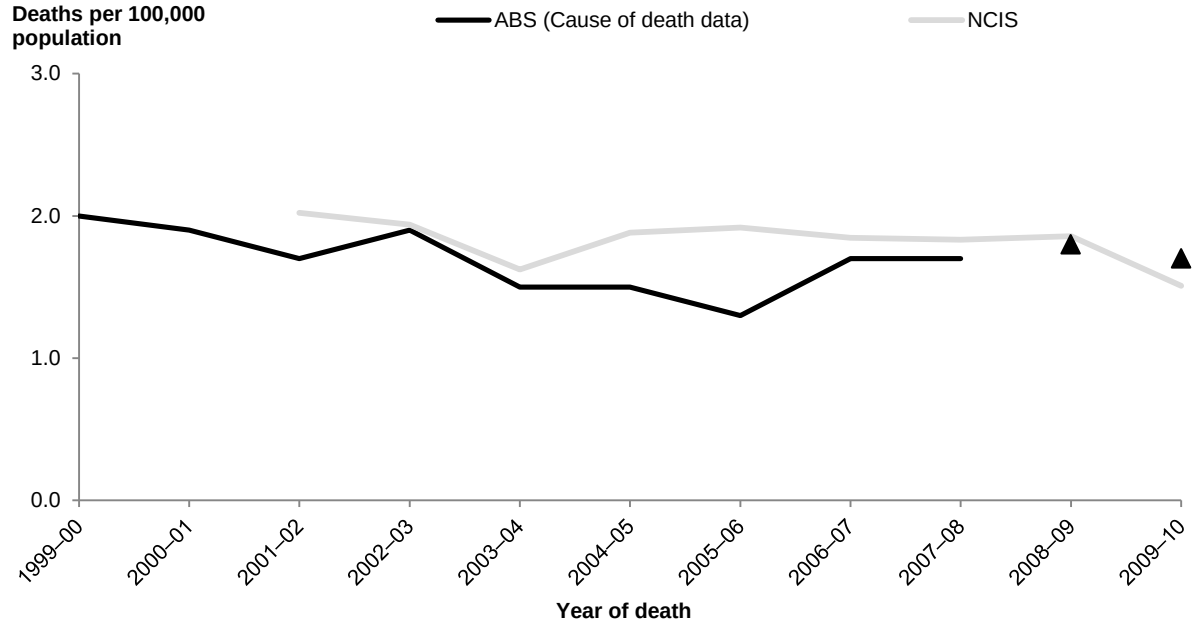
The NCIS was interrogated in August 2013 to provide supplementary estimates for this cause. The selection criteria are stated in Appendix A. NCIS data were assessed for coroner cases that began in years commencing 2001. The supplementary estimates benefit from the fact that the assessment of NCIS records for this report was done longer after date of death than the assessments by the ABS. ABS reference year is not available in the NCIS and the data are presented according to the year in which the cases were reported to a coroner.

No other suitable supplementary source was identified for this topic.



Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data; the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.9: Counts of deaths involving unintentional poisoning by other substances by NCIS period, Australia, 1999 to 2010



Notes

1. Values for the last 2 years of ABS-based rates, shown as symbols (▲), could change due to later revisions of cause of deaths data by the ABS.
2. Estimates based on NCIS data are crude rates.

Figure 4.10: Age-standardised rates of deaths involving unintentional poisoning by other substances, Australia, 1999–00 to 2009–10

Effects of changes in ABS sources and methods

NCIS-based supplementary estimates show no consistent trend, fluctuating from year to year around a mean of a little fewer than 400 cases per year. The lower number of deaths shown for 2010 is probably because more deaths remained Open for this, the most recent year assessed. CODURF-based values are similar to estimates based on the NCIS for 2001 and 2002, though CODURF estimates are a little lower (Figure 4.9).

CODURF estimates diverged downward from NCIS-based values in the *Transition to NCIS* era, the largest difference being 32% lower than the NCIS count in 2005.

The *Final* release of 2006 CODURF data showed a small decrease in cases coded to this cause compared with the initial release. The difference between the CODURF and supplementary estimates was smaller for 2007 cases than in the previous 2 years and very small for 2008 and 2009.

The additional changes to ABS methods that were introduced in reference year 2008 included increased scrutiny of attachments to NCIS records, which include toxicology reports (ABS 2010, 2011). This might have contributed to the improved identification of such cases.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on deaths involving poisoning by substances other than pharmaceuticals is considered here. The most relevant range of the ICD-10 UCOD codes is Y15 to Y19.

The annual average number of deaths assigned UCOD codes Y15 to Y19 in reference years 2001 to 2005 was 3.2. The equivalent number in latest data accessed for reference years 2006 to 2010 ranged from 17 to 31. The increase largely comprises deaths with poisoning by carbon monoxide. In Australia, in recent decades, nearly all deaths with that mechanism and determined intent are due to intentional self-harm, and it can be expected that many, probably most, of the undetermined intent cases of carbon monoxide poisoning were suicidal and few were unintentional.

Other notes

Alcohol is often one of several substances mentioned in records of cases included in this section. In the situation considered here, ICD-10 rules for deciding UCOD have the effect of giving lower priority to alcohol than to other drugs (Lahti et al. 2011). It should be noted that the ICD-10 codes and the inclusion criteria for *Poisoning, other substances* refer to acute effects of alcohol as a poison, not to its cognitive and behavioural effects.

Assessment

The supplementary estimates suggest that annual population-based incidence rates for this cause of death did not vary greatly during the period covered by the trends report and that the CODURFs underestimated case numbers for several years in the middle of the 2000s.

4.7 Injurious falls

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was an unintentional fall (W00–W19).

  or

- The UCOD was coded as *Exposure to unspecified factor* (X59) and the MCODs included a code for a fracture.

  or

- The MCODs included codes for an unintentional fall (W00–W19) and for injury (S00–T75 or T79).

  or

- MCODs included codes for *Exposure to unspecified factor* (X59) and for a fracture.

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

These criteria are the same as in previous reports (Henley & Harrison 2009; Henley et al. 2007). Deaths with UCOD X59 and a fracture code as MCOD have been included routinely when reporting fall injury mortality because of indications that most involve falls (Kreisfeld & Harrison 2005). The combination has the same scope as X59.0, which was added to the 2006 edition of the ICD-10 (WHO 2006). The codes for fractures are S02, S12, S22, S32, S42, S52, S62, S72, S82, S92, T02, T08, T10, T12 and T14.2.

These criteria selected 3,480 fall injury deaths in 2009–10, of which 2,069 were included on the basis of UCOD. Of 1,531 deaths with UCOD in the range W00–W19 (unintentional falls), 72% were of those aged 80 or older, 67% had been certified by a coroner (99% in Victoria), 44% had a MCOD for fracture and another 41% for head injury. Considering only the deaths at ages 80 and older, the proportion registered by a coroner was 98% for deaths registered in Victoria and 39% elsewhere. Of the 538 deaths included on the basis of UCOD X59 with MCOD for fracture, 72% had femur fractures.

The 1,411 deaths identified on the basis of MCOD codes were for those older than the others (81% aged 80 and over) and more likely to have been certified by a medical practitioner (79% nationally; 30% of deaths in Victoria). Of the 1,411 deaths, 86% had at least one fracture code, and 59% had a fracture of the femur. The UCOD in these deaths most often referred to a disease of the circulatory system (41%), a neoplasm (13%), a mental or behavioural disorder (12%), or a disease of the respiratory system (11%).

In only 15 of the 3,480 deaths was osteoporosis mentioned as either the UCOD or an MCOD.

About 4%–5% of suicides involve jumping from a high place (n = 95 in 2009–10) and a small proportion of homicides involve a fall. Fall-related deaths identified as intentional were omitted from this section.

Supplementary data source

Most fall injury deaths occur in old age and are certified by a doctor. Doctors are not permitted to certify the great majority of injury deaths, and are required to report them to a

coroner (Bird 2011; Neate et al. 2013). The main exception is that doctors are allowed to certify deaths of older people following an injurious fall. The circumstances under which this is permitted differ between jurisdictions, but generally require that there must be no suspicious circumstances and that the person was older than a specified age.

Most fall injury deaths in Australia were certified by medical practitioners throughout the period considered here, but the proportion has changed substantially (see below). The NCIS is not a satisfactory supplementary source for fall injury deaths, as it does not include records for doctor-certified deaths. The AIHW National Hospital Morbidity Database can provide a better supplementary source.

Background to the supplementary source

About half of all deaths in Australia occur in hospitals: of admitted patient episodes in Australia that ended in 2009–10, 73,033 finished with death of the person in hospital (AIHW 2011); the total number of deaths that occurred in 2009–10 and had been registered by the end of 2011 is 140,956. This implies that about 52% of the deaths occurred in hospital.

Mortality is high after hospitalised fall injury at older ages, particularly during the first few months (Brauer et al. 2009; Moran et al. 2005) but elevation above expected mortality persists for years (Hindmarsh et al. 2012). It is often the combination of the injury with other morbidity present in old age that results in death. Common comorbidities are diseases of the circulatory and respiratory systems (Hindmarsh et al. 2012). Comorbidity, age and sex all influence mortality, but the presence of a serious injury such as a hip fracture elevates mortality further; most of the many deaths that occur soon after an injurious fall are in excess of the number expected, satisfying the case definition of deaths that would not have occurred when they did, were it not for injury (Cryer et al. 2011).

About two-thirds of all deaths in New South Wales during the 3 months after a hospitalised fall-related hip fracture at ages 65 and older occurred in hospital, nearly half of the in-hospital deaths occurring during the first episode in hospital after the fracture occurred (Hindmarsh et al. 2009).

Deaths in hospital are the subject of two administrative information systems: vital registration (death registers, the NCIS and CODURFs) and hospital records (the National Hospital Morbidity Database). A recent AIHW report presents data on episodes in hospital due to fall-related injury in the period 1999–00 to 2010–11 (Bradley 2013). The supplementary source used here has been specified so that it includes annual counts for 1999–00 to 2009–10 of the cases that satisfy that report's definition of *directly fall-related separation* where the person died in hospital, though not restricted to ages 65 and older.

This supplementary source can be expected to enumerate most, but not all, deaths that occur soon after an injurious fall. The two main types of case that are not included are deaths soon after a fall in which no episode in hospital occurred, and deaths following discharge from hospital. The former type includes cases in which death occurred within seconds to hours after falling, typically when the fall was from a great height. It also includes cases in which a person was injured by a fall and not found until after death. The second type includes cases in which a person died at home or in a nursing home after discharge from hospital. There is no reason to expect substantial change during the period considered here in the proportion of these deaths that occurred in hospital.

Many deaths soon after serious injury are certified without mention of injury

Studies in which hospital data have been linked with deaths data show that injury is often not mentioned as a cause of deaths that occur soon after serious injury. Of all people aged 65 and older who were admitted to a hospital in New South Wales because of a hip fracture due to an unintentional fall and who died within 28 days of admission, in only 53% did the death record make mention of the hip fracture (Hindmarsh et al. 2009). (Kreisfeld & Harrison 2007) reported similar findings for people whose hospital separation record included a principal diagnosis code from the 'Injury' chapter of the Australian modification of the ICD-10 (ICD-10-AM) and an external cause code for unintentional fall (W00–W19) and who died before discharge from a hospital in Western Australia. In only 14% of the death records for these cases was the UCOD coded as an unintentional fall, while another 14% had X59 as the UCOD. In the remaining 72% of deaths, UCOD was recorded as a natural cause (that is, a disease), most often a disease of the circulatory system. In about half of the cases with a natural cause as the UCOD, injury and/or external causes codes were present as MCODs. Similar results have been reported elsewhere (Goldacre et al. 2002).

It would be surprising if a recent serious injury, such as a hip fracture that required hospitalisation, did not warrant mention in a death certificate, though the death certificates for many such cases are silent on the presence of this injury. Hindmarsh et al. (2009) concluded that: '...mortality due to hip fracture would have been vastly underestimated if we were only to consider deaths where the hip fracture was mentioned as a contributing cause of death'. Underestimation would have been greater if attention was limited to deaths with UCOD W00–W19.

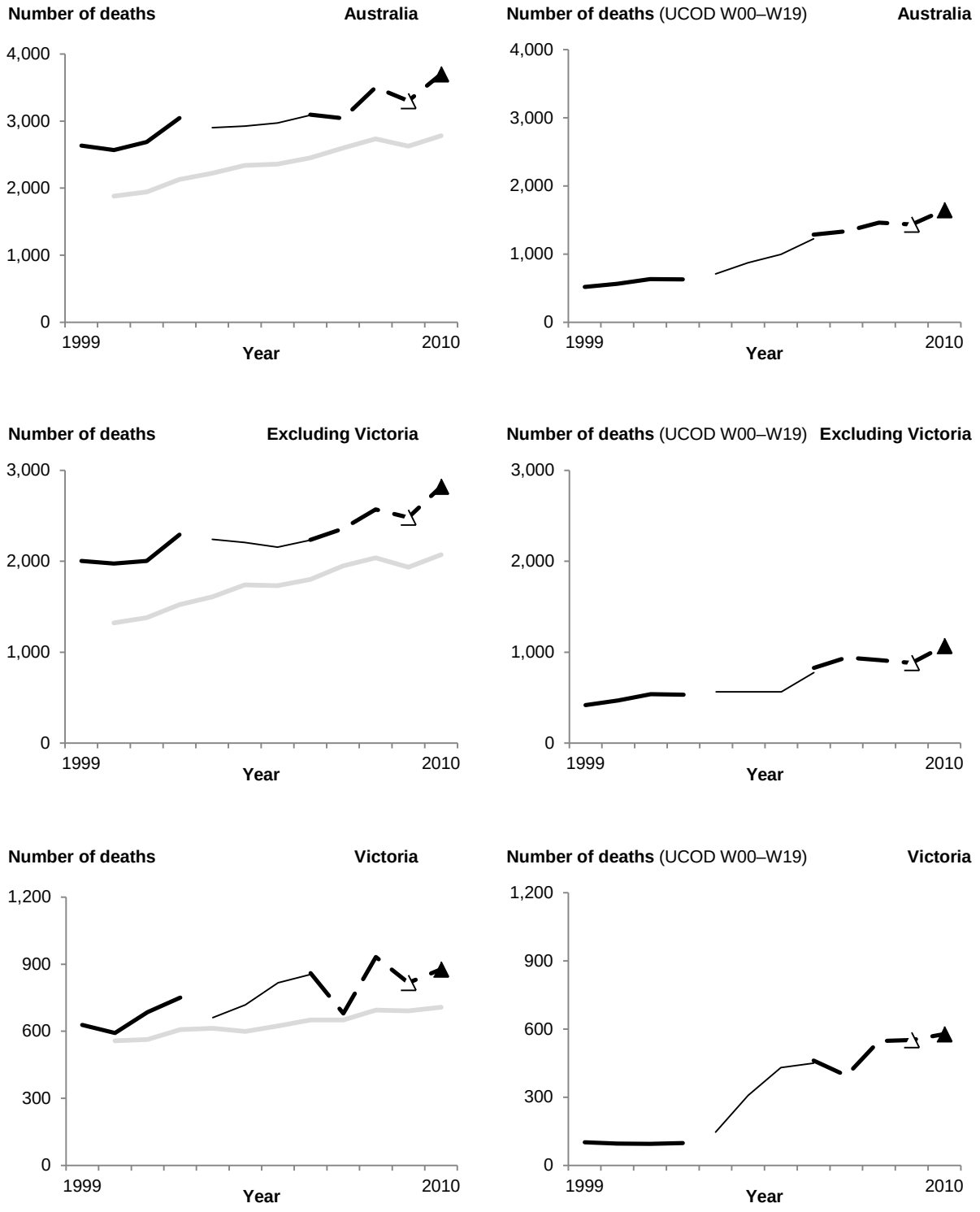
Effects of changes in ABS sources and methods

As most fall injury deaths are certified by a doctor, the issue of misclassification described in Chapter 2 might be expected not to have a major effect on ascertaining cases involving this external cause of death.

However, information available to ABS coders concerning fall injury differs according to whether a death is certified by a coroner or by a doctor (see Chapter 2). The proportion of fall injury deaths coded by coroners rose during the period from reference year 1999 to 2010 from 22% to 39% (from 16% to 79% in Victoria). Since coroner-certified deaths are coded by ABS officers on the basis of NCIS data, whereas only death certificate data are available for doctor-certified cases, there has been an important change in the information used to code a substantial proportion of deaths involving this cause. The effects of that change are considered here.

The annual number of cases in CODURF data that meet the criteria for fall injury death tended to rise over time (Figure 4.11, top left panel). The rise approximately parallels the increase in the population at greatest risk (that is, persons aged about 75 or older) and age-adjusted national rates based on these case-counts show little fluctuation and a slight downward trend (*Trends in injury deaths, Australia 1999–00 to 2009–10,* Figure 7.2).

Data are shown separately for Victoria (Figure 4.11, bottom row) because of a change that required all injury deaths to be referred to a coroner, starting in 2003 (see last part of Chapter 2). The differences in Victorian data were mentioned in notes to ABS Causes of Death reports, beginning with the report for reference year 2004 (ABS 2006).



Notes

1. The pre-NCIS period is represented by the thick line, the transition to NCIS period is represented by the thin line, while the NCIS and multiple release period is represented by the thick dashed line. Hospital deaths are represented by the thick grey line.
2. Data for the period 1999 to 2008 are final. Those for the last 2 years, represented by an empty triangle (∆) for 2009 and a filled triangle for 2010 (▲), are subject to revision. (See Appendix A, 'Data Issues' in *Trends in injury deaths, Australia 1999–00 to 2009–10*.)
3. Years are of registration for CODURF data and of separation from hospital for NHMD data.

Figure 4.11: Numbers of deaths involving unintentional fall injury by period and selection criteria for Australia, Australia, excluding Victoria and Victoria only, 1999 to 2010

There is some indication of a downward step in CODURF-based case counts from the *Pre-NCIS* era to the *Transition to NCIS* era, particularly in data for Victoria, but no step between the latter two eras (Figure 4.11, left-hand panels). Much of the year-to-year variation in the CODURF-based case numbers values is because they are presented here in terms of year of death registration, for the reasons stated in Section 4.1. There is considerably less fluctuation in case numbers by year of death. In particular, the large drop in fall death registrations in Victoria in 2007 and the rise in 2008 are artefacts of variation in time to registration.

The supplementary source shows rising trends in case counts, similar to the upward trends in CODURF-based counts (Figure 4.11, left-hand panels). As expected, the case counts based on the supplementary source are lower than the CODURF-based values because some fall-related deaths do not occur in hospitals (Hindmarsh et al. 2009).

Cases in the CODURFs with UCOD in the range W00–W19 are commonly reported as an indicator of unintentional fall mortality and case counts based on these criteria are shown in the right-hand panels of Figure 4.11. They are lower than either of the estimates in the left- hand panels throughout the period, despite large but irregular increases.

Underlying the national patterns (Figure 4.11, top row) are distinctly different patterns of CODURF-based case counts for Victoria and for the remainder of Australia (Figure 4.11, bottom and middle rows). For Victoria, the number of deaths assigned UCOD W00–W19 increased by more than 4 times soon after the widening of the requirement to report injury deaths to a coroner, whereas the estimate based on the trends report criteria and the supplementary source show fairly steady upward trends.

Further examination of the data suggests that this pattern of change in the data is the result of three factors. The two most important are that coroner-certified injury cases tend to have more specific cause codes than doctor-certified cases, and that the proportion of in-scope deaths certified by coroners has risen, particularly in Victoria. The third factor is that the specificity of cause coding of fall-injury cases has improved over time (that is, more have codes W00–W19 and fewer have X59). This is so for both doctor-certified cases and for coroner-certified cases, though specificity of the doctor-certified cases remains much poorer than that of the coroner-certified cases. These changes are described in more detail below.

Shift to coroner-certification

Until reference year 2003, the proportion of Victorian cases in-scope for the fall injury criteria that were certified by a coroner fluctuated a little below 20%. The proportion rose steeply, beginning in 2003 when doctors were required to report all injury deaths to coroners, to 99% in 1999 (the proportion was 79% in *Preliminary* release 2010 data). The equivalent proportion for the other jurisdictions, combined, fluctuated a little above 20% throughout the whole period.

Increased specificity of cause coding

Coroner-certified cases: most had specific cause codes throughout and the proportion rose

Throughout the reported period, in Victoria and elsewhere, most coroner-certified deaths in-scope for the 'Falls' chapter had a UCOD for unintentional falls (W00–W19). The already high proportion of coroner-certified cases with these codes tended to rise during the period,

from a little over half to about three-quarters, while coroner-certified cases with non-specific code UCOD X59 fell in similar proportion. This pattern occurred in Victoria and elsewhere, but the transition away from UCOD X59 occurred earlier and more quickly in Victoria (between 2003 and 2004) than elsewhere (2005 to 2007). Coroner findings and the police reports attached to many NCIS records often provide information relevant to coding external causes. No equivalent source is available to ABS coding officers for doctor-certified deaths.

Approximately 20% of coroner-certified cases in-scope for the fall-injury criteria were included on the basis of MCODs. Like the type just described, a shift occurred during the reported period away from inclusion on the basis of X59 as MCOD (with a fracture code) to inclusion on the basis of W00–W19 plus an injury code, often a fracture. These changes occurred with the same timing as those affecting UCOD codes, described above.

Doctor-certified cases: a small minority had specific cause codes, but the proportion rose

Doctor-certified cases in-scope for the fall injury criteria differ from coroner-certified cases in terms of the basis on which they were included. The pattern was similar for doctor-certified cases in Victoria and elsewhere.

In Victoria (until medically-certified cases became uncommon late in the period) and elsewhere (throughout the period), most doctor-certified cases were included on the basis of MCOD X59 with one or more fracture codes, or UCOD X59 with fracture codes. In Victoria, X59 with fracture codes accounted for more than 90% of all doctor-certified fall injury cases in the years to 2007 (by which time most cases were certified by coroners, and the small residue of doctor-certified cases is difficult to interpret). In all other jurisdictions combined, the proportion of doctor-certified cases included on the basis of X59 fell gradually from 86% in 1999 to 70% in 2008 and 2009.

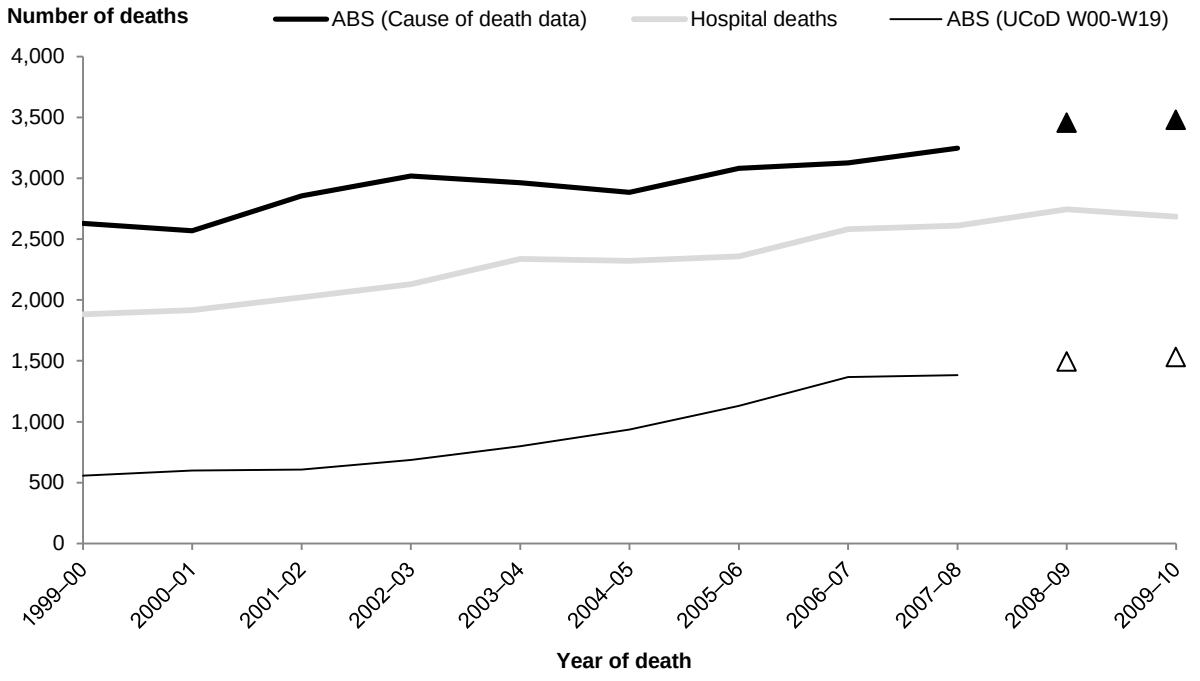
It is not surprising that coroner-certified injury cases tend to have more specific cause codes than doctor-certified cases. The ICD-10 requires that the UCOD recorded for nearly all injury deaths is the external cause of the injury. Almost all coroner-certified cases result in a record in the NCIS, which is the source used by ABS officers when coding the causes of coroner-certified deaths. The NCIS is designed to provide information on sudden and unexpected deaths and gives much attention to information on external causes. It might also be that case that coroners and forensic pathologists tend to give more attention to the presence of injury and external causes as causal factors than do doctors when deciding on causes of death.

For doctor-certified cases, ABS officers had access only to death certification information. The high prevalence of the use of code X59 in these cases, which all involved injury, indicates that records from this source of deaths involving injury lacked information on the external cause in most cases. Code X59 was used much less often for coroner-certified cases, indicating that the information available to ABS coders was sufficient to allow more specific coding of external cause.

In combination, the greater specificity of coding achieved by ABS coders for coroner-certified cases and the increasing proportion of in-scope cases that were coroner certified resulted in improved coding of fall-related injury deaths over the period, but with effects on the data that require great care if misinterpretation is to be avoided. In particular, the growth in coroner certification was accompanied by a shift away from X59 (unstated external factor) and towards W00–W19 (unintentional fall). The rise in the number and proportion of cases

with codes in the range W00–W19 is due mainly to changes in information about cases, rather than to large increases in fall-injury incidence rates.

Case numbers and trends based only on cases with UCOD W00–W19 are not plausible estimates of fall-injury mortality in Australia in the study period. The dramatic rise in cases with UCOD W00–W19 in Victoria when doctors were required to refer all injury deaths to a coroner provides strong evidence of this.



Note: Values for the last 2 years of ABS-based rates, shown as symbols (∆) and (▲), could change due to later revisions of cause of death data by the ABS. (See Appendix A, 'Data Issues' in *Trends in injury deaths, Australia 1999–00 to 2009–10*.)

Figure 4.12: Counts of fall injury deaths, Australia, 1999–00 to 2009–10: all ages

The number of cases included by the criteria used here rose fairly steadily and nearly in line with growth of the main risk population (that is, older people). The supplementary source, based on deaths in hospital of people with injury due to falls, runs nearly parallel to the numbers calculated using the CODURF-based criteria, especially in the more recent part of the period (Figure 4.12). As noted above, the supplementary source should be expected to provide an underestimate of the number of fall-related deaths, since not all occur in hospitals. The fact that the supplementary source values remain well above the number of cases with UCOD W00–W19, despite the large rise in the number of such cases, is further indication that cases with UCOD W00–W19 underestimate fall injury deaths.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on fall injury deaths is considered here.

In reference year 2007, for example, 85 (8%) of the 1,093 deaths with UCOD in the Undetermined intent block in the *Preliminary* release CODURF had been re-coded to UCOD W00–W19 in the *Final* release. However, all 85 of these records satisfied the criteria given at

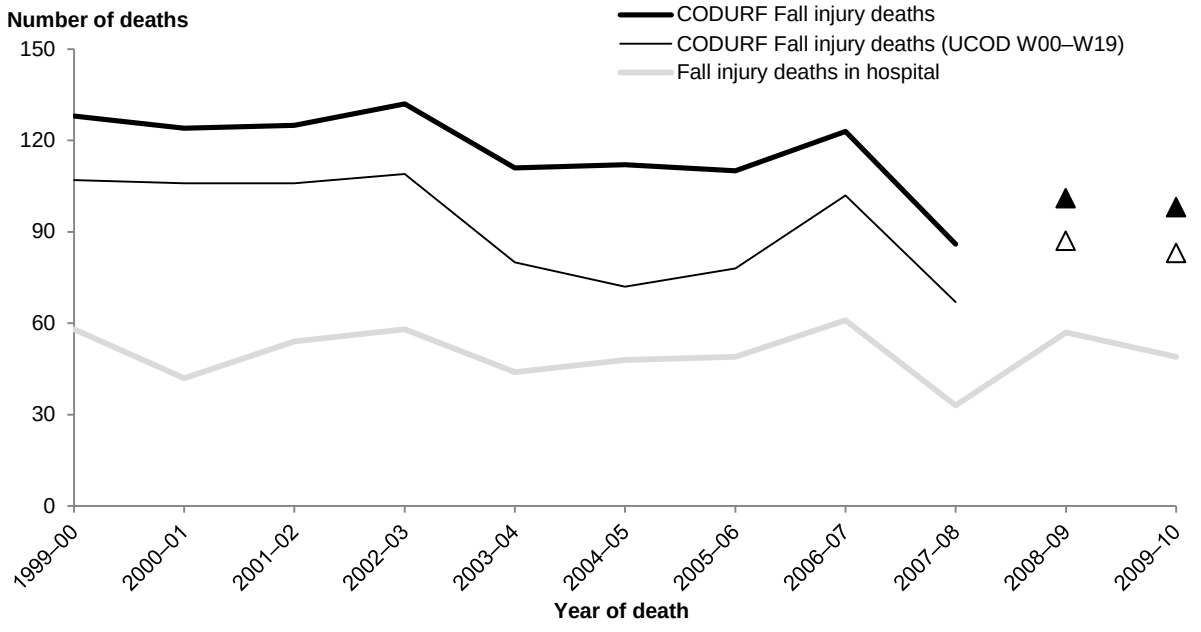
the start of this section in the *Preliminary* release. Very few cases moved in the opposite direction, from UCOD W00–W19 in the *Preliminary* release to Undetermined intent in the *Final* release CODURF. Undetermined intent cases had very little impact on estimates in the trends report for this external cause of injury.

Other notes

Fall injury deaths at younger ages

This section has referred, so far, to fall injury deaths at all ages. The great majority of the cases occur in old age (84% at ages 75 and older). Fall injury deaths at younger ages also warrant consideration. These cases differ in several ways from cases at older ages, and are likely to be overlooked unless considered separately.

Fall injury deaths at ages younger than 50 are much less numerous than those at older ages, comprising 4% of the cases in the 'Fall injury' chapter of the companion injury mortality trends report. They differ from cases at older ages, generally being certified by a coroner (94% compared with 31% of cases at older ages), and having an external cause code as the UCOD (91% versus 53%), a lower proportion of cases with the non-specific UCOD external cause X59 (8% versus 22%), and a higher proportion of male cases (78% versus 40%). The number of fall injury deaths at ages under 50 has fluctuated, but tended to decline (Figure 4.13). Most fatal falls in old age are slips, trips or stumbles to the floor or ground and the person usually survives long enough to be admitted to a hospital. In contrast, most fatal falls at ages under 50 are from a height, and death often occurs at the scene of the fall, which accounts for the considerably smaller number of fall injury deaths in hospital compared with the number recorded in the CODURFs (Figure 4.13).



Note: Values for the last 2 years of ABS-based rates, shown as symbols (∆) and (▲), could change due to later revisions of cause of death data by the ABS.

Figure 4.13: Deaths involving unintentional fall injury, Australia, 1999–00 to 2009–10: age under 50

Assessment

Fall injury deaths include two types. The great majority results from falls by people in old age (78% aged 80 or older in 2009–10) who tend to also have other chronic conditions that, in conjunction with the effects of a fall-related injury, result in death. A small proportion of cases occur at younger ages (4% at ages under 50) and typically involve a fall from a height that suddenly fatally injures a person who was well until that time.

Meaningful and consistent surveillance of fall injury deaths is complicated by (i) the high but reducing proportion certified by doctors rather than coroners, and (ii) the less-specific cause coding achieved for doctor-certified injury deaths compared with coroner-certified injury deaths. This latter issue reflects lack of information about the external causes of deaths involving injury in the information, drawn from medical certificates, on which cause coders rely.

Linkage-based studies have shown that many deaths that occur soon after hospitalised serious fall injury apparently have no mention of the injury on the death certificate (Hindmarsh et al. 2009). A review of doctor-certified injury deaths in Victoria found that nearly all were fall injury cases and that many had errors in the medical certificate of death (Neate et al. 2013).

Data before and after the introduction in Victoria of a requirement to report all injury deaths to a coroner shows that information can be obtained on the great majority of deaths involving injury—including those in old age—that is sufficient to allow ABS coders to record a cause code more specific than X59, which is used when information about the external cause of the injury was not available to the coder. The increase in cases with W00–W19 and the similar decrease in cases with X59 and a code for fracture in response to the administrative change in Victoria provides further support for including deaths with the latter combination of codes when estimating fall-related deaths. Doing so is particularly important for medically-certified deaths involving injury.

The CODURF-based counts of cases selected by these criteria stated at the start of this section run nearly in parallel to the values from the supplementary source, which counts deaths in hospital of people who were admitted for treatment of fall injury. Case numbers from the supplementary source are somewhat lower than the CODURF-based values, as expected, because not all fall injury deaths occur in hospital.

Two mechanisms may account for the much more specific cause coding of injury deaths certified by coroners than those certified by doctors.

1. Data on almost all deaths certified in Australia by coroners since 2001 are recorded in the NCIS, and it has been the sole source used by ABS coders when assigning cause codes to coroner-certified cases for reference years 2006 and later. Most deaths recorded in the NCIS have external causes. The data system was designed with that in mind and the NCIS gives much attention to recording information about external causes of injury. Not only does this information allow better identification of the involvement of a fall, but it may provide information on the circumstances of the fall (for example, slipped over or fell from bed), which allows assignment of a specific cause code.
2. Perhaps coroners have given more emphasis than medical practitioners to falls and resulting injury when deciding on the causal factors that warranted mention when certifying the deaths of old people and their relative contributions to death. Fatal fall

injury at younger ages is much less common than at older ages and is usually certified by a coroner. Case numbers tended to decline during the period considered.

4.8 Thermal injury

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was coded as unintentional exposure to smoke, fire and flames or contact with heat and hot substances (X00–X19).

  or

- The MCODs included codes for unintentional exposure to smoke, fire and flames or contact with heat and hot substances (X00–X19) and for injury (S00–T75 or T79).

  or

- The MCODs included codes for burns (T20–T31) and for external causes of unintentional injury (V01–X59).

About 1%–2% of suicides annually involve exposure to smoke, fire, flames, heat and hot substances (n = 32 in 2009–10), as do a few homicide deaths.

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

For brevity, the term 'thermal injury' is used to refer to the cases included by these criteria.

Of the 96 thermal injury deaths in 2009–10, 93% (n = 89) were assigned a UCOD code in the unintentional injury range V01–Y36. Of these 96 deaths, 41% (n = 39) were assigned a UCOD or MCOD code indicating exposure to an uncontrolled fire in a building or structure. In 78% (n = 75) of deaths, the person suffered some form of burn injury.

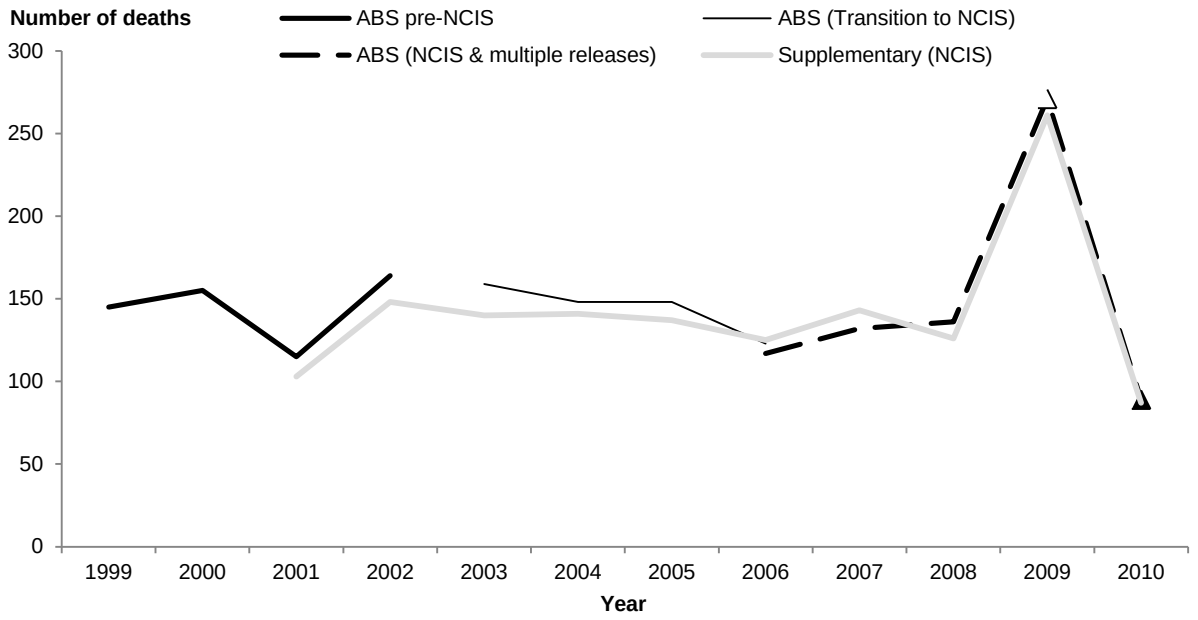
These criteria selected fewer deaths in 2009–10 than in any earlier year in the period covered by the trends report. The number was by far the highest in 2008–09 (due to bushfires in Victoria) but the numbers for all years 1999–00 to 2007–08 (range 122 to 188) were also markedly higher than that for 2009–10.

Supplementary data sources

The NCIS was interrogated in August 2013 to provide supplementary estimates for this cause. The selection criteria are stated at Appendix A. NCIS data were assessed for coroner cases that began in years starting 2001. The supplementary estimates benefit from the fact that the assessment of NCIS records undertaken for this report occurred longer after date of death than did the assessments by the ABS. The ABS reference year is not available in the NCIS and the data are presented according to the year in which the cases were reported to a coroner.

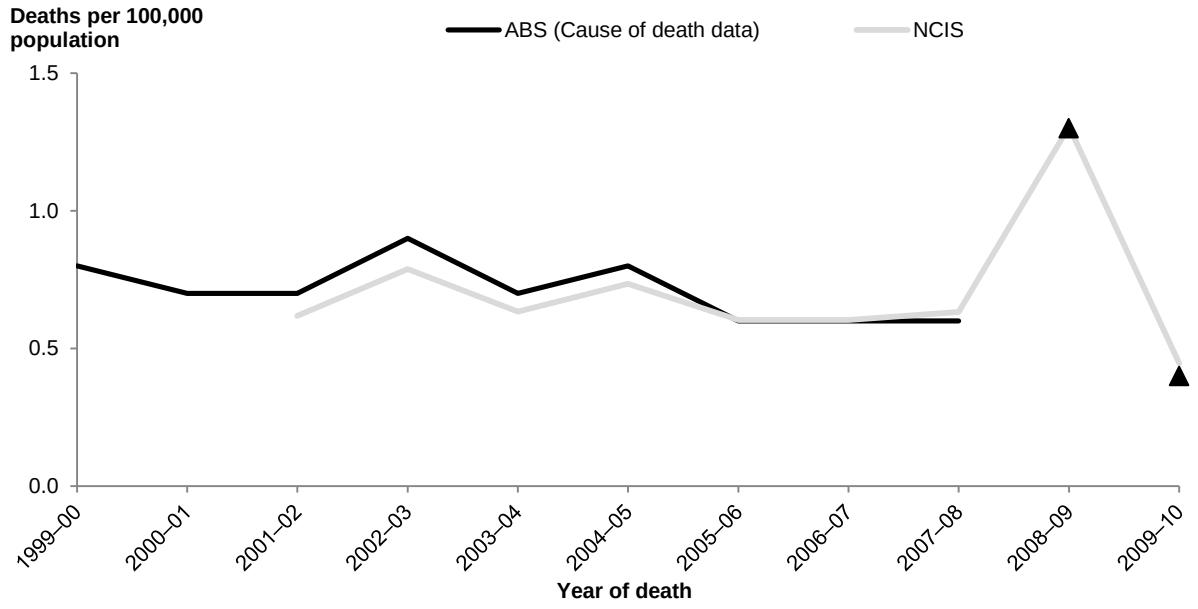
An earlier use of NCIS data in comparison with CODURF data for thermal injury for deaths in 2004–05 found 143 and 142 deaths, respectively, in the two sources (Henley & Harrison 2009).

No other suitable supplementary source was identified for this topic.



Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.14: Counts of deaths involving thermal injury by NCIS period, Australia, 1999 to 2010



Notes

1. Values for the last 2 years of ABS-based rates, shown as symbols (▲), could change due to later revisions of cause of death data by the ABS.
2. Estimates based on NCIS data are crude rates.

Figure 4.15: Age-standardised rates of deaths involving thermal injury, Australia, 1999–00 to 2009–10

Effects of changes in ABS sources and methods

Noticeable steps in case numbers did not occur with the start of the ABS's transition to the NCIS or with the introduction of the changed methods (Figure 4.14).

Supplementary data from the NCIS produced case counts that are similar to the counts based on CODURFs. Year-to-year fluctuations in case numbers correspond closely when both series are presented by year of death (Figure 4.15). The large peak in the count for 2008–09 is due to the deaths that occurred in the bushfires in Victoria early in 2009.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on thermal injury deaths is considered here.

The annual average number of undetermined intent deaths with thermal mechanism in reference years 2001 to 2005 was 2. The number was larger in data from reference year 2006, even in *Final* release CODURFs (mean 11 in 2006 to 2009). If all these were truly unintentional, they would increase annual case counts of unintentional thermal injury deaths by about one-tenth.

Other notes

Numbers of thermal injury deaths were about 150 per year except in 2009 (Figure 4.14). The ICD-10 category that applies to many deaths in bushfires is X01, *Exposure to uncontrolled fire, not in building or structure*. That category accounts for all the peak in 2009 and the number of deaths with this UCOD was low in other years. The number of thermal injury deaths with UCOD other than X01 was similar in 2009 to the numbers in other years.

Assessment

Data for deaths involving thermal injury do not appear to have been much affected by the matters described in Chapter 2. The only substantial changes in reported annual case counts reflects cases due to a specific event. The CODURF-based count was similar to the supplementary estimates throughout the period.

4.9 Other unintentional injury

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was a code from the ranges of unintentional external causes of injury that do not form part of the inclusion criteria for Sections 4.3 to 4.8.

  or

- The MCODs included codes from these ranges of external causes of injury and at least one code for injury (S00–T75 or T79).

The ranges of external cause codes that are in-scope for these criteria are numerous and diverse: exposure to inanimate and animate mechanical forces (W20–W64); unintentional threats to breathing other than submersion and drowning (W75–W84); exposure to electric

current, radiation and extreme ambient air temperature and pressure (W85–W99); contact with venomous animals and plants (X20–X29); exposure to forces of nature (X30–X39); overexertion, travel and privation (X50–X57); and accidental exposure to other and unspecified factors (X58 and some X59).

Suicide and homicide deaths (UCOD X60–Y09) were excluded.

These criteria selected a total of 1,355 deaths in 2009–10. Some of the categories in these ranges refer to few deaths, or none. Those that refer to substantial numbers of cases are summarised here.

Unintentional threats to breathing other than submersion and drowning (W75–W84), as UCOD, selected 214 deaths that occurred in 2009–10 and as MCOD (with an injury code) selected another 693 deaths. Injury code T17, Foreign body in respiratory tract, was present in 74% of these deaths. W76 (*Unintentional hanging and strangulation*), which is part of this range, is considered separately, below. The ICD-10 coding rules allow use of W78–W80 as MCODs when a specific condition is listed as being the cause of the choking. For example, cerebral palsy may cause a person to choke on food or gastric contents.

Cases with UCOD X59 in conjunction with an injury code for a fracture were included with fall injury and not in this section (see Section 4.7 for further information). The remaining cases with X59 are included here: 127 deaths in 2009–10 included on the basis of UCOD X59 and another 136 on the basis of MCOD X59. Of the total of 263 deaths, 231 (88%) were certified by a medical practitioner and 142 (54%) had a MCOD for head injury. These deaths may include cases that resulted from injurious falls that did not result in a fracture.

Coroner-certified cases with UCOD X59 and without a MCOD for fracture numbered well under 100 in each reference year until 2002 then increased, reaching 284 in reference year 2005 and 260 in *Initial* release CODURF for 2006. This dropped to 43 cases in the revised 2006 CODURF. Of the 260 cases assigned a more specific UCOD than X59 in the *Final* CODURF for 2006, 39% went to the unintentional transport injury block, 11% to unintentional falls and 21% to the Other unintentional block. Unlike the 2006 data, cases of this type in reference years 2003 to 2005 have not been revised by the ABS.

The problems with classification of external causes that emerged with the transition to reliance on NCIS data (see Chapter 2) reduced the numbers of cases coded as intentional self-harm and homicide (see later in this chapter). Often the mechanism of injury had been ascertained (for example, hanging) but intent had not been determined sufficiently to allow coding of cause.

As outlined above ('Unintentional injury' section in Chapter 3), ICD-10 coding of a death with an external cause defaults to use of a code from the block V01 to X59 unless the available information satisfies the inclusion criteria for one of the other blocks comprising the 'External cause' chapter of the ICD-10, notably intentional self-harm or assault. Hence, it might be expected that categories in the V01 to X59 range that refer to mechanisms common among intentional injury deaths would have been the destination for many of the misclassified injury deaths, and an increase in the use of these categories during this period was expected. It was expected that this pattern would be most evident in the several CODURFs up to and including the first release for reference year 2006, and would then reduce, due to the effects of the changed method introduced by the ABS.

The data were examined with this in mind. Mechanisms reviewed included *Hanging, suffocation and strangulation*; *Firearm discharge;* and *Contact with sharp object*. Each of these is reported separately in this section, in addition to reporting of *Other unintentional injury*

overall. The number of cases with UCOD X59, with and without a MCOD for fracture, was also examined.

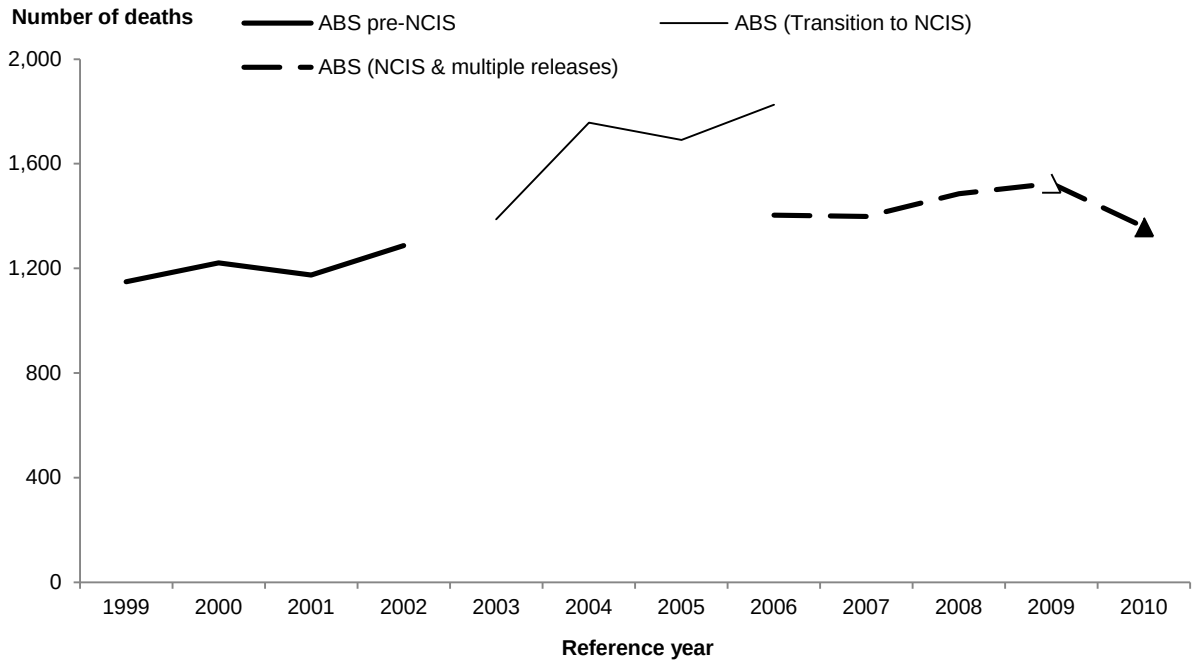
Supplementary data sources

Other unintentional injury, as a whole, is a highly diverse residual category. While it can be specified in terms of the ICD-10 code-ranges (as above), it is not easy to produce an exact replica in terms of NCIS code ranges.

Particular component types of case can be replicated. The NCIS was interrogated in August 2013 to provide supplementary estimates for the following causes:

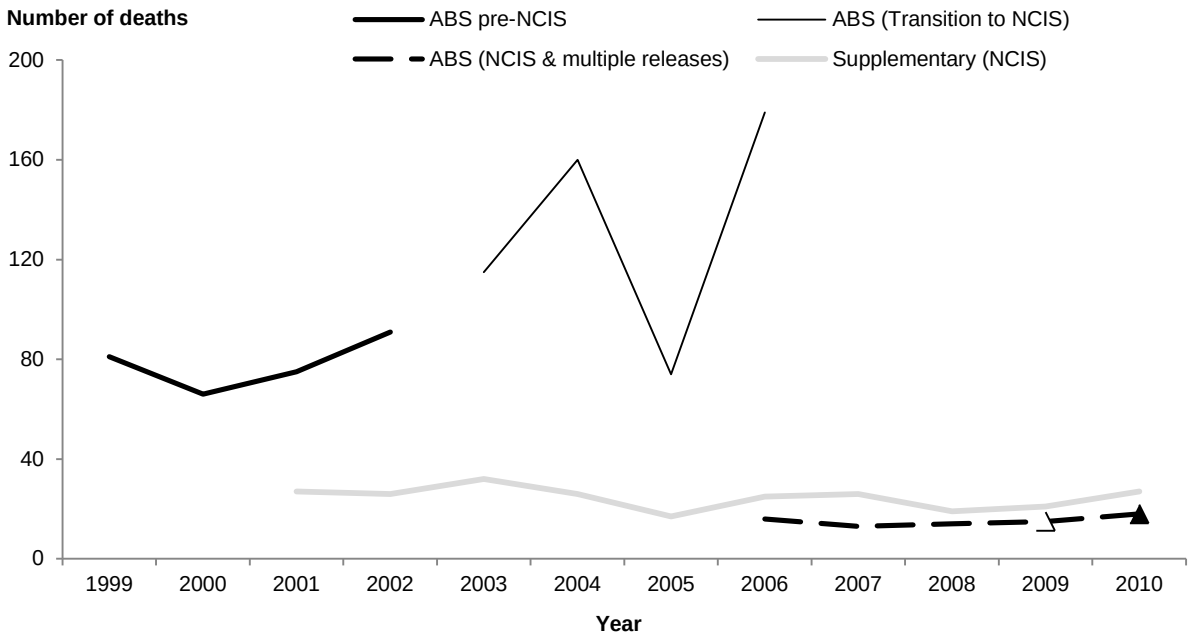
- unintentional hanging and strangulation (UCOD = W76 or MCOD = W76 and S00–T75, T79)
- unintentional firearm discharge (UCOD code = W32–W34 or MCOD = W32–W34 and S00–T75, T79)
- unintentional contact with sword, knife or dagger (UCOD = W26 or MCOD = W26 and S00–T75, T79).

The selection criteria used are stated in Appendix A. NCIS data were assessed for coroner cases that began in years starting 2001. The supplementary estimates benefit from the fact that the assessment of NCIS records for this report was done longer after the date of death than the assessments by the ABS. ABS reference year is not available in the NCIS and the data are presented according to the year in which the cases were reported to a coroner.



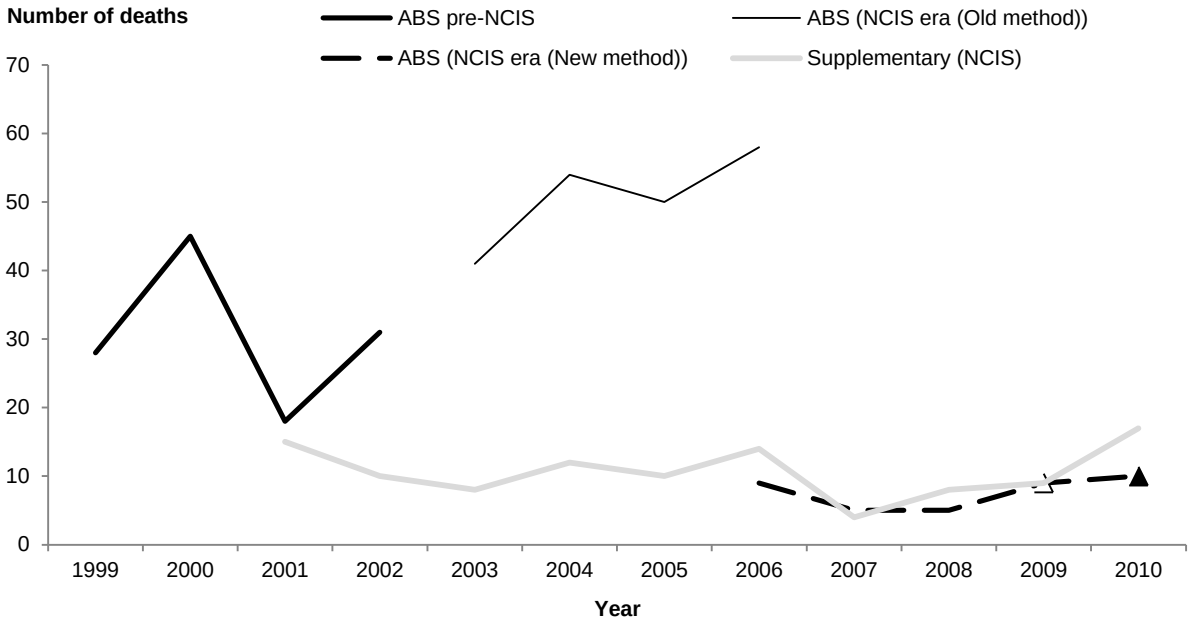
Note: The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.16: Deaths involving other unintentional external causes of injury by NCIS period, Australia, 1999 to 2010



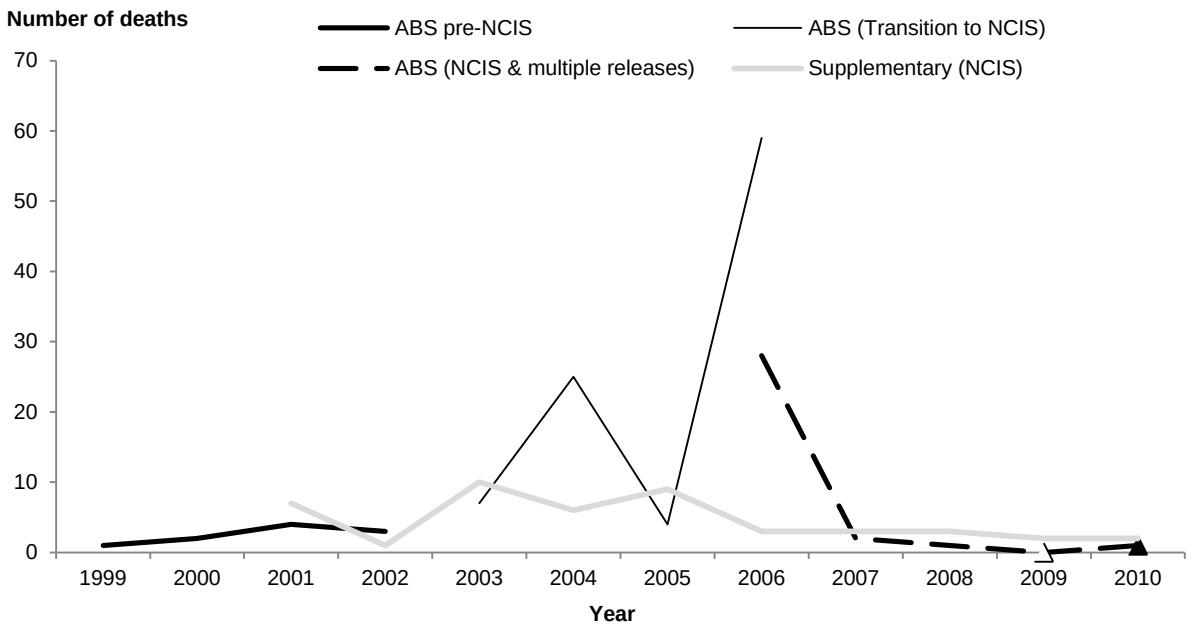
Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.17: Deaths involving unintentional hanging and strangulation by NCIS period, Australia, 1999 to 2010



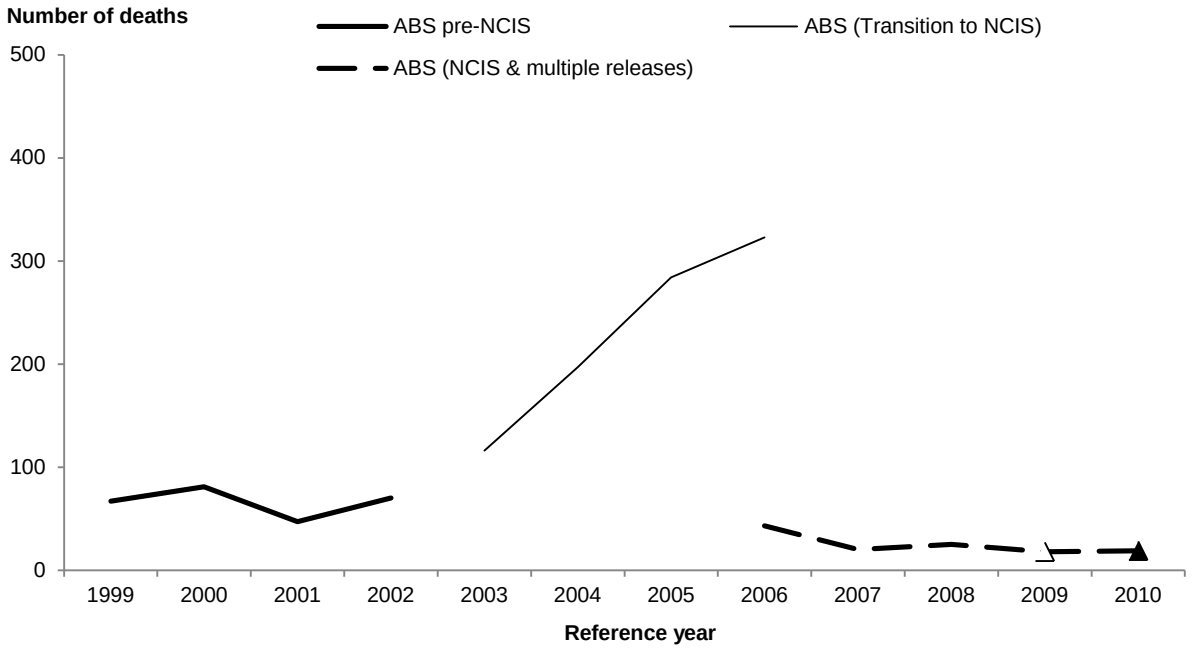
Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.18: Deaths involving unintentional firearm discharge by NCIS period, Australia, 1999 to 2010



Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.19: Deaths involving unintentional contact with sword, knife or dagger by NCIS period, Australia, 1999 to 2010



Note: The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.20: Coroner-certified deaths involving exposure to unspecified factor (UCOD X59) with no multiple cause code for fracture, Australia, 1999 to 2010

Effects of changes in ABS sources and methods

The annual case count for the overall *Other unintentional injury* category tended to rise gradually in the first and third eras, with a steep rise during the transition to reliance on the NCIS (Figure 4.16). Previous work has shown that at least part of the rise in the transition era is due to classification as unintentional of some deaths due to suicide or homicide (Henley & Harrison 2009).

Three common mechanisms of suicide or homicide are represented by unintentional injury codes that are included in the *Other unintentional injury* category, and these have been presented separately in this section: unintentional *Hanging and strangulation* (Figure 4.17), unintentional *Firearm discharge* (Figure 4.18) and unintentional *Contact with sword, knife or dagger* (Figure 4.19).

For each of these causes, the NCIS was used as a supplementary source. NCIS data, inspected in August 2013, show low annual case counts for each of these causes in the period 2001 to 2010 without strong trends (figures 4.17 to 4.19). The supplementary estimates are similar to CODURF-based estimates for the period starting 2007. There are wide divergences between CODURF-based estimates and the supplementary source for earlier years, patterns of which differ between the three causes.

For *Hanging and strangulation* (W76), CODURF-base counts in the Pre-NCIS era were considerably higher than the supplementary source estimates (Figure 4.17). The CODURF counts varied greatly in the Transition to NCIS era, but in 3 of the 4 years they were higher than in the Pre-NCIS era. The *Final* CODURF estimate for 2006 is less than one-seventh of the *Initial* count. This estimate and the others based on the revised ABS methods are similar to the estimates based on the supplementary source, though slightly lower.

Cases which can now be seen as misclassified to this category include some for which intent cannot be determined as well as those eventually determined to be due to intentional self-harm or homicide. This is shown by the *Hanging and strangulation* cases in reference year 2006 that were coded to this category in the *Initial* release. In *Final* release data, 67% of the 179 deaths were re-coded as intentional self-harm by hanging, 3% as assault by hanging or strangulation and 20% as hanging or strangulation with undetermined intent. Only 16 deaths, 9% of the original number, remained coded as unintentional hanging and strangulation.

The smaller annual numbers of cases coded as unintentional deaths due to *Firearm discharge* (W32 to W34) show considerable year-to-year variation in the Pre-NCIS era (Figure 4.18). The CODURF-based estimate for 2001 is similar to the supplementary source, but CODURF-based estimates for the following 5 years are all much higher than those based on the supplementary source.

In *Final* release data for 2006, all but 8 (14%) of the 56 deaths coded in *Initial* data as being due to unintentional *Firearm discharge* were re-coded to another category, mostly intentional self-harm by a firearm (23 deaths; 41%), assault by a firearm (10 deaths; 18%), or event of undetermined intent involving a firearm (12 deaths; 21%).

Only in the two reference years 2004 and 2006 are the numbers of deaths in the CODURFs that were coded as unintentional deaths due to *Contact with sword, knife or dagger* (W26) markedly higher than the numbers based on the supplementary source (Figure 4.18). The CODURF-based estimates for years 2007 to 2010 show no sign of continued overestimation. It is noteworthy that the count for this cause based on the *Final* release of 2006 data, while

fewer than half the number in the *Initial* release, remains well above the supplementary estimate for that year or any of the more recent years charted. All cases in the NCIS with case year of 2006 and ICD-10 W26 as the underlying cause code were scrutinised. Few appeared to warrant coding to W26 on the basis of NCIS data as at August 2013. Of the cases coded to unintentional *Contact with sword, knife or dagger* in the *Initial* release of 2006 data and assigned a different code in the *Final* release, 28 of 31 were re-coded to *Assault by sharp object* (X99).

Deaths known (to a cause coder) to be due to injury, but with information not available on the mechanism or the intent of injury, can be coded to the ICD-10 category X59, *Exposure to unspecified factor*. The transition to reliance on the NCIS presented ABS cause coders with this situation: injury deaths could be known to exist on the basis of data from registrars, but information on the external cause was lacking from the NCIS up to the end of the processing period for a CODURF. If information was lacking on intent but was available on mechanism, the case would be coded to a category from the 'Accidental' causes block that referred to the relevant mechanism (see above). This situation could occur if a record was present in the NCIS but the case had not been Closed. If, however, there was no record of the death in the NCIS at the relevant time, the coder would know neither mechanism nor intent, and would be required to assign the default external cause code, X59. The number of coroner-certified injury deaths assigned UCOD X59 rose sharply during the Transition to NCIS era, and dropped to a low level with the introduction of new methods.

The UCOD X59 cases in Figure 4.20 are restricted to those that do not have a multiple cause code for fracture(s). This is for consistency with the inclusion criteria for *Other unintentional injury* given above. The pattern over the period is much the same if the coroner-certified X59 cases with a fracture code are included, which averaged 104 per year in the first era, 107 in the second and 46 in the third. A suitable supplementary source is not available for Figure 5.20.

Since the causes considered in figures 4.17 to 4.19 are nearly always certified by a coroner, there was no need to restrict the underlying data to coroner-certified cases to ensure that the figures would illustrate effects related to reliance on the NCIS. Code X59, however, occurs commonly in doctor-certified deaths as well as coroner-certified deaths. Attention is restricted in Figure 4.20 to the coroner-certified cases, since only they are susceptible to effects of the transition to the NCIS. The number of doctor-certified deaths equivalent to those charted (that is, with UCOD X59 and no fracture code) fluctuated through the transition era, without a clear trend or step (average 113 per year).

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data when the trends report was prepared is given in the last part of this chapter. The potential effect of undetermined intent cases on the other unintentional injury category is considered here.

The number of cases coded to Undetermined intent categories with mechanisms hanging, and so forth (Y20), firearm discharge (Y22 to Y24) and contact with sharp object (Y28) all increased after reference year 2006. When *Final* release data for 2007 are considered, the rises are smaller than are the declines after *Initial* release of 2006 data shown in figures 4.17 to 4.19. This is because the multiple release process, first applied to the 2007 reference year, allowed about 2 years longer than the previous process between date of a death and the final opportunity to code cause of death, during which time the intent of many cases was determined and recorded in the NCIS.

Assessment

Certain categories in the *Other unintentional injury* block were the main 'destinations' for cases affected by the increased misclassification during transition to the NCIS, as described in Chapter 2. Accordingly, case counts for these categories before the ABS introduced its revised methods are overestimates, particularly in the *Transition to NCIS* era. The correct case counts for these categories were small in relation to the numbers of cases misclassified to them, so the case counts for these categories in the CODURFs before the introduction of revised methods provide a poor indication of injury incidence.

4.10 Intentional self-harm

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was intentional self-harm (X60–X84).

  or

- The MCODs included codes for intentional self-harm (X60–X84) and for injury (S00–T75 or T79).

Few deaths were included by the second criterion (about 4 deaths per year on average).

Indications of under-identification of suicide in Australia, which began to emerge in about 2003, prompted investigations and the introduction of the changes to the ABS's methods for processing and releasing cause of death. This is described in Chapter 2 and in a report on suicide data in Australia (Harrison et al. 2009).

Concerns about the completeness and reliability of suicide data are longstanding and widespread—for example (Claassen et al. 2010; Senate Community Affairs Reference Committee 2010). Two characteristics of this cause of death largely account for this.

The first is the widespread disapproval of suicide. In many cultures (but not all) taking one's own life is strongly discouraged and suicide has often been a crime. Suicidal behaviour was decriminalised in Australia and many other countries in the twentieth century, but remains a crime in some countries (for example, Singapore: statutes.agc.gov.sg s309 of Penal Code). The Indian Government announced in December 2014 its intention to abolish a similar law <www.nia.gov.in/acts/THE_INDIAN_PENAL_CODE.pdf>.

Even where it has been decriminalised, suicide is widely deprecated. Social and legal disapproval of suicide might lead to under-enumeration because surviving family and friends usually prefer not to have the death of a loved one attributed to this cause and are sometimes able to achieve this by either influencing information about the death or the way it is described in official records (De Leo et al. 2010).

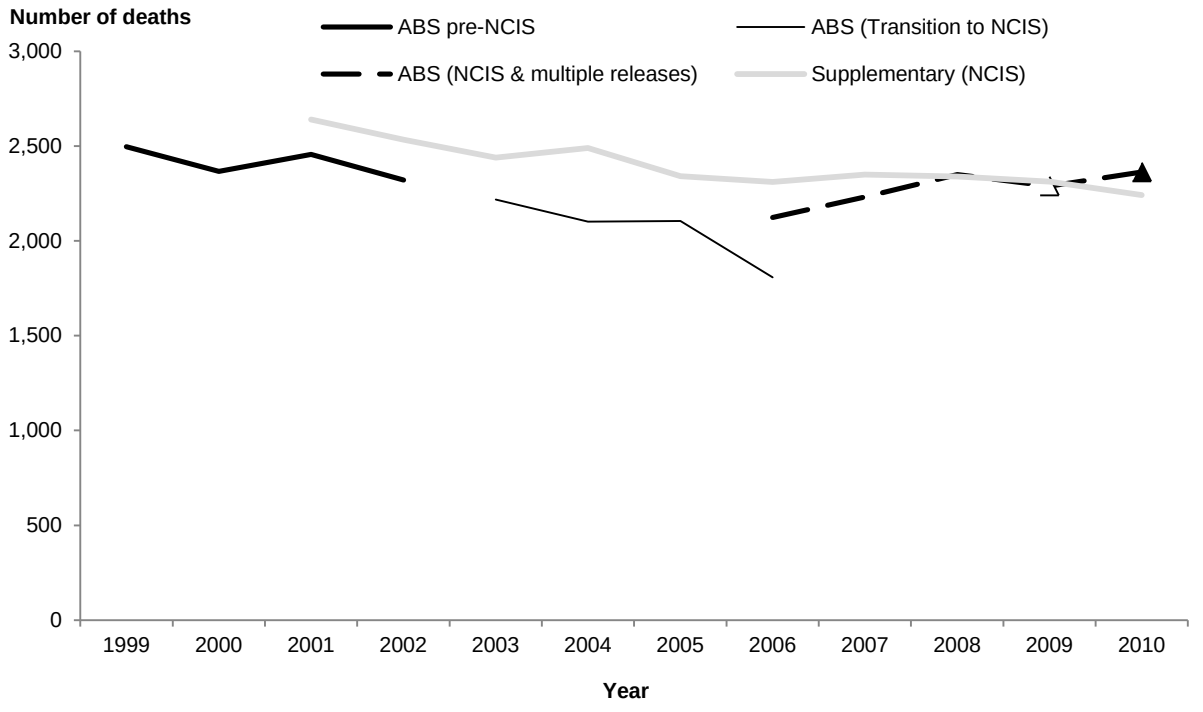
The second type of threat to comprehensive ascertainment of suicide is that intent cannot be determined confidently after some deaths (Freckleton & Ranson 2006). Circumstances in which such doubt may arise are deaths by drowning, deaths involving an overdose of a drug that the person was known to use (for example, as a prescribed medication or recreationally) and some types of motor vehicle crash. Doubt may also arise about the mental state of the person at a relevant time (for example, because of mental illness or intoxication) or the person's ability to form the intent to commit suicide (for example, due to young age or

intellectual incapacity). The availability of certain evidence may do much to reduce doubt (for example, a suicide note or other expression of intent by the deceased), and weight might be placed on factors such as documented history of mental illness or of suicide attempts. Doubt remains about some deaths, even after careful and expert investigation.

Supplementary data source

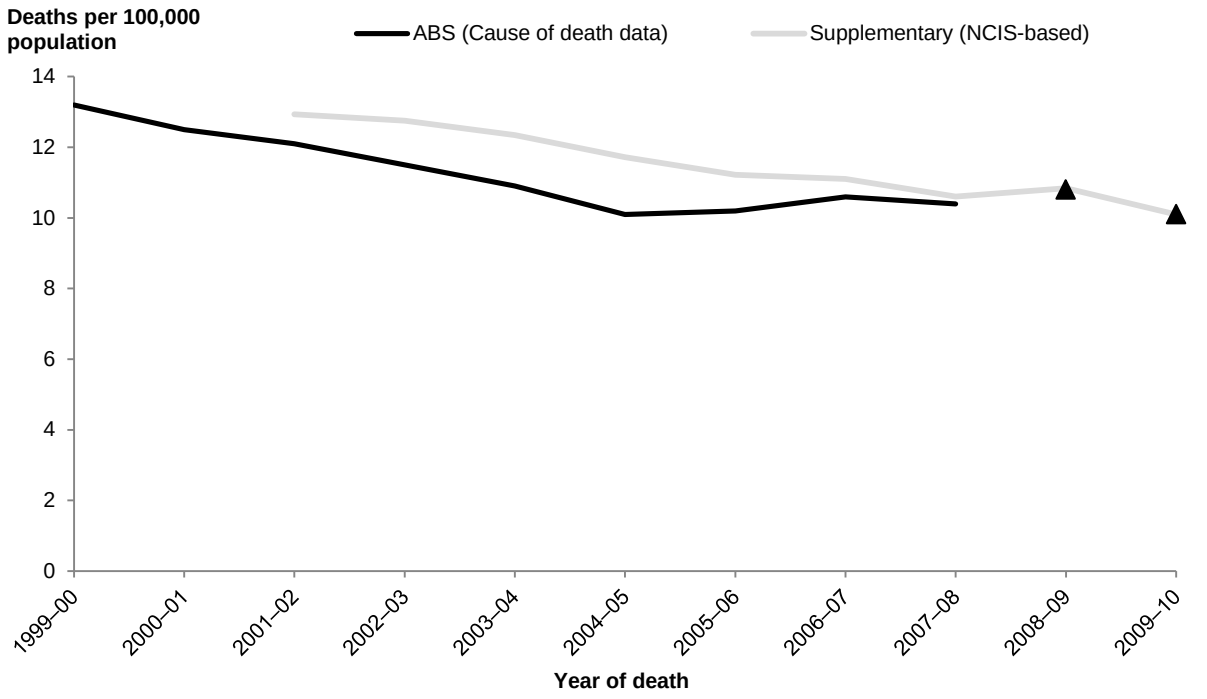
The NCIS was interrogated in August 2013 to provide supplementary estimates for this cause. The criteria that were used are given in Appendix A. NCIS data were assessed for coroner cases that began in years starting 2001, the first year of national operation. The supplementary estimates benefit from the fact that the assessment of NCIS records for this report occurred longer after date of death than the assessments by ABS officers on which CODURF data are based. ABS reference year is not available in the NCIS and the data are presented here according to the year in which the cases were reported to a coroner.

No other suitable supplementary source was identified for this topic with national scope.



Note: Periods are reference year for CODURF data and case year for supplementary NCIS data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.21: Counts of suicides deaths by NCIS period, Australia, 1999 to 2010



Note: Values for the last 2 years of ABS-based rates, shown as symbols (▲), could change due to later revisions of cause of death data by the ABS.

Figure 4.22: Age-standardised rates of intentional self-harm deaths, Australia, 1999–00 to 2009–10

Effects of changes in ABS sources and methods

The supplementary source suggests that the incidence of intentional self-harm deaths declined fairly steadily during the first decade of the century (Figure 4.21), especially when presented as population-based rates and organised by date of death (Figure 4.22). In contrast, rates based on CODURF data declined more steeply than those based on the supplementary source until 2004–05, then rose (Figure 4.22).

The CODURF-based annual case counts are close to the supplementary estimates from 2008 to 2010 (Figure 4.22). Rates for cases grouped by year of death are similar for 2007–08 and almost identical for the next 2 years (Figure 4.21). The revised processing method introduced by the ABS for reference year 2008 was thus effective in overcoming under-enumeration of this cause of death compared with the NCIS.

The case count for reference year 2010 based on the *Preliminary* release CODURF for that year is a little higher than the supplementary estimate based on the National Injury Surveillance Unit's (NISU) assessment of NCIS data as at August 2013. This may be due to the more complete access to data on Open cases in the NCIS that is granted to the ABS than to other third-party users of the NCIS.

Supplementary source estimates for the last 2 years of the *pre-NCIS* era suggest that suicide was underestimated in CODURF data in that period, though less so than in the *Transition to NCIS* era. The NCIS can provide no information on whether underestimation occurred in the CODURFs in the period before 2001.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on intentional self-harm injury deaths is considered here. The changed use to which the Undetermined intent code block has been put for CODURFs beginning with reference year 2007 is particularly important for intentional self-harm.

The Undetermined intent block was added to the ICD, in the eighth revision, primarily in response to concerns about the coding of suicide. In some countries, notably England and Wales, it continues to be usual practice to include undetermined intent cases in statistical descriptions of suicide (Department of Health 2014). That has not been usual practice in Australia, where relatively small numbers of deaths were generally assigned Undetermined intent codes (for example, fewer than 90 deaths per year in reference years 1999 to 2004, fewer than 4% of the number of deaths coded as intentional self-harm).

The situation changed markedly with the changes introduced by the ABS in response to the concern over misclassification of intentional self-harm (Chapter 2). First, the new use to which the Undetermined intent code block was put (that is, as a 'holding bay' for deaths the intent of which had not yet been determined) could be expected to alter the mixture of types of case coded to the Undetermined intent block, compared with both the period before the change and between releases of data for a given reference year. Second, the number of deaths assigned codes from this block increased greatly, particularly in the initial CODURF release for a reference year; however, even *Final* release CODURFs have several times as many undermined intent cases as do CODURFs for earlier years (see section 4.12 later in this chapter).

The larger number of cases in the Undetermined intent block from 2007 has made it more important to decide how to deal with them. For example, the *Final* CODURFs for reference years 2007 and 2008 include, respectively, 363 and 491 deaths with undetermined intent. Some of the deaths that remain coded to the Undetermined intent block in the *Final* CODURF for a reference year are due to intentional self-harm and remain undetermined because data in the NCIS were incomplete at the cut-off date for that release. Some others may be cases with features suggestive of intentional self-harm but a coroner concluded that intent could not be ascertained with sufficient confidence, and so found that intent was undetermined.

It cannot be said exactly how many of these deaths were due to intentional self-harm but mechanisms of injury provide some indication. The mechanisms involved in suicides have a different distribution from those involved in unintentional and homicidal deaths. About 84% of deaths coded as intentional self-harm involve one of three mechanisms—hanging and suffocation, poisoning, and shooting—but these mechanisms were involved in only 20% of deaths with determined intent, excluding intentional self-harm. This is helpful when estimating how many intentional self-harm cases remain among undetermined intent cases. These values, and the exercise below, are based on the *Final* CODURFs for 2007 and 2008.

The proportion of intentional self-harm cases among determined-intent cases with each mechanism was measured. If the proportion of intentional self-harm cases among the undetermined intent cases involving each of these mechanisms is the same as among the determined-intent cases, about 363 (42%) of the undetermined intent cases would be due to intentional self-harm. This would increase estimates of intentional self-harm by between 5 and 10%. It should be recognised that while it is probable that some intentional self-harm

deaths are among the undetermined intent cases, this particular estimate is based on an unverified assumption and is intended only to indicate the possible extent of under-enumeration due to undetermined intent. The number of undetermined intent deaths in *Final* CODURFs was largest for reference year 2008 and lower in the next 2 years.

Other notes

Assisted suicide (whether assistance is provided by a physician or another person) and voluntary euthanasia are not legal in Australia, but have been found to occur (Kuhse et al. 1997). In Australia, as well as in countries where assisted suicide is permitted, withholding or withdrawing life-prolonging treatment and intensified alleviation of symptoms are much more common than medically-assisted suicide or euthanasia (van der Heide 2014).

The ICD-9 and the ICD-10 do not provide specific categories for assisted suicide or euthanasia, nor for withholding or withdrawing life-prolonging treatment or potentially life-shortening intensified alleviation of symptoms. In any case, since euthanasia and medically-assisted suicide are illegal in Australia, it is likely that certificates of deaths that involve these causes will not usually state that fact.

Legislation under which assisted suicide is, or has been, permitted affects how such deaths are classified. For example, the Northern Territory *Rights of the Terminally Ill Act 1995 (Northern Territory Government 2014),* in force from 1995 to 1997, stated that deaths under its provisions 'shall not, for that reason only, be taken to be unexpected, unnatural or violent for the purposes of the definition of 'reportable death' in the application of Part 4 of the Coroner's Act'. Similarly, the *Death With Dignity* legislation in the state of Oregon in the United States (Government of Oregon 2014) specifies that 'action taken in accordance with the DWDA does not constitute suicide, mercy killing or homicide under the law'.

Hence, assisted suicide or euthanasia, whether it occurs illegally or in compliance with laws such as those referred to above, is likely not to be discernible in deaths data coded according to the ICD-10.

Assessment

These results confirm earlier findings that CODURFs underestimated intentional self-harm deaths in the middle of the first decade of the century (Harrison et al. 2009). The findings also show under-estimation extending back to 2001, the first year for which national NCIS data are available. Whether the underestimation implied by this finding was also present in years before 2001 is not known.

Estimates based on the CODURFs are very similar to those based on reviewing NCIS data from reference year 2008, when the ABS introduced the revised version of its new method. This finding provides a reason to conclude that under-counting of intentional self-harm deaths is much reduced.

It should be noted that agreement of these estimates does not necessarily imply that either is entirely correct. Some of the deaths that remain coded as to Undetermined intent categories after coroners have completed their work are likely to be due to intentional self-harm.

It has been argued that some other injury deaths might be due to unrecognised intentional self-harm, particularly where circumstances leave room for doubt about intent. Moreover, some deaths result from behaviours which, while not satisfying usual definitions of intentional self-harm, have something in common with it (for example, acts undertaken with

apparently reckless indifference to consequences). While it is possible to enhance cause of death data systems in ways that better reveal such deaths, ambiguities and uncertainties inherent in the formation of intent, rapid changes of intent in some cases, and differences between coronial and public health perspectives on causation are likely present ongoing challenges to enumeration (De Leo et al. 2010).

4.11 Homicide

Inclusion criteria

The criteria for injury deaths were applied and the records that included the following ICD-10 codes were included in this section:

- The UCOD was assault (X85–Y09); or legal intervention and operations of war (Y35, Y36).
- The MCODs included any of these codes and a code for injury (S00–T75 or T79).

No deaths were included solely by the second criterion. An average of about 4 deaths per year were included on the basis of UCOD Y35 or Y36.

Supplementary data sources

Two supplementary data sources were used for this cause of death.

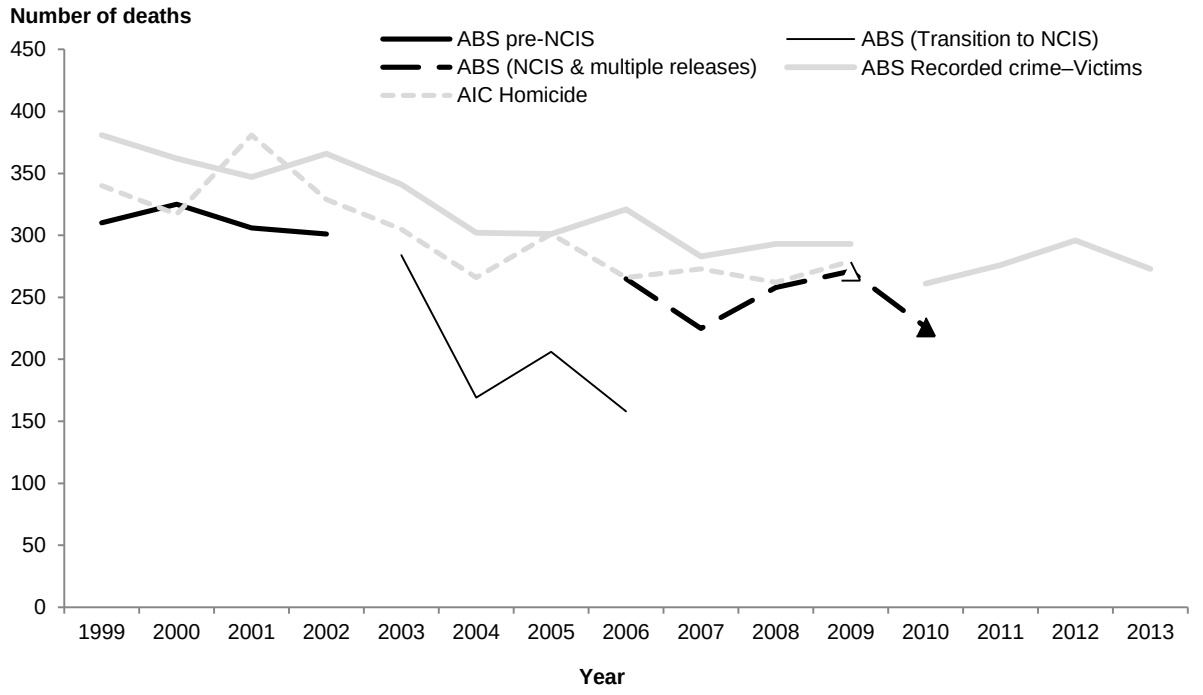
The first supplementary source is the ABS series 'Recorded Crime—Victims, Australia' (ABS cat. no. 4510.0), which is based on administrative data systems maintained by state and territory police forces. The reports were obtained from the ABS website <www.abs.gov.au>. The values presented here are the sum of reported counts of victims of homicide and of manslaughter, because both of these types are in-scope for the ICD-10 code block Assault (X85–Y09).

Reports in this series have been published annually since 1993. ABS explanatory notes caution against comparing data for 2010 and later years with earlier data because of a change in police recording and implementation of the National Crime Recording Standard. The categories of victimisation reported here (homicide and manslaughter) appear to have been affected less by the changes than some other types. Nevertheless, a break has been inserted into the series when it is charted (Figure 4.23).

The second source is the series of annual reports of the National Homicide Monitoring Program (NHMP) of the Australian Institute of Criminology (Chan & Payne 2013). Reports are for years to 30 June. The reports used here are those for 2000–01 to 2009–10, which were obtained from the Australian Institute of Criminology website <www.aic.gov.au>.

The NHMP includes all cases resulting in a person or persons being charged with murder or manslaughter, but not driving-related deaths unless they occur immediately after a criminal event such as armed robbery or theft of a motor vehicle. All other deaths classed by police as homicide are in-scope, including murder–suicide and infanticide, whether or not an offender has been apprehended (Chan & Payne 2013).

Note that these supplementary sources, in keeping with requirements of the administrative systems that capture the underlying data, include data framed in terms of criminal events and perpetrators as well as in terms of victims of crime. The data used as supplementary sources here, however, are estimates of numbers of victims.



Note: Periods are reference year for CODURF data and year of reporting to police for ABS Recorded Crime data. The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data. The Recorded Crime values are the sum of homicide plus manslaughter. The discontinuation in this series after 2009 reflects a change in police recording and implementation of the National Crime Recording Standard.

Figure 4.23: Counts of deaths due to assault, Australia, 1999 to 2013

Effects of changes in ABS sources and methods

CODURF estimates of deaths due to assault were lower than the total of homicide plus manslaughter cases that were reported to police throughout the reporting period, and lower than homicide as estimated by the NHMP, except in part of the third period of CODURF data (Figure 4.23).

The difference became markedly larger in the period of transition to reliance on the NCIS (Figure 4.23). The count given in the initial CODURF for reference year 2006 was fewer than half the number of homicide and manslaughter cases reported to police in 2006. From the outset of the investigation of a violent death, it may appear likely that it was due to interpersonal violence, but the ultimate test is often a case in a criminal court. A period of up to several years may elapse before such cases conclude, and until then the data in the NCIS may be incomplete or subject to change. This characteristic made homicide deaths particularly susceptible to under-counting during the *Transition to NCIS*.

The gap between CODURF-based estimates and the supplementary source estimates narrowed with the introduction of revised methods by the ABS. Note that the CODURF-based count for 2010 is based on *Preliminary* data and the value can be expected to increase in later releases.

Undetermined intent

An overview of injury deaths for which intent is undetermined in the latest available CODURF data is given in the last part of this chapter. The potential effect of undetermined intent cases on homicide injury deaths is considered here.

The number of undetermined intent cases in the *Final* CODURFs for reference years 2007 (363) and 2008 (491) are more numerous than the number of cases in those years coded as homicide. This, considered against the background of fluctuating ascertainment of homicide in the CODURFs, has increased the need to give attention to this possibility that undetermined intent cases might include a non-trivial number of homicide deaths.

It cannot be said exactly how many undetermined intent deaths were due to homicide but, as for intentional self-harm, mechanisms of injury provide some indication. The mechanisms involved in homicide have a very different distribution to those involved in unintentional and suicidal deaths. About 76% of deaths coded as homicide involve one of three mechanisms—cutting and piercing, striking or being struck by, and shooting—but these mechanisms were involved in only 4% of other deaths with determined intent. This is helpful when considering how many homicide cases might remain among undetermined intent cases. The exercise below was based on the *Final* CODURFs for 2007 and 2008.

The proportion of homicide cases among determined-intent cases with each mechanism was measured. If the proportion of homicide cases among the undetermined intent cases involving each of these mechanisms is the same as among the determined-intent cases, about 126 (15%) of the undetermined intent cases would be due to homicide. This would increase estimates of homicide by over 20 per cent. It should be recognised that, while it is likely that some homicide deaths are among the undetermined intent cases, this particular estimate is intended only to indicate the possible extent, and is based on an unverified assumption.

Assessment

Deaths due to interpersonal violence were particularly susceptible to under-counting in the period of transition to the NCIS, probably because finalisation of investigations and court processes often takes a long time. Following the introduction of revised processes, CODURF-based estimates are close to values in supplementary sources.

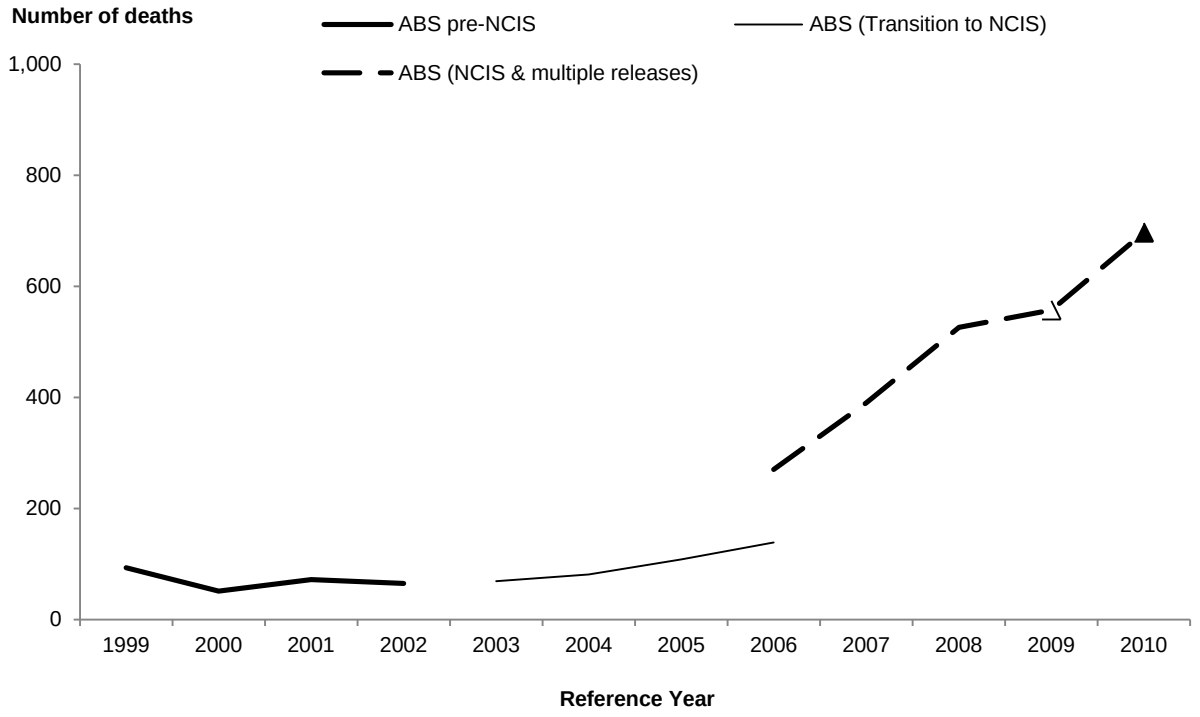
4.12 Other injury-related deaths

Undetermined intent (UCOD Y10–Y34)

The average annual number of deaths coded to the Undetermined intent block in the 5 reference years ending 2005 was 78 (Figure 4.24). In the 4 reference years starting with 2007, the average was 785 in *Preliminary* release CODURFs, falling to 309 in *Final* releases. The greatly increased number of cases in this block and the movement of cases between this block and others between releases of data for a reference year warrant attention.

As described in Chapter 2, the ABS altered the way it uses the ICD-10 Undetermined intent code block with the introduction of changed methods in reference year 2007. Formerly, the block was used for injury deaths which, at the end of coronial investigation, had not been determined to be due to accident, suicide or homicide. This type of case continues to be coded to the Undetermined intent block under the new methods, but another type of case is

now also coded to this block. These are cases that had not been finalised when the ABS officer consulted the NCIS. Often, the information available in the NCIS at that time indicated that the death was due to injury and specified the mechanism of injury (for example, poisoning, hanging, car crash) but a determination had not been made on the role of human intent, or had not been entered into the NCIS.

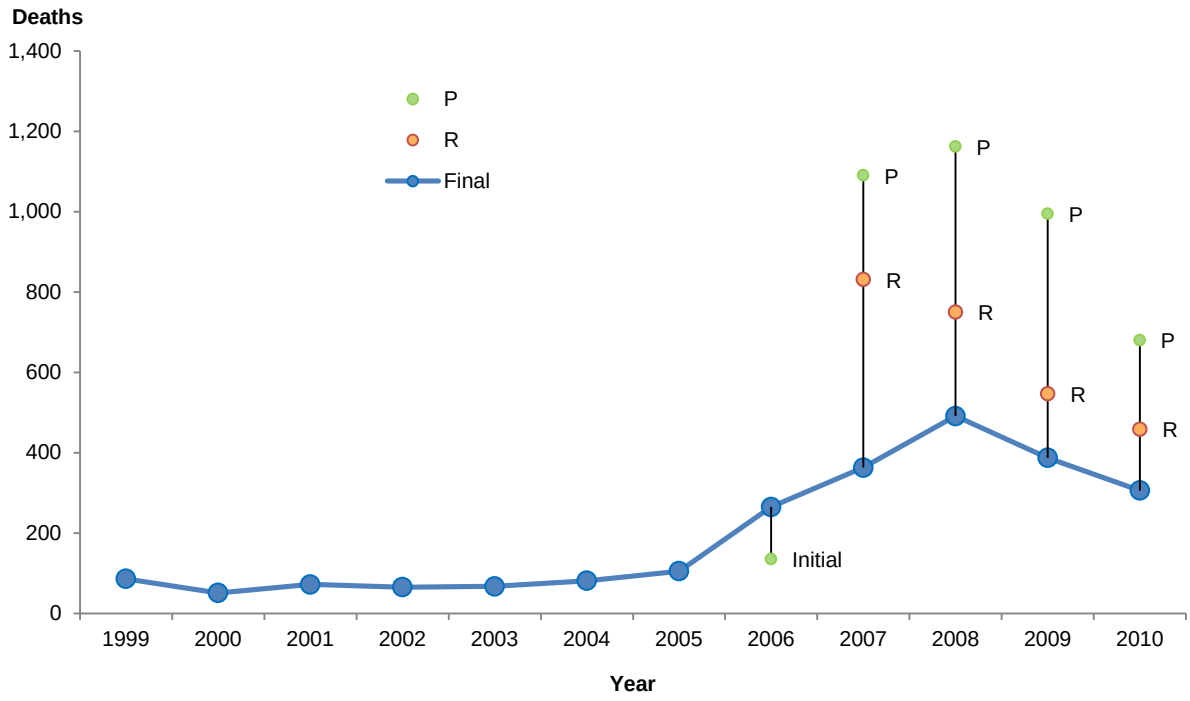


Note: The empty triangle (∆) is the number of deaths based on the *Revised* release of ABS data while the filled triangle (▲) is the number of deaths based on the *Preliminary* release of ABS data.

Figure 4.24: Counts of injury deaths with undetermined intent by NCIS period, Australia, 1999 to 2010

Under the new method, the number of cases for which intent remains undetermined declines with increasing duration since death. Hence, undetermined intent cases are most numerous in *Preliminary* release data for a given reference year, and less numerous in the later releases (Figure 4.24). While *Final* release case counts are lower than those for earlier releases for a given year, they are much higher than the numbers of undetermined intent cases under the previous method. The highest *Final* count in the period charted was for reference year 2008 (n = 491), falling to 306 for 2010 (Figure 4.24).

The exception to this pattern is reference year 2006, in which the number of undetermined intent cases in the *Initial* release (n = 135) was lower than in the *Final* release (n = 265). The *Initial* release for that year was processed according to the older method, and the number of undetermined intent cases was only a little higher than in previous years. The *Final* release of 2006 data was published in 2012, implying an unusually long duration between dates of death and the cut-off date for processing. Hence, the number of cases that remained undetermined or incomplete in the NCIS can be expected to have been lower than at the usual cut-off date for *Final* release CODURFs. This might account for the relatively low number of undetermined intent cases in the *Final* for 2006.



Note: Cause codes for deaths in 2009 and 2010 are subject to possible revision by the ABS. Periods are ABS reference years. P=*Preliminary* CODURF. R=*Revised* CODURF. The first 2006 CODURF is referred to as the Initial release.

Figure 4.25: Counts of injury deaths with undetermined intent by reference year and CODURF release, Australia, 1999 to 2010

The fluctuations in numbers of undetermined intent cases within and between reference years imply flows of cases to and from other code blocks. In reference year 2007, for example, 821 cases that were coded to the Undetermined intent block in the *Preliminary* release CODURF had been assigned a different UCOD by the *Final* release. Of these, 33% moved to the unintentional transport injury block, another 33% to Intentional self-harm and 10% to each of unintentional poisoning and unintentional falls. Smaller proportions moved to the other unintentional injury blocks and 3% were assigned UCOD codes outside of the 'External causes' chapter.

The changes in ABS practice starting in 2007 are not necessarily the only factor contributing to the increase in deaths coded to Undetermined intent. Changes in the NCIS, on which the ABS relied entirely when coding coroner-certified deaths in reference years after 2005, could also have contributed.

Two data fields in the NCIS that concern intent are important in this regard: *Intent on Notification* and *Intent on Completion*. One of the values available for these fields is undetermined intent. It is noteworthy that the number of NCIS cases with *Intent on Completion* = Undetermined intent was low for all NCIS data years before 2006. The annual number cases coded as Undetermined intent on completion rose rapidly after that, to more than 200 per year by 2008.

Cases with unknown cause (UCOD R99)

R99, the ICD-10 category for use when no information is available to a coder about the cause of death, is potentially important here, because deaths coded to it might include cases which,

if more information were available, would be recognised to result from injury (see also Chapter 2).

In the context of coroner-certified deaths in the period during which ABS coders have relied on the NCIS, R99 could be assigned to a death in two situations:

1. The finding at the end of investigation could be that the cause of death remains entirely unknown. In that situation, R99 is likely to remain the appropriate cause code.
2. The ABS coder is aware of the existence of a coroner-certified death (normally through data from a Registrar of deaths), but little or no information has been entered into the NCIS, leaving R99 as the only applicable UCOD. In this situation, information may be added to the NCIS later, allowing a more specific cause to be coded in the *Revised* or *Final* release CODURF. Some of these deaths might be due to injury.

In reference years 1999 to 2002, fewer than 200 coroner-certified deaths per year in Australia were assigned UCOD R99. The number rose to about 400 per year in the next 3 years and ranged from 283 to 373 in *Final* release data for 2006 to 2008.

Taking 2007 as an example, 883 coroner-certified deaths with UCOD R99 in the *Preliminary* CODURF had a more specific cause code in the *Final* release, which was an external cause code in 303 deaths. Of these 303 deaths, the external cause was unintentional poisoning for 25%, intentional self-harm for 23% and transport-related injury for 16%. Intent was undetermined for 11%.

Appendix A: Selection criteria for NCIS-based estimates

Table A.1: Inclusion and exclusion criteria by external causes of injury for cases extracted from the NCIS website

External cause of injury	Criteria for inclusion	Criteria for exclusion
Drowning	Secondary Mechanism = 5.02	Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6
Poisoning, pharmaceuticals	Primary Mechanism = 6 *&* Object Level 1 = 20	Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6 *or* Secondary mechanism = 6.02 *or* Secondary mechanism = 6.98 or 6.99 unless *Medical Cause of Death1a* field contained the text 'toxicity' or 'overdose' *or* Tertiary mechanism = 6.01.3, 6.01.5, 6.01.6 or 6.01.7 *or* Object code level 2 = 20.40
Poisoning, other substances	Primary Mechanism = 6 *&* (Object Level 1 = 21 *or* Object level 2 = 20.40 *or* Object_description = 20.50.01 to 20.50.11)	Case Type at completion = 1 or Intent at completion = 2, 3, 4, 5 or 6 *or* Secondary mechanism = 6.98 or 6.99 unless *Medical Cause of Death1a* field contained the text 'alcohol' *or* Tertiary mechanism = 6.01.5, 6.01.6
Thermal (that is, smoke, fire and flames, heat and hot substances)	Secondary Mechanism = 4.01	(Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6) *or* Tertiary mechanism = 4.01.4
Suicide	(Case Type at Notification or Case Type at Completion = 2) *&* (Intent at Notification or Intent at Completion = 2 *or* Activity code Level 2 = 98.1)	Case Type at completion = 1 *or* Intent at completion = 1, 3, 4, 5 or 6
Contact with knife, sword or dagger	Tertiary mechanism = 2.01.3, 2.02.1, 2.02.8 or 2.02.9 *&* Object description = 8.01.05, 12.01.10 or 12.01.15	Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6
Unintentional hanging and strangulation	Tertiary mechanism = 5.01.1 or 5.01.2	Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6
Unintentional firearm discharges	Tertiary mechanism = 2.02.2 or 2.02.3	Case Type at completion = 1 *or* Intent at completion = 2, 3, 4, 5 or 6

Glossary

ABS reference year: the year to which the presented data refers. The scope for each reference year of the Deaths Registrations includes:

- deaths registered in the reference year and received by the ABS in the reference year
- deaths registered in the reference year and received by the ABS in the first quarter of the subsequent year
- deaths registered in the years before the reference year but not received by the ABS until the reference year or the first quarter of the subsequent year, provided that these records have not been included in any statistics from earlier periods.

NCIS case year: the year in which notification of a death was received by the coroner.

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List of tables

Table A.1: Inclusion and exclusion criteria by external causes of injury for cases extracted from the NCIS website 73

List of figures

Figure 4.1: Counts of all injury deaths, Australia, 1999 to 2010 27
Figure 4.2: Age-standardised rates for all injury deaths, Australia, 1999–00 to 2009–10 27
Figure 4.3: Unintentional transport injury deaths, Australia, 1999 to 2010 29
Figure 4.4: Unintentional motor vehicle traffic injury deaths, Australia, 1999 to 2012 29
Figure 4.5: Counts of unintentional drowning deaths, Australia, 1999 to 2010 33
Figure 4.6: Counts of unintentional drowning deaths, Australia, 1999–00 to 2012–13 34
Figure 4.7: Counts of unintentional pharmaceutical poisoning deaths, Australia, 1999 to 2010 38
Figure 4.8: Age-standardised rates of unintentional pharmaceutical poisoning deaths, Australia, 1999–00 to 2009–10 38
Figure 4.9: Counts of deaths involving unintentional poisoning by other substances by NCIS period, Australia, 1999 to 2010 42
Figure 4.10: Age-standardised rates of deaths involving unintentional poisoning by other substances, Australia, 1999–00 to 2009–10 42
Figure 4.11: Numbers of deaths involving unintentional fall 47
Figure 4.12: Counts of fall injury deaths, Australia, 1999–00 to 2009–10: all ages 50
Figure 4.13: Deaths involving unintentional fall injury, Australia, 1999–00 to 2009–10: age under 50 51
Figure 4.14: Counts of deaths involving thermal injury by NCIS period, Australia, 1999 to 2010 54
Figure 4.15: Age-standardised rates of deaths involving thermal injury, Australia, 1999–00 to 2009–10 54
Figure 4.16: Deaths involving other unintentional external causes of injury by NCIS period, Australia, 1999 to 2010 57
Figure 4.17: Deaths involving unintentional hanging and strangulation by NCIS period, Australia, 1999 to 2010 58
Figure 4.18: Deaths involving unintentional firearm discharge by NCIS period, Australia, 1999 to 2010 58
Figure 4.19: Deaths involving unintentional contact with sword, knife or dagger by NCIS period, Australia, 1999 to 2010 59
Figure 4.20: Coroner-certified deaths involving exposure to unspecified factor (UCOD X59) with no multiple cause code for fracture, Australia, 1999 to 2010 59
Figure 4.21: Counts of suicides deaths by NCIS period, Australia, 1999 to 2010 63

Figure 4.22: Age-standardised rates of intentional self-harm deaths, Australia, 1999–00 to 2009–10....64
Figure 4.23: Counts of deaths due to assault, Australia, 1999 to 2013....68
Figure 4.24: Counts of injury deaths with undetermined intent by NCIS period, Australia, 1999 to 2010....70
Figure 4.25: Counts of injury deaths with undetermined intent by reference year and CODURF release, Australia, 1999 to 2010....71

List of boxes

Box 1: Three eras of CODURF data....2
Box 2: Medical Certificate of Death....9

This technical report is a companion to the statistical report *Trends in injury deaths, Australia 1999–00 to 2009–10* and provides additional information on data sources and methods.

When comparing estimates of injury deaths based on Cause of Death Unit Record Files (CODURFs), produced by the Australian Bureau of Statistics (ABS) with other supplementary sources of information for external causes of injury mortality, CODURF based estimates for particular major external causes were consistent with estimates based on supplementary sources for several reference years before 2003 and from 2006 onwards, but differ to a noteworthy extent for several external causes from 2003 to 2006.