Australian mortality coding: history, benefits and future directions

Maryann Wood and Tara Pritchard

Introduction
The Australian Bureau of Statistics (ABS), Australia’s national statistical agency, processes around 130,000 deaths annually, using an automated coding system (ACS). The Mortality Medical Data System (MMDS) allows the classification of multiple causes of death in accordance with the current version of the International Classification of Diseases (ICD). This results in the coding of every condition mentioned on a death certificate as contributing to the death.

Multiple cause coding is best defined as: …the coding of all morbid conditions, diseases and injuries entered on the death certificate, including those involved in the morbid train of events leading to the death which were classified as either the underlying cause, the intermediate cause, or any intervening causes, and those conditions which contributed to death but were not related to the disease or condition causing death (Australian Bureau of Statistics 2006: p. 88).

The ABS implemented the MMDS system during 1997, after considerable research and testing using ICD-9 (World Health Organization 1975) and the subsequent introduction from 1999 of ICD-10 (World Health Organization 1984). The two previous years of data (1997 and 1998) were ‘back coded’ in ICD-10. All deaths occurring within Australia, registered from 1 January 1997, have been multiple cause coded in ICD-10.

Background to mortality coding in Australia
Prior to 1997 the ABS manually coded the ‘underlying cause of death’, assigned according to World Health Organization (WHO) guidelines. The underlying cause of death is defined as ‘the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury’ (Australian Bureau of Statistics 2006: p. 88).

When more than one condition is entered on the death certificate, the underlying cause is selected using the coding rules of the ICD. Since its adoption in 1948, statistics based on the underlying cause concept have served the purpose of summarising international cause-specific mortality statistics into a single index which has been used to assess trends in causes of death.

The rationale for introducing multiple cause coding
The leading causes of death have changed over time from infectious and parasitic diseases to chronic and degenerative diseases. As the population ages the focus on chronic diseases and understanding their comorbidities becomes increasingly important. Selecting only a single underlying cause leads to the loss of other valuable information that is often important in understanding disease processes.

The benefits of multiple cause coding
The need for the ABS to introduce multiple cause coding for causes of death has been recognised for some time. Major benefits of multiple cause coding include:

- an increase in the type and variety of data available for analysis
- an improved product for matching mortality and morbidity data
- an improved product for internationally comparable data
- further details on deaths from external causes (including nature of injuries).

Multiple cause coding allows researchers to focus on other levels of variables. Over four in every five deaths registered in Australia result in the recording of more than one condition on
the death certificate. Increasing analysis on the contributory causes, as well as traditional analysis of underlying causes, may increase the available knowledge on these conditions and offer alternatives in terms of treatment and/or prevention.

For example, of the 132,508 deaths registered in 2004, there were 404,366 causes reported giving a mean of 3.1 causes per death. Only one cause was reported in 19.4% of all deaths, whereas 56.3% of deaths were reported with three or more causes. (Australian Bureau of Statistics 2006)

Malignant neoplasms represented 28.7% of all underlying cause of death in 2004 as shown in Table 1. However, malignant neoplasms contributed to 39.4% of all deaths as either an underlying cause or associated cause. Similarly, 18.5% of all death were due to ischaemic heart disease as an underlying cause, but contributed to 35.5% of all deaths as either an underlying cause or associated cause.

Table 2 highlights the relationships between selected underlying causes of death and associated causes in 2004. Malignant neoplasms, the leading underlying cause of death (37,989 deaths), were reported alone in 37.5% of cases and although associated with a number of other causes, is less likely to be reported with other leading causes. In contrast, renal failure was reported alone as the underlying cause in only 8.8% (1,895) deaths and was reported more frequently with the associated cases of ischaemic heart disease and heart failure.

How the automatic coding system works
The ABS uses the MMDS software to undertake automated mortality coding. MMDS has been developed by the United States National Centre for Health Statistics (NCHS). Development of the software commenced in 1967. The software is based on the English language, and is the

Table 1: Multiple causes of death, 2004

<table>
<thead>
<tr>
<th>CAUSES OF DEATH AND ICD CODE</th>
<th>NUMBER</th>
<th>MULTIPLE CAUSES (A) % RANK</th>
<th>UNDERLYING CAUSES % RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant neoplasms (C00-C97)</td>
<td>52 217</td>
<td>39.4 1</td>
<td>28.7 1</td>
</tr>
<tr>
<td>Ischaemic heart disease (I20-I25)</td>
<td>46 985</td>
<td>35.5 2</td>
<td>18.5 2</td>
</tr>
<tr>
<td>Cerebrovascular diseases (I60-I69)</td>
<td>23 359</td>
<td>17.6 3</td>
<td>9.1 3</td>
</tr>
<tr>
<td>Influenza and pneumonia (J10-J18)</td>
<td>18 305</td>
<td>13.8 4</td>
<td>2.6 7</td>
</tr>
<tr>
<td>Heart failure(I50)</td>
<td>16 837</td>
<td>12.7 5</td>
<td>1.7 10</td>
</tr>
<tr>
<td>Hypertensive diseases (I10-I15)</td>
<td>15 605</td>
<td>11.8 6</td>
<td>1.0 16</td>
</tr>
<tr>
<td>Renal failure (N17-N19)</td>
<td>15 235</td>
<td>11.5 7</td>
<td>1.4 12</td>
</tr>
<tr>
<td>Chronic lower respiratory disease (J40-J47)</td>
<td>14 190</td>
<td>10.7 8</td>
<td>4.4 4</td>
</tr>
<tr>
<td>Organic, including symptomatic, mental disorders (F00-F09)</td>
<td>11 843</td>
<td>8.9 9</td>
<td>2.2 8</td>
</tr>
<tr>
<td>Diabetes mellitus (E10-E14)</td>
<td>11 749</td>
<td>8.9 10</td>
<td>2.7 6</td>
</tr>
<tr>
<td>Deaths from all causes</td>
<td>132 508</td>
<td>100.0 –</td>
<td>100.0 –</td>
</tr>
</tbody>
</table>

– nil or rounded to zero (including null cells)
(a) Number of deaths and percentages may add to more than totals because a death certificate can report more than one leading multiple cause.

internationally accepted standard for automated mortality coding. Work is currently being undertaken collaboratively by a number of countries to develop a language independent automated coding system.

Three main programs make up the MMDS software suite: SuperMICAR, MICAR200 and ACME/TRANSAX.

- SuperMICAR is a text searching application designed to automatically encode medical cause of death data into numeric entity reference numbers (ERN). The software takes ‘cause’ text and splits it into separate causes ignoring noise words, such as ‘massive’, ‘terminal’, and ‘life threatening. For example, if ‘myocardial infarction due to hypertension’ is recorded on one line of the certificate, it will be separated into two causes: the hypertension and the myocardial infarction. Each cause is then analysed, and a unique numeric code (ERN) for each accepted cause of death term is assigned.

SuperMICAR contains a thesaurus, dictionary and word list. The dictionary holds valid descriptions for each ERN, while the thesaurus contains synonyms for words which cannot be matched in the dictionary. For example, the word ‘narrowing’ may be recorded instead of the medical term stricture. Finally, the word list contains words which are to be ignored and words which separate causes. For example, the words ‘left’ and ‘right’ are important in some cases for coding but superfluous in others. Alternatively, in the above case of myocardial infarction due to hypertension, the ‘due to’ are words which are used to separate causes. The ERNs represent a much more detailed classification than

<table>
<thead>
<tr>
<th>Selected underly cause</th>
<th>Reported with selected associated cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of deaths</td>
<td>Reported alone</td>
</tr>
<tr>
<td>NO.</td>
<td>%</td>
</tr>
<tr>
<td>Malignant neoplasms (C00-C97)</td>
<td>37 989</td>
</tr>
<tr>
<td>Ischaemic heart diseases (I20-I25)</td>
<td>24 576</td>
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<td>1 895</td>
</tr>
</tbody>
</table>

– nil or rounded to zero (including null cells)

(a) This table presents data for selected causes only. Numbers and percentages due to reporting of underlying cause with selected associated cases do not add to totals.

the various versions of the International Classification of Diseases. The design of this system enables a smoother transition between versions of the ICD.

- MICAR200 performs editing and validation functions by accessing mortality coding rules, which are held in look-up files, together with a dictionary. These rules are applied to the ERNs assigned during the SuperMICAR process, to produce ICD multiple cause codes.

- ACME/TRANSAX applies World Health Organisation (WHO) rules to the ICD codes determined by MICAR200. ACME uses a number of look-up tables to allocate underlying cause codes appropriately. ACME makes implicit linkages between multiple causes in assigning ICD codes for underlying cause. TRANSAX identifies the relationship between conditions mentioned on the death certificate, and then assigns an ICD code for any significant combinations. For example, if diabetes mellitus is recorded in Part I of the certificate, and coma is mentioned in Part II, ACME will initially assign a code of E14.9, Diabetes without mention of complication for Part I. However taking all of the information on the certificate into account, the correct code to assign would be E14.0, Diabetes with coma. TRANSAX performs this ‘translation’ of the ‘axis’ from entity coding to coding of a particular person, taking into account all causes recorded on the certificate.

Benefits of an automated coding system

In addition to the benefit of allowing for all the conditions on the death certificate to be coded, this system offers several other advantages, including:

- removal of the subjectivity inherent in manual systems, through the use of pre-coded logic (a percentage of coding still requires manual intervention)
- generation of more internationally comparable mortality statistics.

Future plans

Future MMDS developments

NCHS is currently developing future directions for MMDS. The most important of these will be the development of SuperMICAR as a web based service. ‘Web-Micar’ is the redevelopment of the MMDS suite of software in line with current technologies by integrating web based functions with current MMDS functionality. This process is currently in the design phase and is not expected to be implemented for another two to three years.

ABS developments

For the processing of 2006 mortality data, the ABS will introduce a later version of MMDS than that which is currently used. Moving to a later version of MMDS will allow the ABS to take advantage of the increased functionality, particularly with regard to the SuperMICAR component of the MMDS system. Concurrently with the move to the new version of MMDS, the ABS is undertaking a redevelopment of all the components of mortality processing. Many functions which are currently performed manually will be automated. This will result in coders spending more time ‘coding’ and less time on administrative IT tasks, for example moving files and records through the MMDS software.

ICD-11

Work has commenced on the development of ICD-11. The focus for the new revision will be improving the classification for the purposes...
Reports

of health service activity and morbidity. It is expected that the new version will be presented to the WHO General Assembly in 2012 for implementation in 2015. With regard to mortality statistics, the major changes will be in Volume 2 of the classification. This volume will be completely re-written using different concepts. The National Centre for Health Classification will take responsibility for leading Australian input and comment into this eleventh revision of the ICD.

Coder certification
The World Health Organization-Family of International Classifications (WHO-FIC) Education Committee, in partnership with the International Federation of Health Records Organizations (IFHRO), is currently developing a standardised international curriculum for the training of mortality coders. Successful completion of the training will lead to an internationally recognised certification process. The certification process will be put in place for mortality coders as well as those training mortality coders. This is an opportunity to increase knowledge and proficiency, leading to higher quality national and international data, and to provide recognition of coders’ skills.

Current practicing coders will have an opportunity to obtain certification through a one-off certification process for one year after commencement of the certification program. Certification will assess a coder’s ability to read and comprehend death certificates and to recognise and select the proper ICD-10 code for the underlying cause of death, based on international conventions for use of the ICD. Current practicing coders will undertake an exam built around the coding part of the core curriculum. Practicing coders would successfully code 50 certificates, describe the rules they have used, and explain their selection. The certificates would feature a variety of situations, such as external causes and maternal mortality.

Summary
The introduction of multiple cause coding has been a major step in enhancing the usefulness of causes of death statistics as a basis for providing researchers with a better understanding of the circumstances associated with mortal events. While the main focus of the data relates to the health area, it also provides a rich source of demographic information that can be further refined to show interesting similarities and differences in groupings within the population.

References

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