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Monitoring acute coronary syndrome using national hospital data

An information paper on trends and issues

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Abbreviations

ABS	Australian Bureau of Statistics
ACACIA	Acute Coronary Syndrome Prospective Audit
ACHI	Australian Classification of Health Interventions
ACS	acute coronary syndrome
AIHW	Australian Institute of Health and Welfare
AMI	acute myocardial infarction
ARIA	Accessibility/Remoteness Index of Australia
ASGC-RA	Australian Standard Geographical Classification - Remoteness Area
ASR	age-standardised rate (per 100,000 population)
CABG	coronary artery bypass grafting
CHD	coronary heart disease
ECG	electrocardiogram
ICD	International Classification of Diseases and Related Health Problems
ICD-9	International Classification of Diseases, Ninth Revision
ICD-10	International Classification of Diseases, Tenth Revision
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
LOS	length of stay
MONICA	Multinational MONItoring of trends and determinants in CArdiovascular disease project
NMD	National Mortality Database
NHMD	National Hospital Morbidity Database
NSTEMI	non-ST segment elevation myocardial infarction
PCI	percutaneous coronary intervention
STEMI	ST segment elevation myocardial infarction
UA	unstable angina
WHO	World Health Organization

Summary

The term 'acute coronary syndrome' (ACS) refers to the spectrum of acute coronary artery diseases spanning acute myocardial infarction (AMI) and unstable angina (UA). They are sudden, severe and life-threatening events.

Currently there is no way to directly count the number of ACS events at a national level. Instead, estimates are derived using an algorithm developed in the late 1990s, based on national hospital and deaths data. However, over the past decade, considerable changes have occurred in diagnostic techniques, clinical practice and the coding of diseases in hospital data. It is timely, therefore, to review the algorithm for estimating the incidence of ACS events.

As a first step, this report examines the trends and patterns in hospital data in relation to ACS, looking in detail at those factors most likely to impact on the ACS algorithm. The findings from the analysis reflect the changing patterns of diagnosis, care and treatment for hospital patients with ACS. In summary:

- The number of AMI and UA hospitalisations increased between 1993–94 and 2007–08 (79.5% and 33.1%, respectively). In 2007–08 there were almost 56,000 hospitalisations for AMI and 39,000 for UA. Note that, due to hospital transfers, one ACS event may be associated with multiple hospitalisations.
- The rate of transfer associated with ACS hospitalisations has increased over the past decade.
- The length of stay for ACS hospitalisations has declined.
- The proportion of AMI hospitalisations ending in death in hospital almost halved over the period from 1998–99 to 2007–08.
- The number and rate of cardiac procedures have increased considerably.

As ACS deaths are included in the incidence algorithm, mortality data are also briefly examined in this report. In 2007, 22,729 people died from coronary heart disease (CHD). Half of these had AMI recorded as the underlying cause of death.

Finally, the report presents a range of alternative algorithms for the estimation of ACS incidence based on results from the analysis. It is not currently possible to validate these against independent counts of ACS.

Despite differences in the actual estimates, all algorithms show the same trend direction, with a decline in the incidence of ACS events and case-fatality over the past 10 years.

1 Introduction

1.1 Background

The term 'acute coronary syndrome' (ACS) refers to the spectrum of acute coronary artery diseases spanning acute myocardial infarction (AMI) and unstable angina (UA). They are sudden, severe and life-threatening events.

Currently there is no way to directly count the number of ACS events at a national level. Australia does not have a national register of ACS or a database that enables individual ACS events to be identified and examined. Instead, two administrative collections, the Australian Institute of Health and Welfare (AIHW) National Mortality Database (NMD) and the AIHW National Hospital Morbidity Database (NHMD), are used to calculate estimates of the number of ACS events and the proportion of those that result in death (case-fatality). The ACS algorithm was developed in the late 1990s and validated against data collected in the Multinational MONItoring of trends and determinants in CArdiovascular disease project (MONICA) study in Perth and Newcastle over a 10-year period between 1984 and 1994 (Jamrozik et al. 2001).

Over the past 10 years, considerable changes have occurred in the awareness of ACS in the population, diagnostic techniques to identify ACS, clinical practice, treatment protocols, the coding of diseases and in the quality of data collected from hospitals. Linked hospital and mortality data from Western Australia suggest that the current algorithm may no longer be an accurate measure, at least for that jurisdiction (Sanfilippo et al. 2008).

It is timely, therefore, to review the algorithm for estimating the incidence of ACS events and case-fatality. To do this properly, however, it is first necessary to analyse the trends and patterns in hospital data in relation to ACS, to assist in understanding the issues that are likely to impact on the interpretation of those trends.

This report examines hospitalisations for ACS over the past decade, looking in detail at those factors most likely to impact on the estimation of ACS events, including hospital transfer rates, length of stay, urgency of admission and hospital deaths. The main procedures for ACS are also examined.

In addition, a brief analysis of trends in deaths from coronary heart disease (CHD) is included, as this also forms part of the algorithm for estimating ACS events and case-fatality.

The analysis has been undertaken at a national level, as this is the level at which the monitoring of ACS is required.

Due to the nature of this report, the terminology used throughout is sometimes required to be technical or clinical. To assist readers, a detailed glossary is provided at the back of this report.

1.2 Objectives

This is a technical report undertaken to improve our understanding of hospital data in relation to ACS, and to review our current method of monitoring ACS. The aims of this analysis are to:

- gain a better understanding of the trends in hospitalisations for ACS, in order to improve the monitoring of ACS using existing administrative data (the NHMD and the NMD)

- review the current algorithm for estimating ACS events and case- fatality, based on findings from the analysis of the trends in hospitalisations for ACS and mortality data for CHD
- present a range of alternative algorithms for measuring the incidence of ACS events and case-fatality, to demonstrate the sensitivity to different assumptions.

The key questions being addressed in this report are:

- What are the trends in ACS in the NHMD?
- What are the issues that impact on interpretation of those trends?
- Is the current derivation of the incidence of ACS events from the NHMD and NMD still appropriate?
- What are the options for future monitoring of ACS events?

1.3 Structure of report

The first chapters of this report provide definitions of ACS, of how the number of ACS events and case-fatality are currently estimated from the NHMD and NMD, and the reasons for reviewing the current estimation method.

It then provides a brief discussion of some of the main changes that have occurred in relation to ACS and how these are likely to have impacted on hospital data in the NHMD and the interpretation of trends in that data.

The body of the report presents trends in ACS hospitalisations, looking separately at those for AMI and UA. Trends in hospitalisations for 'chest pain', which is not part of ACS but an indicator of broader change in hospitalisations for suspected acute heart disease events, are also presented. Trends by age and sex of hospitalisations and in length of stay, urgency of admission, transfers and cardiac procedures are presented. The trends are presented mainly as graphs, for ease of interpretation. However, detailed tables are provided in a separate document on the AIHW website (www.aihw.gov.au).

The report also provides a very brief discussion of CHD deaths and how these affect the estimation of ACS events and case-fatality.

Finally, the report presents alternative algorithms for estimating the incidence of ACS events and case-fatality from the NHMD and NMD to illustrate the sensitivity of the algorithm to different assumptions.

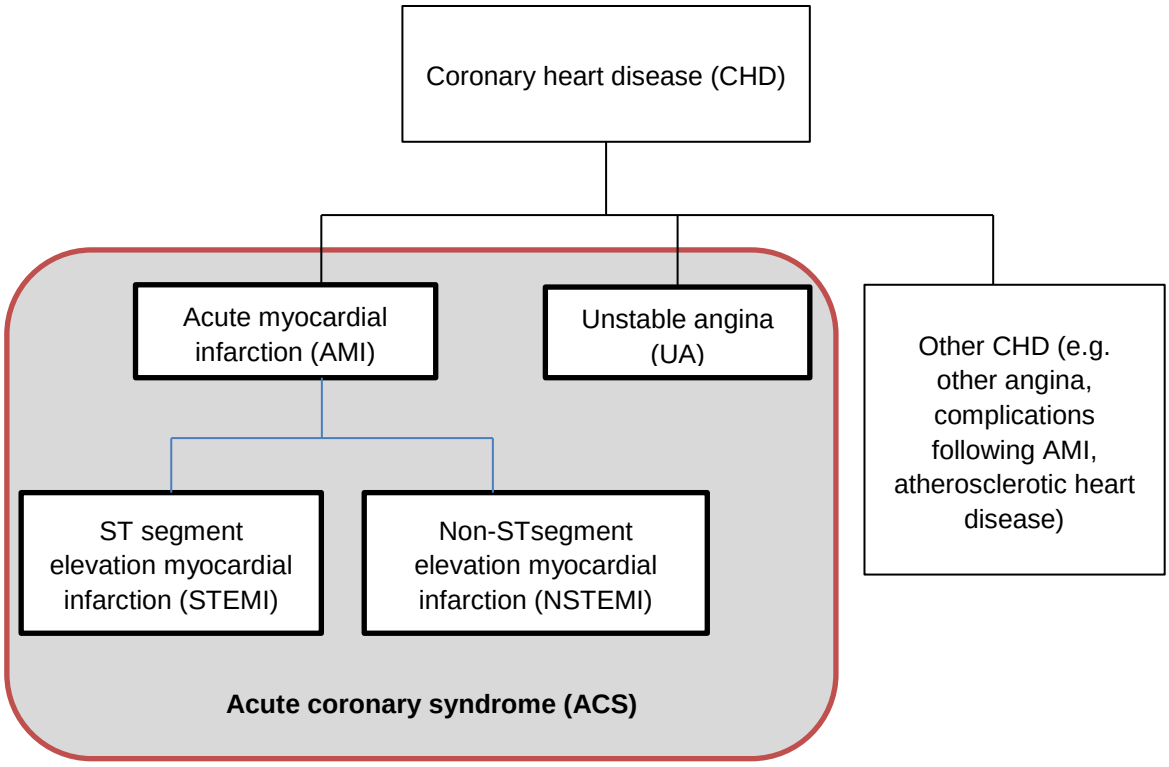
2 Background

2.1 What do we mean by acute coronary syndrome (ACS)?

Acute coronary syndrome (ACS) is the result of a sudden incomplete or complete blockage of a coronary blood vessel, leading to a compromise in blood supply to a portion of heart muscle. This compromise will often, but not always, lead to injury or death of heart muscle.

The underlying cause of ACS is most commonly atherosclerosis, a condition in which an artery wall thickens as the result of a build-up of fatty materials such as cholesterol. Atherosclerosis is a chronic disease that may remain asymptomatic for decades. However, if the atherosclerotic plaque ruptures, a resulting clot can lead to a complete or incomplete blockage of the coronary vessel, restricting oxygen to the heart muscle (Chew et al. 2005).

ACS includes a broad spectrum of clinical presentations, spanning a continuum from acute myocardial infarction (AMI), through to unstable angina (UA) (Figure 2.1). Collectively, these diseases represent one of the most common causes of acute medical admissions to Australian hospitals.



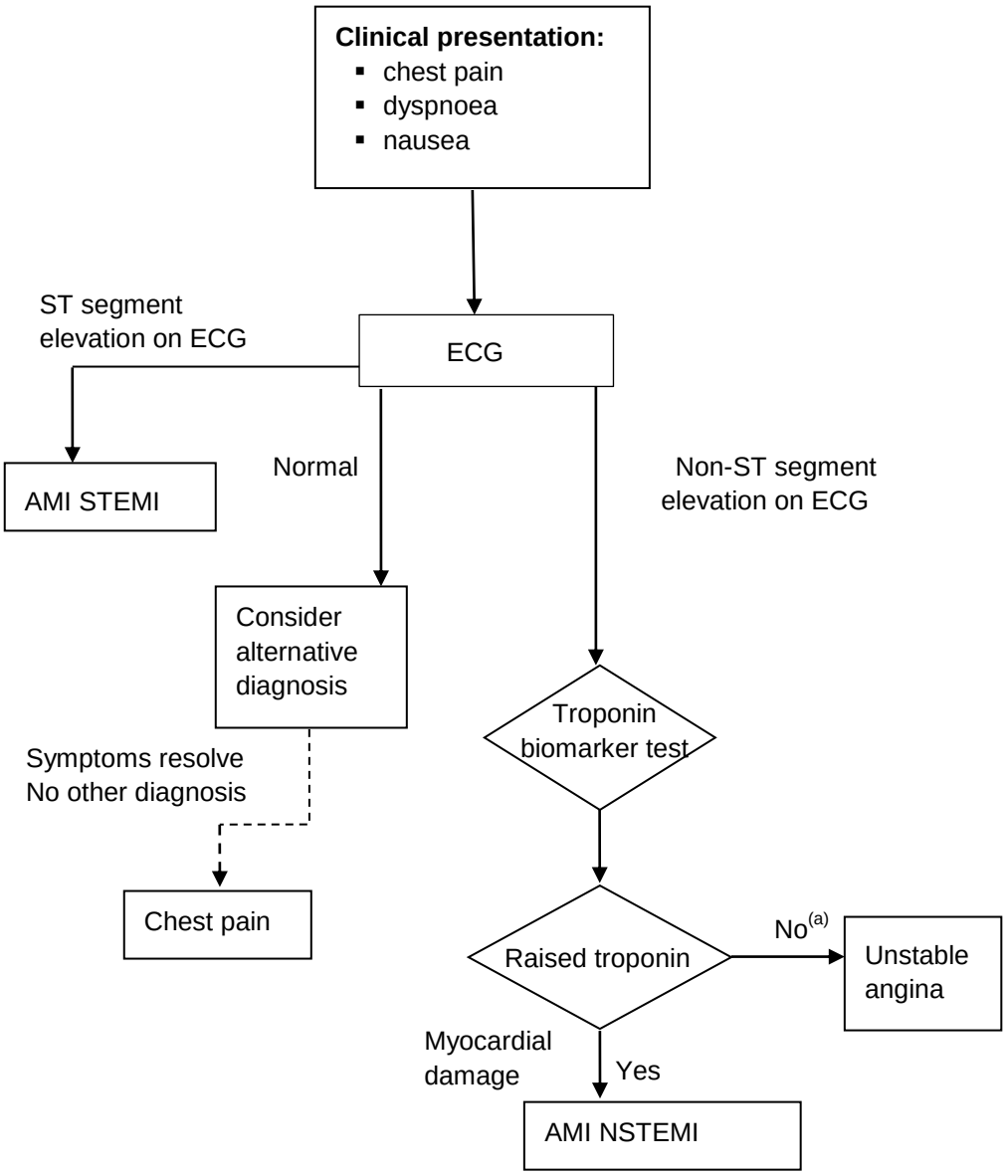
Note: ST segment elevation observed on an electrocardiogram (ECG).

Figure 2.1: What is acute coronary syndrome?

Death directly attributable to UA is uncommon, but people with UA are at imminent and very high risk of an AMI. Death from an AMI is much more common. The risk of death is

greater if the blood supply is not quickly restored through either medications that break up blood clots, or a procedure that opens the blocked artery.

Figure 2.2 illustrates, in a very simplified manner, the clinical pathways for the diagnosis of an ACS event for patients presenting to hospital with relevant symptoms (such as chest pain).



(a) If negative, troponin test should be repeated ≥8 hours after the last episode of pain.

Source: Modified from National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand 2006.

Figure 2.2: Clinical pathways for identification of acute coronary syndrome

Acute myocardial infarction

AMI is commonly termed a heart attack, but more correctly refers only to those heart attacks that have caused some death of heart muscle.

Clinically, AMI is often categorised based on the pattern that appears on the electrocardiogram (ECG) (a diagnostic tool that measures and records the electrical activity of the heart). The most severe AMI is an 'ST segment elevation myocardial infarction' (or STEMI), so named because the 'ST segment' on the ECG appears elevated. STEMI is when there is a blockage to a major coronary artery.

Non-ST segment elevation myocardial infarction (NSTEMI) also results in the death of heart muscle cells, but to a lesser extent than STEMI. It is thought to be a result of locally decreased blood supply, possibly from a narrowing of the coronary arteries. Unlike STEMI, the 'ST segment' on the ECG is not elevated.

In this report STEMI and NSTEMI are analysed together as an AMI and included with UA as ACS.

AMI may also be categorised based on the thickness of heart tissue affected. A transmural AMI involves death of the full thickness of the affected muscle segments, extending from the endocardium through the myocardium to the epicardium. In a nontransmural (or subendocardial) AMI, the area of tissue death is limited to the endocardium or to the endocardium and myocardium.

What is unstable angina?

Similarly to AMI, UA is most often caused by the rupture of a plaque in a coronary artery. In UA the ruptured plaque, and the blood clot commonly associated with it, produce a partial blockage of the artery. The partial blockage may take a 'stuttering' pattern (as the blood clot dynamics change), producing symptoms that come and go in an unpredictable fashion. The main difference between NSTEMI and UA is that in NSTEMI the severity of the blockage to the blood supply is sufficient to cause death of heart tissue.

The imminent risk of an AMI is very high in people with UA. If the clot causes complete obstruction of the artery, the heart muscle supplied by that affected artery may sustain irreversible damage.

2.2 Why monitor ACS events on a national level?

Coronary heart disease (CHD) is one of the major causes of death in Australia, directly responsible for 22,729 deaths in 2007. CHD is also one of the main contributors to the burden of disease, particularly the burden due to premature death. In 2003, CHD was the leading contributor to mortality burden, measured in years of life lost, for both men and women (18.2% and 15.7%, respectively). Fatal events account for over 80% of the total CHD burden (Begg et al. 2007).

In 2007, half of all CHD deaths (11,353) had AMI recorded as the underlying cause of death. The damage caused by an AMI can also lead to ongoing chronic heart failure.

In 2007–08 there were 161,417 hospitalisations for CHD, of which 34.7% had a principal diagnosis of AMI and 24.0% of UA. In addition, there were 115,684 hospitalisations with a principal diagnosis of 'chest pain'.

Changes in the number and outcomes of ACS events reflect the effectiveness of both primary and secondary preventive measures, as well as the effectiveness of reperfusion treatments (such as angioplasty and bypass surgery). Therefore, having an accurate means to monitor ACS over time is very important.

2.3 How do we currently monitor ACS events?

Currently there is no ongoing national register of ACS in Australia. There are data collections conducted at a local level and there have been snapshot collections across a sample of hospitals. An example of the latter is the Australian Collaborative Acute Coronary Syndrome Prospective Audit (ACACIA) register. ACACIA was conducted between November 2005 and May 2006 in 39 hospitals across Australia, selected to represent the demographic variability of hospitals across the country. ACACIA collected information on patients with ACS, their treatment and outcomes (Chew et al. 2008).

The AIHW currently monitors the number of acute coronary events using hospitalisations sourced from the NHMD and deaths from the NMD. The algorithm to calculate the estimate was developed in the late 1990s and was validated against 'gold standard' data on acute coronary events in Perth and Newcastle collected over a 10-year period from 1984 through the World Health Organization (WHO) MONICA study (Jamrozik et al. 2001). This algorithm is still used to estimate the number of acute coronary events and case-fatality/survival rates in Australia, and for monitoring trends in ACS. It is described in Box 2.1. Incidence and case-fatality are usually presented for males and females aged 40–90.

Box 2.1: Current algorithm for estimating acute coronary events and case-fatality

The incidence of acute coronary events in each year is estimated by:

The number of non-fatal hospitalisations with a discharge date in the calendar year, with a principal diagnosis of acute myocardial infarction (AMI) and with a length of stay greater than or equal to 3 days

PLUS

The number of deaths (in and out of hospital) with an underlying cause of coronary heart disease (CHD) registered in the calendar year.

The case-fatality is the proportion of acute coronary events that were fatal. It is calculated by:

The number of CHD deaths registered in a year divided by the estimated number of acute coronary events (as calculated above), multiplied by 100.

That is:

$$Incidence = \frac{Non\text{-}fatal\ hospitalisations\ (A) + Deaths\ (B)}{Estimated\ resident\ population\ Australia} \times 100{,}000$$

$$Case\text{-}fatality = \frac{Deaths\ (B)}{[Non\text{-}fatal\ hospitalisations\ (A) + Deaths\ (B)]} \times 100$$

$A = principal\ diagnosis = AMI + length\ of\ stay \geq 3\ days$

$B = CHD\ deaths$

As the NHMD does not have a unique patient identifier, multiple hospitalisations (hospital episodes or separations) for an individual's acute coronary event cannot be linked. So a person who is transferred from one hospital to another (such as for treatment) will have multiple episodes for the one acute coronary event in the NHMD. In an attempt to account

for this and to only count individual acute coronary events once, hospitalisations are limited to those with a length of stay of 3 or more days. Only non-fatal hospitalisations are included as all deaths from acute coronary events (both those occurring in hospital and those outside hospital) are sourced from the NMD.

2.4 Why review the current method of estimating ACS events?

There have been considerable changes in the diagnosis, recording, treatment and understanding of acute coronary events since the development and validation of the method to estimate incidence and case-fatality from acute coronary events over a decade ago. These changes, detailed in Chapter 4, are likely to have an impact on the characteristics and coding of hospitalisations for ACS. Given these changes and their likely impact on the current method of monitoring ACS, it is timely to review the NHMD data on ACS and how they may better be used to monitor in the future.

The current algorithm counts only AMI hospitalisations, reflecting the clinical focus at the time of development and validation. However, it is now considered important to monitor acute coronary events in a broader sense, including UA as well as AMI. UA and AMI are part of a continuum and patients are subject to the same protocols and treatments. If untreated, UA patients are at imminent risk of having an AMI.

3 Data sources, codes and methods

3.1 National Hospital Morbidity Database

The AIHW's NHMD is a compilation of episode-level records from admitted patient data collection systems in Australian hospitals. The database contains data relating to admitted patients in almost all hospitals, including public acute hospitals, public psychiatric hospitals, private acute hospitals, private psychiatric hospitals and private free-standing day hospital facilities. Public sector hospitals that are not included are those not within the jurisdiction of a state or territory health authority (hospitals operated by the Department of Defence or correctional authorities, for example, and hospitals located in offshore territories).

The data supplied are based on the National Minimum Data Set for Admitted Patient Care and include demographic, administrative and length of stay data, and data on the diagnoses of the patients, the procedures they underwent in hospital and external causes of injury and poisoning.

The data are episode-based, and do not contain identifiers for individual people. As a result, it is not possible to count patients individually. A 'hospitalisation' or 'separation' refers to an episode of care for an admitted patient, which can be a total hospital stay (from admission to discharge, transfer or death), or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation).

In this report, counts of hospitalisations exclude those with a care type of: newborn without qualified days, hospital boarders and posthumous organ procurement (standard exclusions).

Diagnosis codes for ACS events

Each hospitalisation in the NHMD has a principal diagnosis recorded. This is the diagnosis chiefly responsible for occasioning the patient's episode of admitted care in hospital. Other additional diagnoses may also be recorded. Diagnoses have been coded to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) by clinical coders in each hospital, based on the diagnosis reported by a medical practitioner on discharge of the patient. The diagnosis is recorded for each hospital episode and is specific to that episode.

Acute coronary events resulting in admission to hospital are highly likely to be the major reason for the hospitalisation. Thus only principal diagnosis is examined in this analysis. The ICD-9-CM and ICD-10-AM codes used for this analysis are shown in Table 3.1 and provided in more detail in Appendix A.

Table 3.1: ICD-9-CM and ICD-10-AM codes for hospitalisations for ACS (AMI and UA)

Condition	ICD-9-CM codes (1993–94 to 1998–99)	ICD-10-AM codes (1998–99 to 2007–08)
Acute myocardial infarction (AMI)	410	I21, I22
Unstable angina (UA)	411.1	I20.0

It should be noted that for this analysis AMI includes ICD-10-AM code I22 which is 'subsequent AMI'. This is to be consistent with ICD-9-CM code 410 as far as possible. The number of hospitalisations for I22 is relatively small (see Table 3.2).

Table 3.2: Hospitalisations for subsequent AMI (ICD-10-AM code I22), Australia, 1998–99 to 2007–08

Condition	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
I22	358	635	486	426	349	360	290	294	310	321
AMI (I21+I22)	33,908	36,053	38,158	40,759	44,118	47,245	47,923	49,828	51,977	55,997
I22 as % of AMI	1.1	1.8	1.3	1.0	0.8	0.8	0.6	0.6	0.6	0.6

Source: AIHW National Hospital Morbidity Database.

Hospitalisations with a principal diagnosis of chest pain are also discussed in this analysis. Chest pain is not included with diseases of the circulatory system in ICD-9-CM or ICD-10-AM but under *Symptoms, signs and ill-defined conditions* in ICD-9-CM and *Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified* in ICD-10-AM. The codes are provided in Table 3.3.

Table 3.3: ICD-9-CM and ICD-10-AM codes for chest pain

Condition	ICD-9-CM codes (1993–94 to 1998–99)	ICD-10-AM codes (1998–99 to 2007–08)
Chest pain	786.5	R07

The analysis and discussion of the morbidity data in this report are restricted to the period to 2007–08. This approach is taken as the aim of this report is to assess the algorithm currently used to monitor ACS (Box 2.1) and to present alternative possible algorithms. A major component of the algorithm, in addition to non-fatal hospitalisations for ACS, is the number of deaths from CHD. The latest detailed mortality data currently available to the AIHW are for 2007. As a result, the algorithm can only be calculated to 2007, using 2006–07 and 2007–08 hospitalisation data from the NHMD.

However, to enable trends for ACS hospitalisations to be placed in the current context, the figures and tables for overall trends have been extended to include 2008–09 and 2009–10 data.

3.2 National Mortality Database

The AIHW's NMD contains information about all deaths registered in Australia since 1964. Deaths are certified by a medical practitioner or the coroner and registered by the Registrar of Births, Deaths and Marriages in each state and territory. The Australian Bureau of Statistics codes the cause of death using international standards (ICD-9 and ICD-10). Information from the National Coronial Information System is used to code the cause of death for those deaths certified by a coroner.

As with hospitalisations, this analysis is only concerned with deaths with a main cause of ACS. Therefore, only underlying cause of death is considered. The codes used for ACS deaths for this report are provided in Table 3.4.

Table 3.4: ICD-9 and ICD-10 codes for deaths for AMI, UA and CHD

Condition	ICD-9 codes (1979–1996)	ICD-10 codes (1997–2007)
Acute myocardial infarction (AMI)	410	I21, I22
Unstable angina (UA)	411.1	I20.0
Other acute CHD	. .	I24
Chronic CHD	. .	I25
Coronary heart disease (CHD)	410–414	I20–I25

Note that 2007 deaths data presented in this report are preliminary and final numbers may vary slightly.

3.3 Statistical methods

Trends in numbers, proportions, and age-specific and age-standardised rates are presented in this report in tables and graphs.

Age-standardised rates are presented for the overall trends and for the alternative algorithms. Age-standardisation takes account of the effect of changes in the age structure of the population over time, and differences in the age structure of the male and female populations within the 1 year.

The method for age-standardisation used in this report is provided in Appendix B.

4 Issues that impact on monitoring ACS events using national hospital data

Over the past decade there have been considerable changes in the diagnosis, recording, treatment and understanding of acute coronary events. These need to be taken into account when reviewing the current algorithm for monitoring acute coronary events (described in Box 2.1), and for developing alternative options for monitoring in the future using the NHMD.

4.1 Changes to coding and coding standards

The data in the NHMD are coded using various modifications and editions of the International Statistical Classification of Diseases and Related Health Problems (ICD). These include both specific coding standards and guidelines. The coding is based on diagnostic information included in patient medical records and provided by clinicians.

Information on diagnoses, procedures and external causes was provided to the NHMD using ICD-9-CM for the years 1993-94 to 1997-98. For 1998-99, South Australia, Western Australia, Tasmania and Queensland provided data using ICD-9-CM, while New South Wales, Victoria, the Northern Territory used ICD-10-AM. Mapping backwards to ICD-9-CM for some jurisdictions and forward to ICD-10-AM for the other jurisdictions was undertaken to provide data coded to both ICD-9-CM and ICD-10-AM for 1998–99 (these two points are shown in trend graphs in this report). For the years 1999-00 to 2009–10, all states and territories used ICD-10-AM.

The change from ICD-9-CM to ICD-10-AM had an impact on the codes for some of the components of ACS, particularly the code for UA. Under ICD-9-CM (before 1998–99), UA was included as part of the subcategory called intermediate coronary syndrome (ICD-9-CM code 411.1), which also included impending infarction, preinfarction angina and preinfarction syndrome. With the change to ICD-10-AM in 1998–99, UA was coded as a separate subcategory on its own (ICD-10-AM code I20.1).

AMI was previously coded as ICD-9-CM codes 410.0 to 410.9 (with a fifth digit to be used to identify whether it was an initial or subsequent AMI). Under ICD-10-AM, the codes for AMI are I21 and I22.

The ICD-9-CM and ICD-10-AM codes for AMI and UA are provided in detail in Appendix A.

Similar changes in coding were implemented for mortality data in 1997 with the change from ICD-9 to ICD-10 (see Table 3.4).

With new editions of the ICD-10-AM there have also been changes to the coding directions, coding standards and wording of some disease codes. These changes have affected both UA and AMI. Wording of the AMI codes in ICD-10-AM was revised in the fourth edition ICD-10-AM (July 2004), with the introduction of references to 'STEMI' and 'NSTEMI' AMI. All transmural AMI (ICD-10-AM codes I21.0 to I21.3) had the additional label of 'STEMI' added, while subendocardial AMI (I21.4) was labelled 'NSTEMI'. This combines two different measures of AMI (with transmural/subendocardial diagnoses being based on pathology results and STEMI/NSTEMI being based on ECG results). There is some overlap between these measures—a STEMI AMI can be subendocardial and a NSTEMI AMI can be

transmural. However, as it is often the ECG diagnosis that dictates the diagnosis and care, rather than pathology results, it seems that the coding of AMI as a STEMI or NSTEMI is likely to be reasonably accurate from 2004 onwards.

4.2 Changes in diagnostic tests

The use of biomarkers, particularly cardiac troponins (Box 4.1), has become fundamental to the diagnosis of AMI. These are used in conjunction with an ECG and with a clinical assessment of the patient's symptoms and history. Figure 2.2 provides high level information on how these biomarkers are used in the identification of ACS.

Box 4.1: Biomarkers for diagnosis of acute myocardial infarction (AMI)

A number of different biomarkers are used to detect damage to cardiac tissue and the tests continue to be developed and improved upon. Improvements made to tests can result in benefits such as ruling out acute coronary syndrome (ACS), identifying less severe AMIs and faster diagnosis and more appropriate management of patients with ACS.

Cardiac troponins have become commonly used for the diagnosis of AMI in recent years as they are highly accurate, sensitive and specific for the detection of cardiac tissue damage. There are two cardiac-specific forms of troponin, T and I, and they can be detected in the bloodstream 3–6 hours after symptom onset during an AMI. Their levels remain elevated for a prolonged period of time. Therefore their usefulness for the detection of recurrent AMI is limited. Troponins must be measured on multiple occasions some hours apart to rule out cardiac tissue damage. They can be used to determine the patient's risk status as there is a relationship between the elevation of troponins and a poor outcome for the patient. Highly sensitive tests are emerging and point-of-care testing is being used at the bedside to reduce time delays so that treatment decisions can be made more rapidly.

Creatine kinase-MB was the most commonly used marker before the introduction of cardiac troponin testing. It is a protein that is predominantly found in cardiac cells and released into the bloodstream in response to cardiac tissue damage during an AMI. However, it is also found in other cell types, including skeletal muscle, which limits its specificity as it is elevated during muscle trauma, such as during surgery. It has a short half-life so it can be useful for the diagnosis of a re-infarction.

Myoglobin is a small protein found in all tissues that can be used during the early stages following AMI symptom onset as its levels rise early and rapidly. However, it has limited use as a stand-alone marker as it has low specificity for AMI and can be elevated in patients with renal failure or skeletal muscle trauma. It is commonly used in conjunction with creatine kinase-MB or cardiac troponins.

Of particular importance in the past 10 years has been the introduction and widespread adoption in clinical practice of tests for troponins which, compared with previously available biomarkers of AMI, are highly specific and sensitive tests for cardiac cell death. As a result, it is probable that a larger number of less severe AMIs are now being identified and coded as AMI. These may have been more likely to be diagnosed and coded as UA previously.

However, it should be noted that other conditions can also lead to an elevation in the biomarkers, and with the development of more sensitive tests, the possibility for over-diagnosis of AMI may have increased.

4.3 Changes in clinical practice

Clinical practice in relation to ACS is changing rapidly as more is learnt about the disease and how to successfully treat it to prevent early deaths and to limit the longer term damage to the patient. It also varies across Australia, depending on service availability and protocols in each state or territory.

These changes are reflected in the results of analysis of the national hospital data presented in Chapter 5 of this report.

The clinical emphasis is on early detection and treatment of ACS. There is considerable evidence that the sooner a patient is treated for the blockage in their artery, the more positive the outcome. As a result, pre-admission protocols (such as ambulance and emergency department protocols), as well as hospital protocols, are changing with the aim of reducing the time from an acute coronary symptom onset to effective medical intervention.

In some areas the ambulance can undertake the preliminary ECG and transmit this ahead to the hospital to be read by a cardiologist. The decision on where to take the patient is then made (depending on the severity of the ACS, the time since the onset of symptoms, the location and the availability of appropriate services to treat the patient). This saves the patient being transported to the nearest hospital for the ECG only to then have to be transported to another for a cardiac procedure. However, this practice is not in place Australia wide.

The use of cardiac procedures, such as angiography and percutaneous coronary intervention (PCI), is becoming more common overall, and more commonly used to treat patients with less severe AMI and with UA. Angiography is often used to identify or rule out blockages to arteries.

Procedures such as angiography, PCI and coronary artery bypass grafting (CABG) are undertaken in hospitals with specialist cardiac facilities. These are usually reasonably sized hospitals in major urban centres. As these procedures become more common and the gold standard treatment, and transport between hospitals more available, there has been an increase in the transfer of patients with ACS from one hospital to another. For example, a patient may be admitted in one hospital for a day, transferred to another hospital for a PCI and stay a day or two, and then be transferred back to their original or another hospital before discharge home. This will be recorded as three hospitalisations in the NHMD (even though it is for the one ACS event) as the counting unit in the NHMD is the separation or hospitalisation, not the patient.

An increase in the number and rate of transfers due to these changes in clinical practice is reflected in the NHMD. Associated with an increase in transfers there has been a change in the length of each hospital episode. These trends are demonstrated in Chapter 5 of this report.

4.4 Monitoring ACS rather than acute myocardial infarction

Associated with the points above, there has been an increased awareness of the need to monitor the spectrum of acute coronary diseases from UA to STEMI AMI rather than just AMI (as with the current algorithm). Both UA and AMI are acute coronary events with a high risk of death if not treated immediately and appropriately. Patients with UA undergo

similar protocols and treatments to those with AMI, in order to try to prevent escalation of the disease and possible death of the patient.

5 Trends in hospitalisations for ACS

This section presents trends in hospitalisations with a principal diagnosis of AMI or UA. While both are considered as part of ACS for this report, trends for the two diseases are presented separately as they show quite different patterns over time. While not considered part of ACS, some overall trends in hospitalisations for 'chest pain' are also presented. These provide an indicator of broader change in hospitalisations for suspected ACS.

The trends are presented as figures in the body of the report for ease of interpretation. The associated tables are provided in Appendix C.

Two data points are presented for 1998–99 in the longer time series graphs. Data for 1998–99 were extracted using both ICD-9-CM and ICD-10-AM codes to illustrate the effect of the change in classification. The break in the graphs is the point of change from ICD-9-CM to ICD-10-AM.

As mentioned previously, the focus of the data analysis and discussion in this report is restricted to the period to 2007–08, to be consistent with currently available detailed mortality data. The aim of this report is to assess the algorithm currently used to monitor ACS (Box 2.1) and to present alternative possible algorithms. A major component of the algorithm, in addition to non-fatal hospitalisations for ACS, is the number of deaths from CHD or AMI. The latest detailed mortality data currently available to the AIHW are for 2007. As a result, the algorithm can only be calculated to 2007, using 2006–07 and 2007–08 hospitalisation data from the NHMD.

However, to illustrate that the trends in hospitalisations for ACS have generally continued since 2007–08, the figures and tables for overall trends in this report have been extended to include data for 2008–09 and 2009–10.

5.1 Overview

In 2007–08 in Australia there were 161,417 hospitalisations where CHD was the principal diagnosis. Of these, 34.7% were for AMI and 24.0% for UA. The remainder were for other forms of CHD such as stable angina, complications from an AMI and chronic ischaemic heart disease (Table C1).

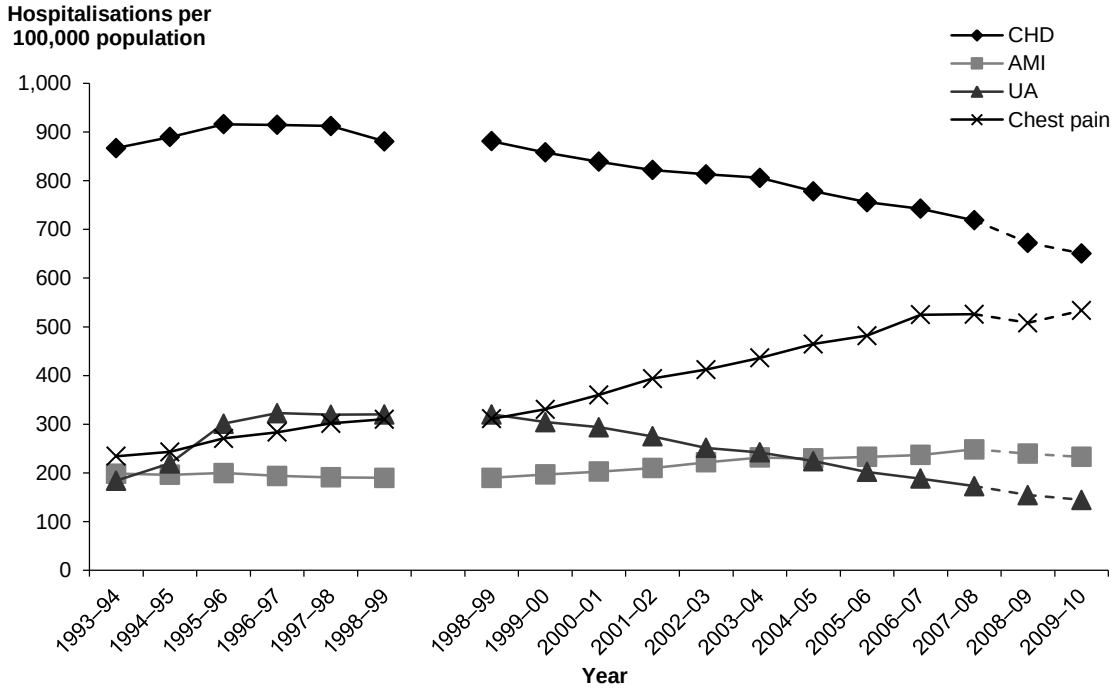
From 1993–94 to 2007–08, the number of hospitalisations for CHD increased by 16.7%. Over the same period, AMI hospitalisations increased by 79.5% and UA by 33.1%. It should be noted that this is a count of episodes of care as an admitted patient in hospital. It is not a count of ACS events or of people. An individual will have more than one episode for the one ACS event if they are transferred from one hospital to another for treatment or care. In addition, an individual could have more than one ACS event in a year.

The trends in the number of hospitalisations for throat and chest pain (signs and symptoms involving the circulatory system—not elsewhere classified) are particularly interesting to note as well. Hospitalisations for throat and chest pain increased by over 200% from 1993–94 to 2007–08. While this is not considered part of ACS, the trend is indicative of major changes in hospitalisations for potential acute coronary events. The large increase may be due to changes in hospital admission practices for people presenting to the emergency department with chest pain. It is also possible that more people are now presenting to hospital if they have chest pain or suspected symptoms of a heart attack.

To take account of the effect of growth and ageing of the population on the trends, the age-standardised rate (ASR) of hospitalisations for CHD, AMI, UA and chest pain were calculated. These are presented as the number of hospitalisations per 100,000 population (Table C2 and Figure 5.1).

While the ASRs for CHD and UA hospitalisations gradually declined from a peak in the mid-1990s, the ASR for AMI increased. From 1998–99 to 2007–08 the ASR for AMI hospitalisations increased by 30.8%, compared to declines of 46.0% for UA and 18.4% for total CHD. The ASR for chest pain hospitalisations increased by 124.5% from 1993–94 to 2007–08.

The reason for the relatively steep increase in the UA hospitalisation rate in the early to mid-1990s is unclear. It is possibly due to changes in the diagnosis and coding of this disease before the introduction of ICD-10-AM (see Section 4.1). There was no corresponding decline in the rate of AMI hospitalisations at that time, so it is unlikely that the increase in UA rates were due to a shift in diagnosis from AMI to UA.



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.1: Age-standardised hospitalisation rates with a principal diagnosis of a cardiac event or chest pain, Australia, 1993–94 to 2009–10

Trends in acute myocardial infarction hospitalisations

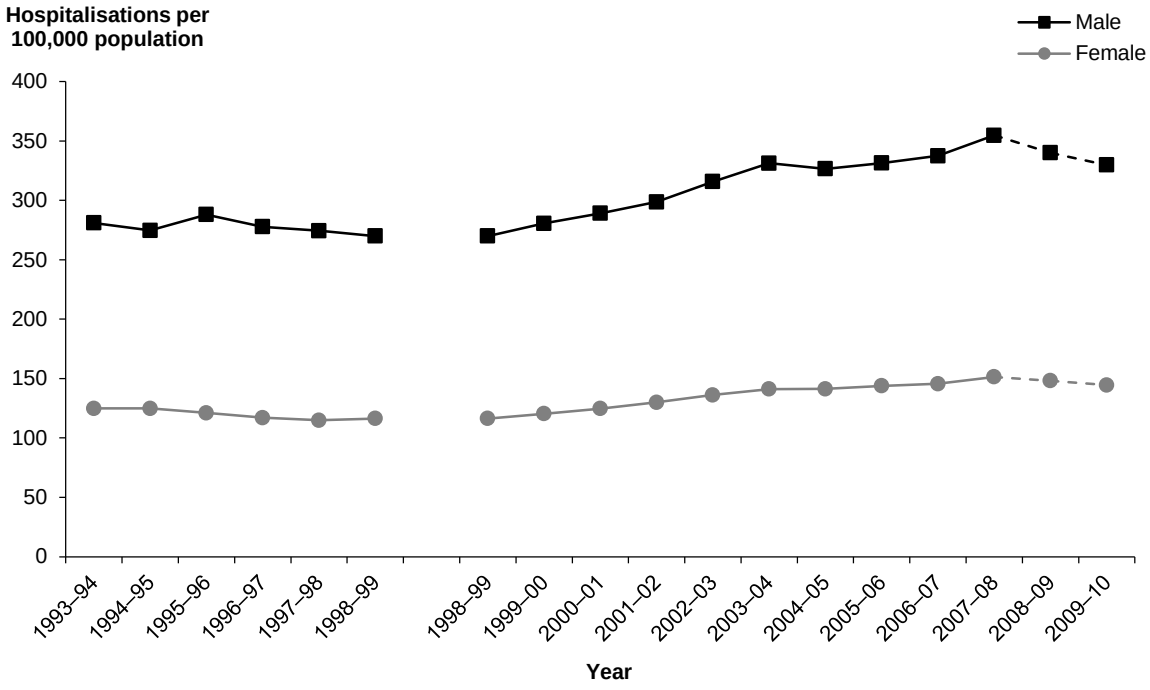
Age and sex

In 2007–08 there were 55,997 hospitalisations for AMI. Almost two-thirds of these were for men (Table C1). Just over 40% were for people aged 55–74 and almost 40% were for people aged 75 and over (Table C3).

The ASR for AMI hospitalisations for males in 2007–08 was 354.7 per 100,000 population, compared to 151.4 for females (Table C2). The rate of AMI hospitalisations increases

substantially with age, with males and females 85 and over having the highest rates (Table C4).

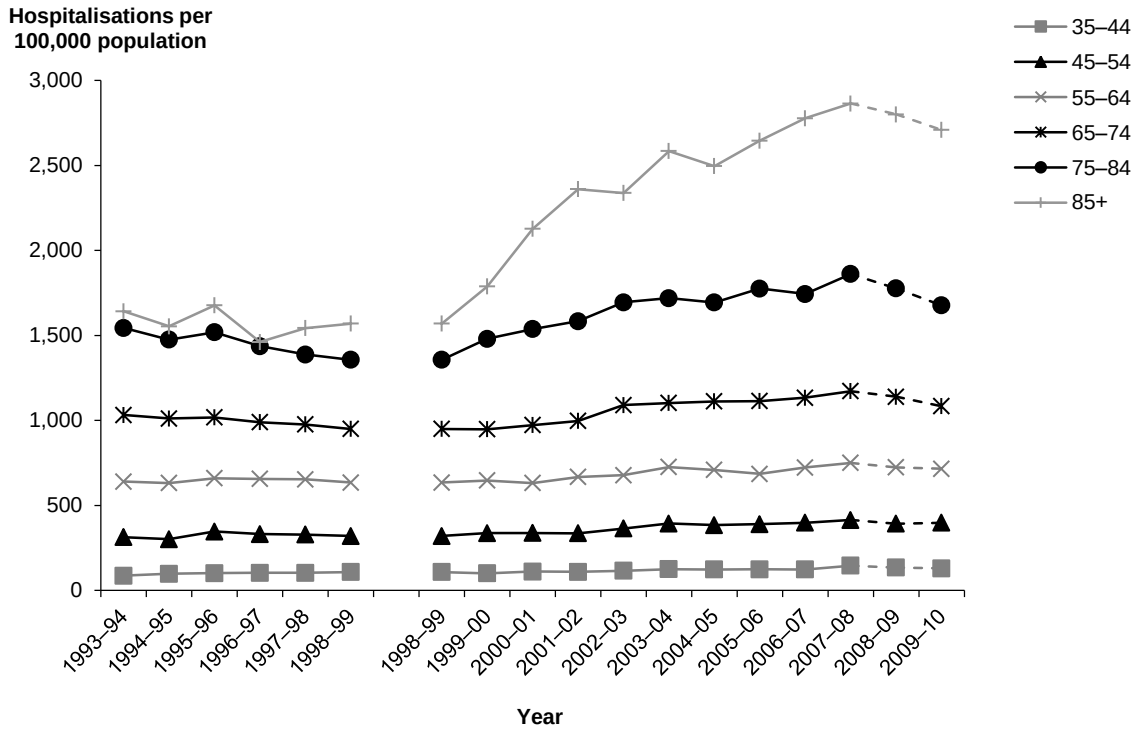
Both the number and ASR of AMI hospitalisations increased overall from 1993–94 to 2007–08 (tables C1 and C2). The increase in hospitalisation rates was for both males and females and across all age groups 35 and over (Figures 5.2, 5.3 and 5.4). The apparent decline in the ASR of AMI hospitalisations since 2007–08 is of interest to note. However, the reasons for this decline and whether it reflects trends in AMI events have not been investigated, as this is beyond the scope of this report.



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

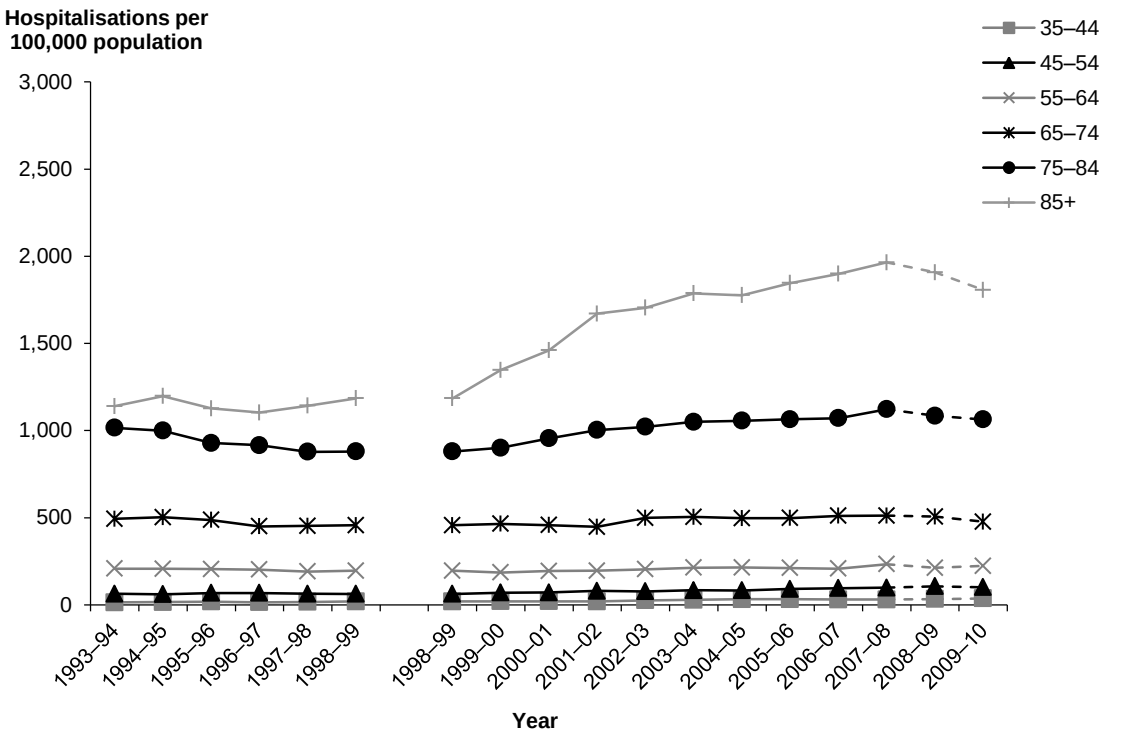
Figure 5.2: Age-standardised hospitalisation rates for people with a principal diagnosis of an AMI, Australia, 1993–94 to 2009–10



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.3: Age-specific hospitalisation rates for men aged 35 and over with a principal diagnosis of AMI, Australia, 1993–94 to 2009–10



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.4: Age-specific hospitalisation rates for women aged 35 and over with a principal diagnosis of AMI, Australia, 1993–94 to 2009–10

The ASR for AMI hospitalisations increased by 26.2% for males and 21.2% for females from 1993–94 to 2007–08 (Table C2). For males, the largest relative increase in AMI hospitalisation rates was for those aged less than 35 (a rise of 90.2%), those aged 35–44 (68.5%) and those aged 85 and over (74.4%). For females, the largest relative increase in rates was for those aged 35–44 (a rise of 108.2%), followed by those aged 85 and over (72.3%) (Table C4).

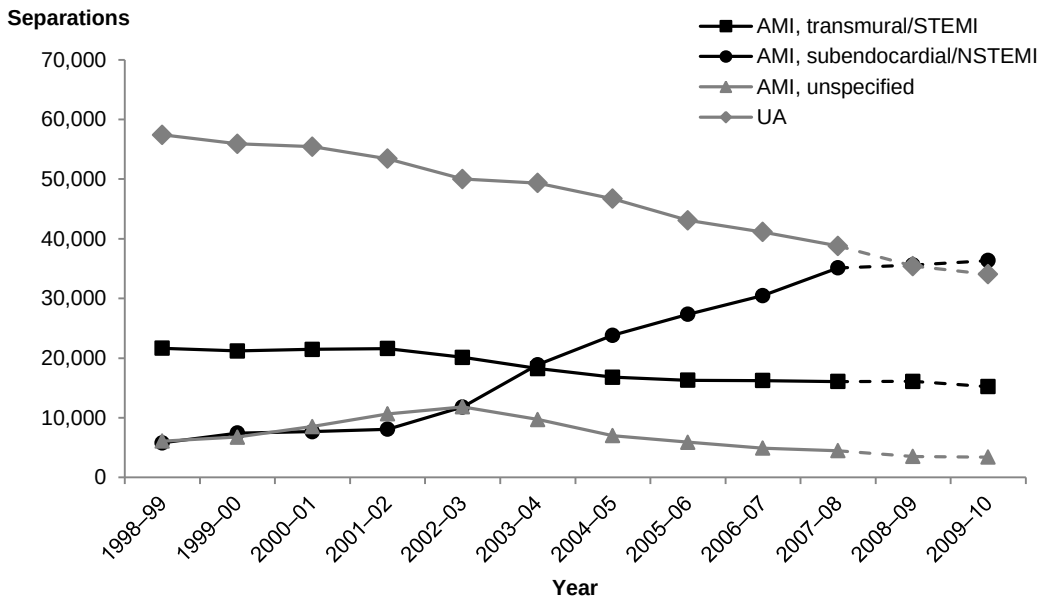
It should be noted that these are rates of hospitalisations, not people, and not measures of incidence as they do not include deaths from AMI that occurred outside hospital. It should also be noted that the numbers of hospitalisation for AMI in the younger age groups are relatively small and so changes in rates should be interpreted carefully.

Type of acute myocardial infarction

Since the introduction of ICD-10-AM in 1998–99, there have been considerable changes in the number of hospitalisations by the type of AMI recorded in the NHMD (Table C5 and Figure 5.5). Analysis of these trends is complicated by the introduction of the terms STEMI and NSTEMI into the existing definitions for transmural and subendocardial AMI in July 2004 (with the implementation of ICD-10-AM fourth edition) as described in Chapter 4.

The number of hospitalisations for transmural/STEMI AMI declined steadily from 1998–99 to 2007–08 (overall a 25.8% decline from 21,649 to 16,072). In contrast, over the same period, the number of hospitalisations for subendocardial/NSTEMI AMI increased by over 500%, from 5,813 to 35,123.

It is interesting to note the fall in the number of hospitalisations for UA over the same period (Figure 5.5 and Table C1). It is possible that, with the use of more sensitive biomarker tests, a greater number of 'less severe' AMIs are now being diagnosed than in the past. Previously these may have been diagnosed as UA.



Note: The inclusion of terms STEMI and NSTEMI were introduced with the 4th edition of ICD-10-AM in July 2004.

Source: AIHW National Hospital Morbidity Database.

Figure 5.5: Hospitalisations with a principal diagnosis of an AMI, by type of AMI, or UA, Australia, 1998–99 to 2009–10

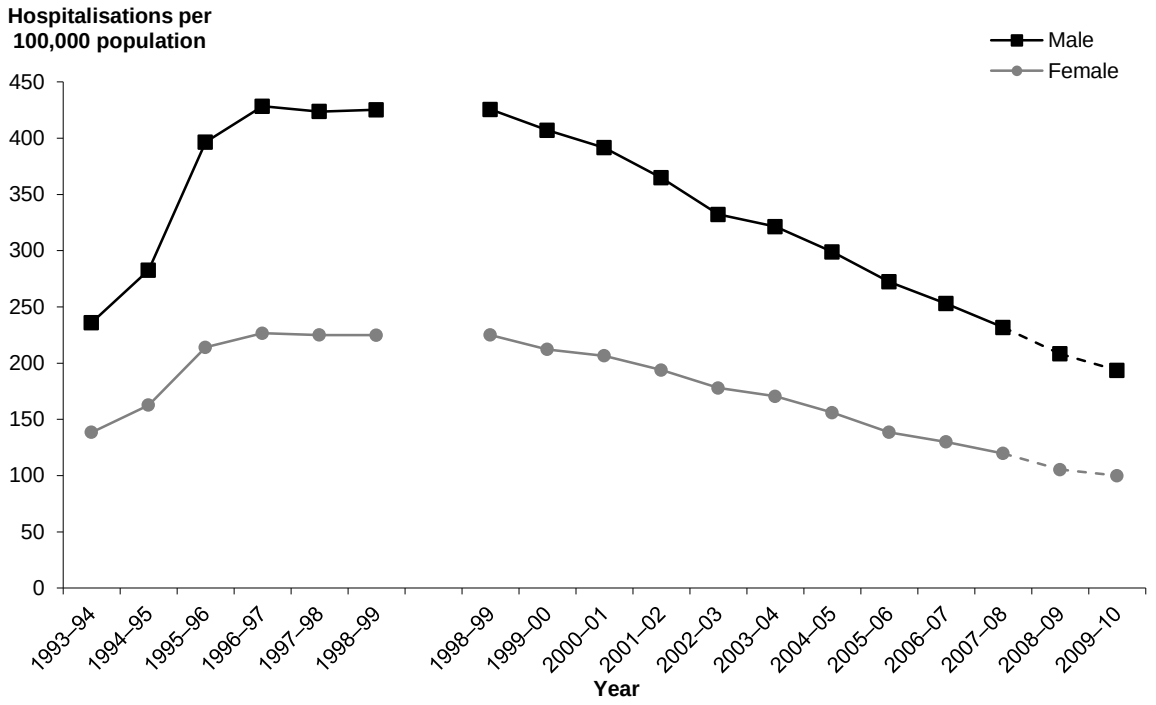
Trends in unstable angina hospitalisations

Age and sex

In 2007–08 there were 38,795 hospitalisations for UA. As with AMI, almost two-thirds of these were for men (Table C1). Almost 50% were for people aged 55–74 and 33.3% for people aged 75 and over (Table C6).

The ASR for UA hospitalisations for males in 2007–08 was 231.6 per 100,000 population, compared to 119.7 for females (Table C2). The rate of UA hospitalisations increases substantially with age, with males and females 75 and over having the highest rates (Table C7).

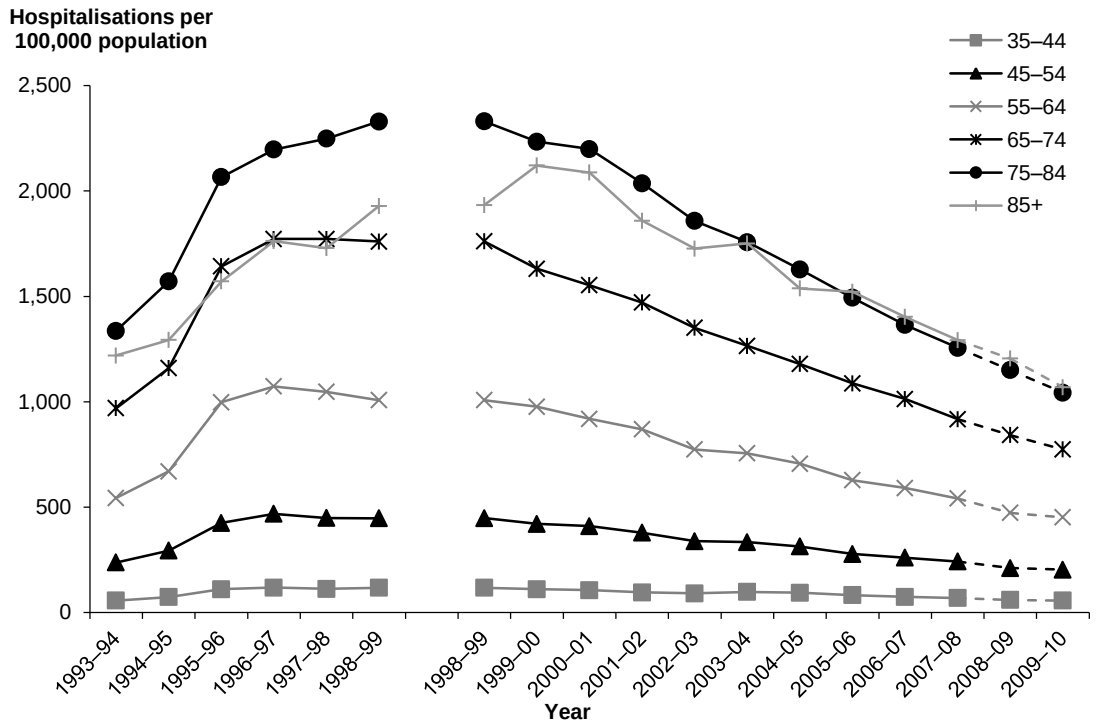
The trend in UA hospitalisation ASRs shows a steep rise in the early to mid-1990s. Since 1998–99, however, the ASR has gradually declined for both males and females (Table C2 and Figure 5.6). From 1998–99 to 2007–08 the ASR declined by 45.6% for males and 46.8% for females. The age-specific rates for UA hospitalisations declined across all age groups (Table C7 and figures 5.7 and 5.8).



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

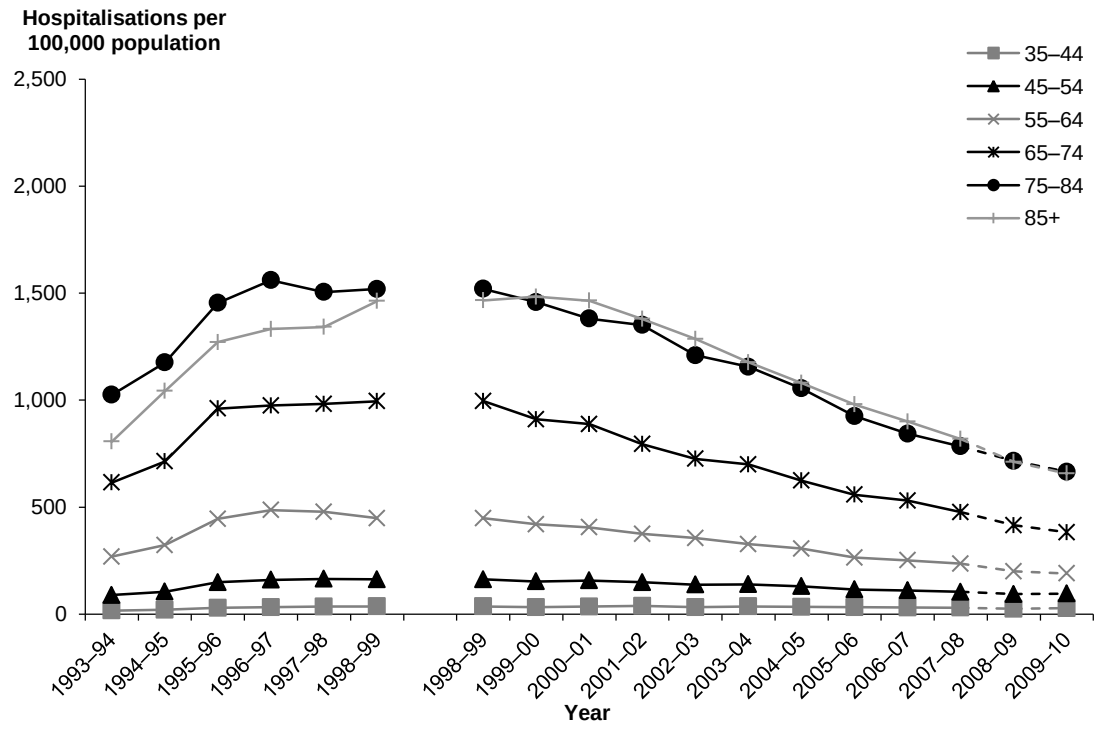
Figure 5.6: Age-standardised hospitalisation rates for people with a principal diagnosis of unstable angina, Australia, 1993–94 to 2009–10



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.7: Age-specific hospitalisation rates for men aged 35 and over with a principal diagnosis of unstable angina, Australia, 1993–94 to 2009–10



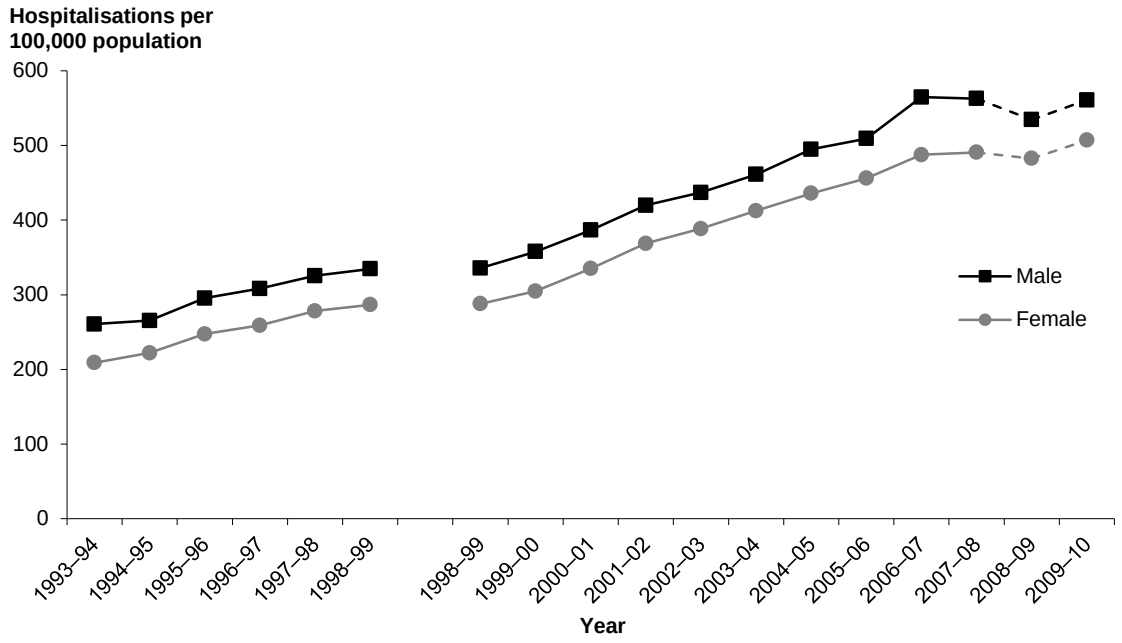
Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.8: Age-specific hospitalisation rates for women aged 35 and over with a principal diagnosis of unstable angina, Australia, 1993–94 to 2009–10

Trends in chest pain hospitalisations

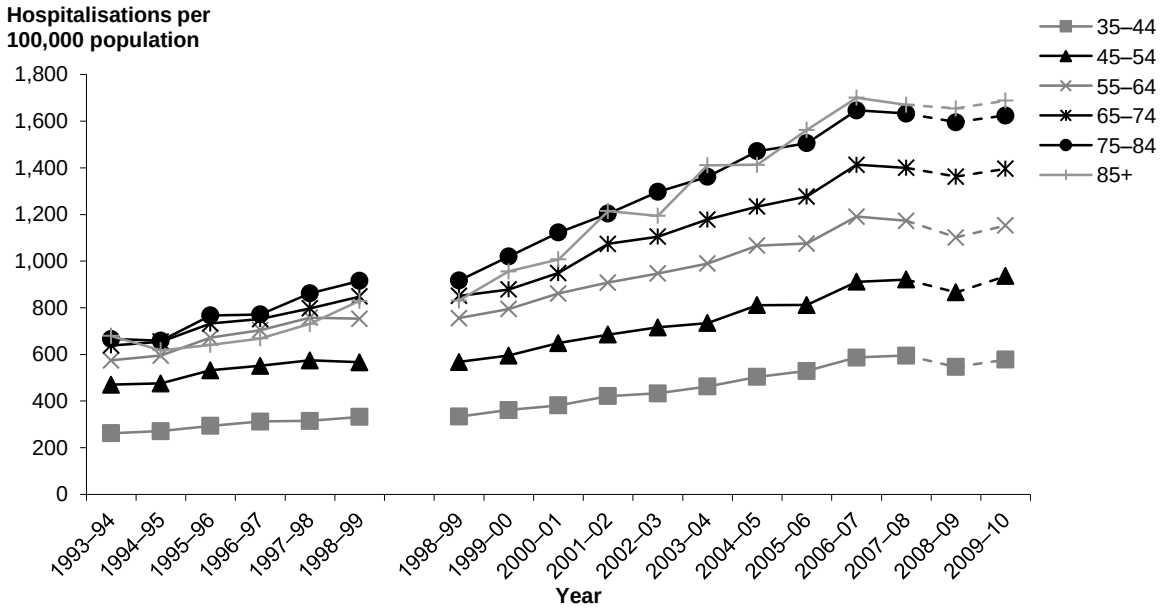
Both the number and ASR of hospitalisations for chest pain have increased substantially over the period from 1993–94 to 2007–08. The increase was similar for males and females (115.8% and 134.7% increase in ASRs, respectively) and across all age groups (tables C1, C8 and C9 and figures 5.9, 5.10 and 5.11). The largest relative increases in age-specific rates were for those aged less than 44 and those aged 85 and over.



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

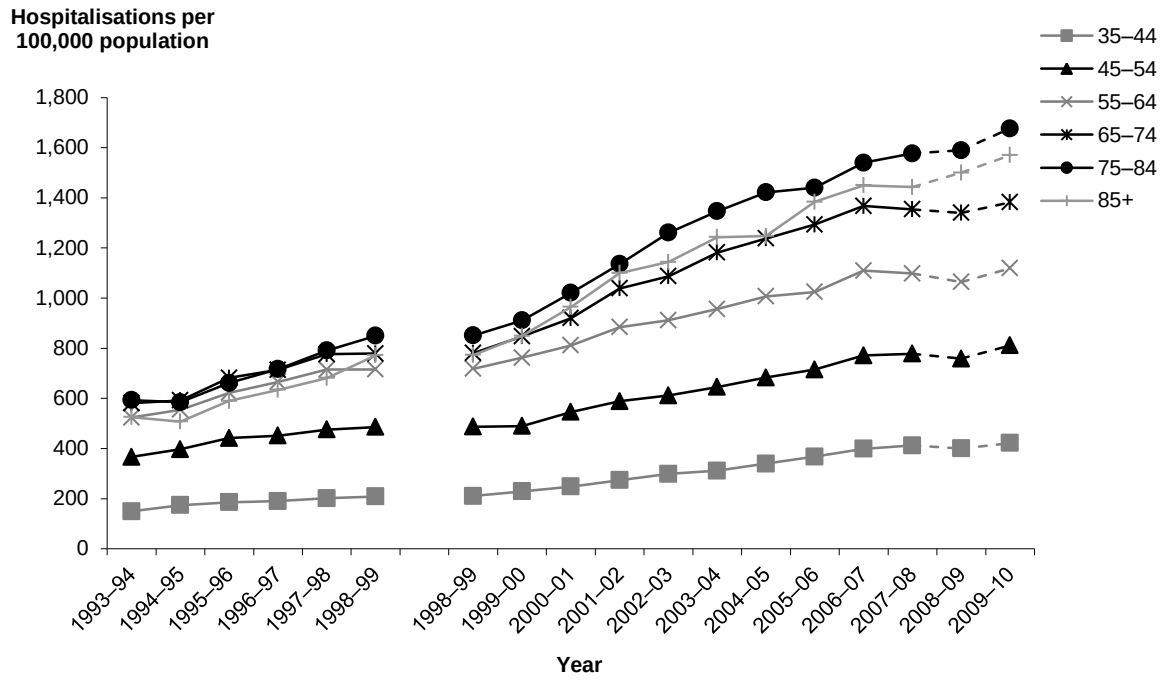
Figure 5.9: Age-standardised hospitalisation rates for people with a principal diagnosis of chest pain, Australia, 1993–94 to 2009–10



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.10: Age-specific hospitalisation rates for men aged 35 and over with a principal diagnosis of chest pain, Australia, 1993–94 to 2009–10



Note: The break in the time series corresponds to the move from ICD-9-CM to ICD-10-AM (with 1998–99 hospitalisations coded according to both classifications).

Source: AIHW National Hospital Morbidity Database.

Figure 5.11: Age-specific hospitalisation rates for women aged 35 and over with a principal diagnosis of chest pain, Australia, 1993–94 to 2009–10

5.2 Length of stay

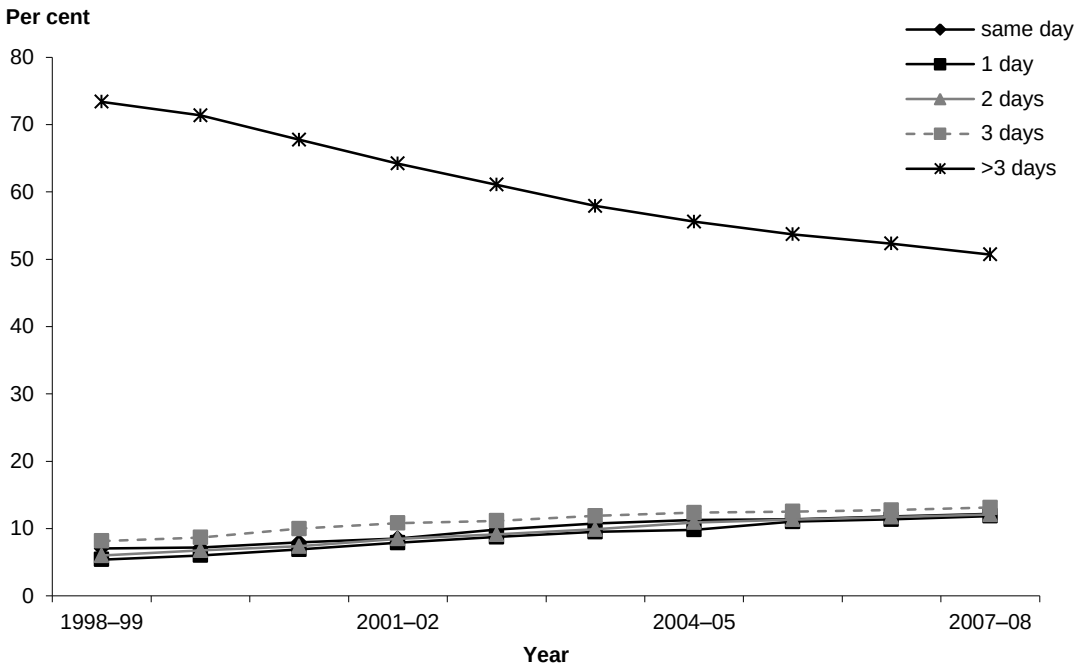
The length of stay is calculated for each hospital episode (hospitalisation) as the difference between admission and discharge (separation) dates less leave days (if any). A same-day patient is allocated a length of stay of 1 day.

For this report the analysis of length of stay was restricted to non-fatal hospitalisations (that is, excluding those where the mode of separation was recorded as 'died'). Changes in length of stay are examined from 1998–99 to 2007–08. This provides a consistent time period in terms of coding of the diseases as ICD-10-AM coding was introduced in 1998–99.

Length of stay for acute myocardial infarction hospitalisations

From 1998–99 to 2007–08 there was a steady decline in the proportion of non-fatal AMI hospitalisations with a length of stay of greater than 3 days, and a steady increase in the proportion that were same day, 1 day, 2 days and 3 days (Table C10 and Figure 5.12).

In 1998–99, almost three-quarters of AMI hospitalisations had a length of stay greater than 3 days. By 2007–08 this had declined to just over half.



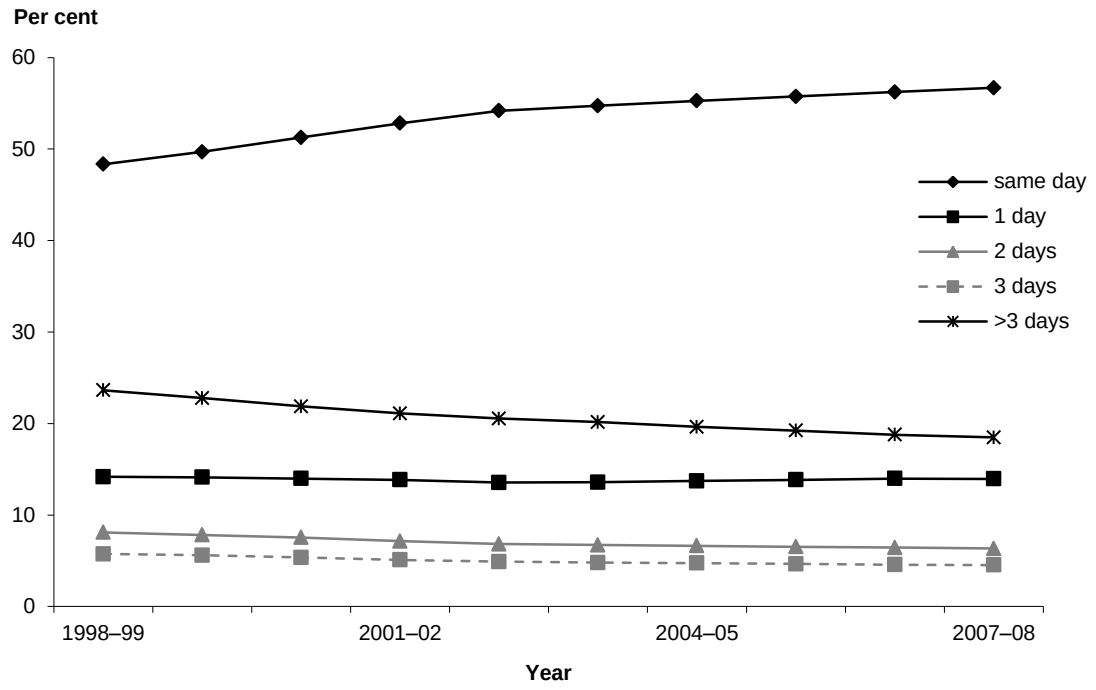
Source: AIHW National Hospital Morbidity Database.

Figure 5.12: Length of stay for non-fatal hospitalisations with a principal diagnosis of AMI, Australia, 1998–99 to 2007–08

Length of stay for an AMI hospitalisation is associated with age of the patient, with hospitalisations for older patients being more likely to be greater than 3 days than those for younger patients (Table C11). In 2007–08, 31.9% of AMI hospitalisations for people aged less than 35 were for more than 3 days compared with 58.0% of AMI hospitalisations for people aged 85 and over.

To take account of the effect of ageing of the population on trends, age-specific rates for AMI hospitalisations (AMI hospitalisations per 100,000 population) with a length of stay of 1 day or less and greater than 3 days have been age-standardised (see Appendix B for methods of calculating ASRs). From 1998–99 to 2007–08 the ASR of AMI hospitalisations with a length of stay of 1 day or less increased by 172.7%. In comparison, the ASR of AMI hospitalisations with a length of stay of greater than 3 days declined by 5.0% (Table C12).

The decline in length of stay is a general trend for total hospitalisations (Table C10 and Figure 5.13).



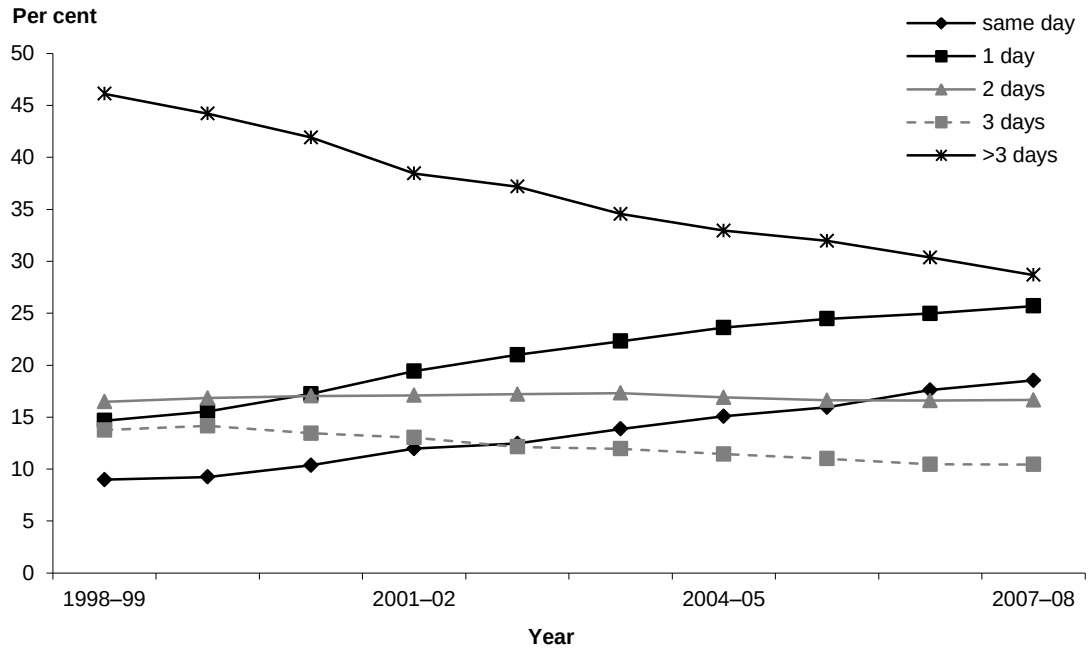
Source: AIHW National Hospital Morbidity Database.

Figure 5.13: Length of stay for all non-fatal hospitalisations, Australia, 1998–99 to 2007–08

Length of stay for unstable angina hospitalisations

The trends in length of stay for hospitalisations with a principal diagnosis of UA are slightly different to those for AMI. They are also generally shorter.

In 1998–99, 46.1% of UA hospitalisations had a length of stay of greater than 3 days. By 2007–08 this had declined to 28.7%. From 1998–99 to 2007–08 there was a steady decline in the proportion of UA hospitalisations with a length of stay of greater than 3 days, and also in those with a length of stay of 3 days. There was a steady increase in the proportion that were same day and 1 day while the proportion with a length of stay of 2 days stayed fairly constant (Table C10 and Figure 5.14).



Source: AIHW National Hospital Morbidity Database.

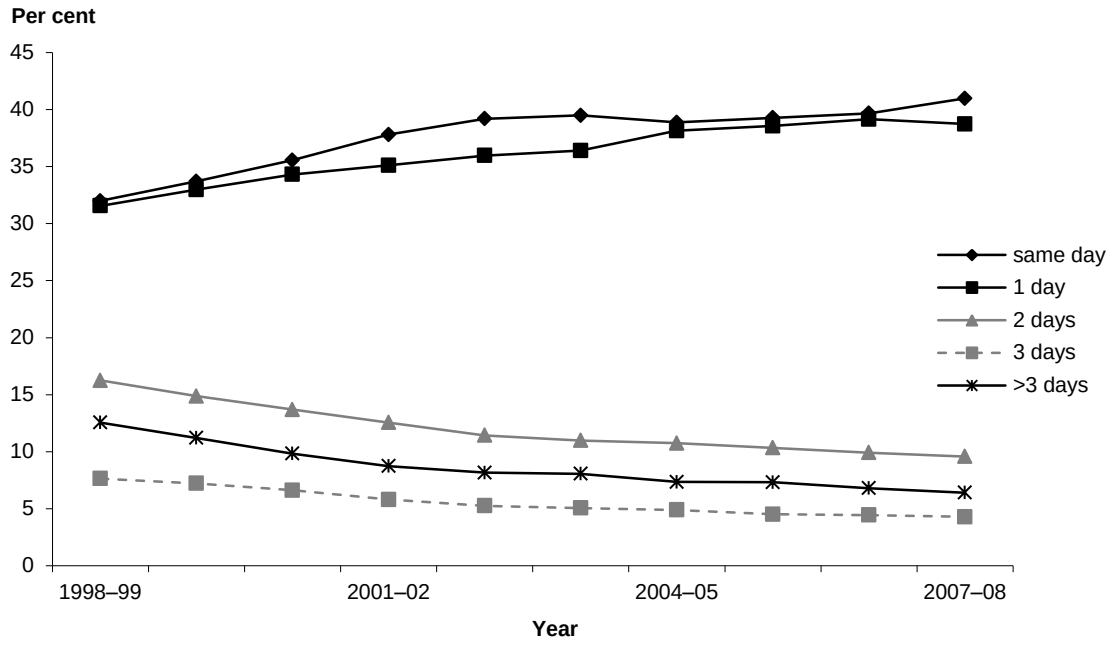
Figure 5.14: Length of stay for non-fatal hospitalisations with a principal diagnosis of UA, Australia, 1998–99 to 2007–08

As with AMI hospitalisations, length of stay for an UA hospitalisation is associated with the age of the patient, with hospitalisations for older patients being more likely to be greater than 3 days than those for younger patients (Table C11). In 2007–08, 12.6% of UA hospitalisations for people aged less than 35 were for more than 3 days compared with 38.3% of UA hospitalisations for people aged 85 and over.

From 1998–99 to 2007–08 the ASR of UA hospitalisations with a length of stay of 1 day or less increased by 1.9%. In comparison, the ARS of UA hospitalisations with a length of stay of greater than 3 days declined by 66.4% (Table C12).

Length of stay for chest pain hospitalisations

Most hospitalisations for chest pain are for a very short length of stay. In 1998–99 over 60% were for 1 day or less. This proportion has been increasing over time, and was almost 80% in 2007–08 (Table C10 and Figure 5.15). The ASR of hospitalisations for chest pain with a length of stay of 1 day or less increased by 113.3% from 1998–99 to 2007–08. In comparison the ASR for those with a length of stay of greater than 3 days declined by 16.2% (Table C12).



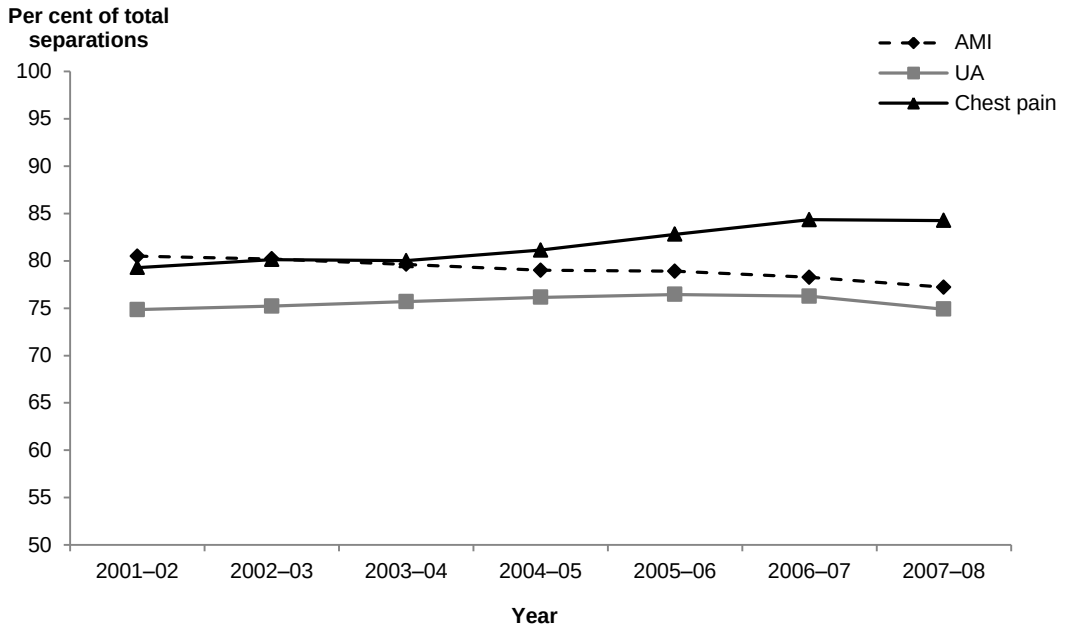
Source: AIHW National Hospital Morbidity Database.

Figure 5.15: Length of stay for non-fatal hospitalisations with a principal diagnosis of chest pain, Australia, 1998–99 to 2007–08

5.3 Urgency of admission

Hospitalisations can be categorised as 'emergency' (admission required within 24 hours according to the treating clinician), or 'elective' (required at some stage beyond 24 hours). Urgency of admission is not assigned for some admissions, such as admissions for normal delivery and birth, statistical admissions (that is, where there is a change in type of care) and planned readmissions for some treatments. The following analysis of ACS hospitalisations by urgency of admission should therefore be interpreted with care.

Around three-quarters of hospitalisations for AMI and UA were recorded as 'emergency' admissions in 2007–08 (Table C13). While this proportion had remained stable for UA over the period from 2001–02 to 2007–08, there was a decline from 80.5%to 77.2% for AMI (Figure 5.16). For AMI hospitalisations there was an increase in the 'unassigned' category (from 2.1% in 2001–02 to 4.6% in 2007–08). The proportion of chest pain hospitalisations that were recorded as emergency admissions increased from 79.3% to 84.3%, and those that were recorded as elective declined from 19.7% to 14.5% over the period.



Source: AIHW National Hospital Morbidity Database.

Figure 5.16: Proportion of hospitalisations for AMI, UA and chest pain with an 'emergency' admission type, Australia, 2001–02 to 2007–08

The urgency of admission varied slightly with age for all three diseases, with younger (under 35) and older (85 and over) people being generally more likely to have an 'emergency' admission (Table C14).

The ASRs for hospitalisations by urgency of admission are provided in Table C15.

5.4 Transfers

Trends in transfer rates (that is, the proportion of hospitalisations that end in a transfer to another acute hospital) have major implications for the monitoring of the incidence of diseases using the NHMD. To count individual ACS events requires that some account be taken of the multiple hospitalisations that may make up the one ACS event.

Patients are transferred for a number of reasons. For ACS the main reason is for treatment, as the main life-saving procedures can only be undertaken in hospitals with specialised cardiac care facilities and cardiologists with appropriate skills. Most of these are located in the main urban centres in Australia. Patients may also be transferred after cardiac procedures to other hospitals for their recovery care.

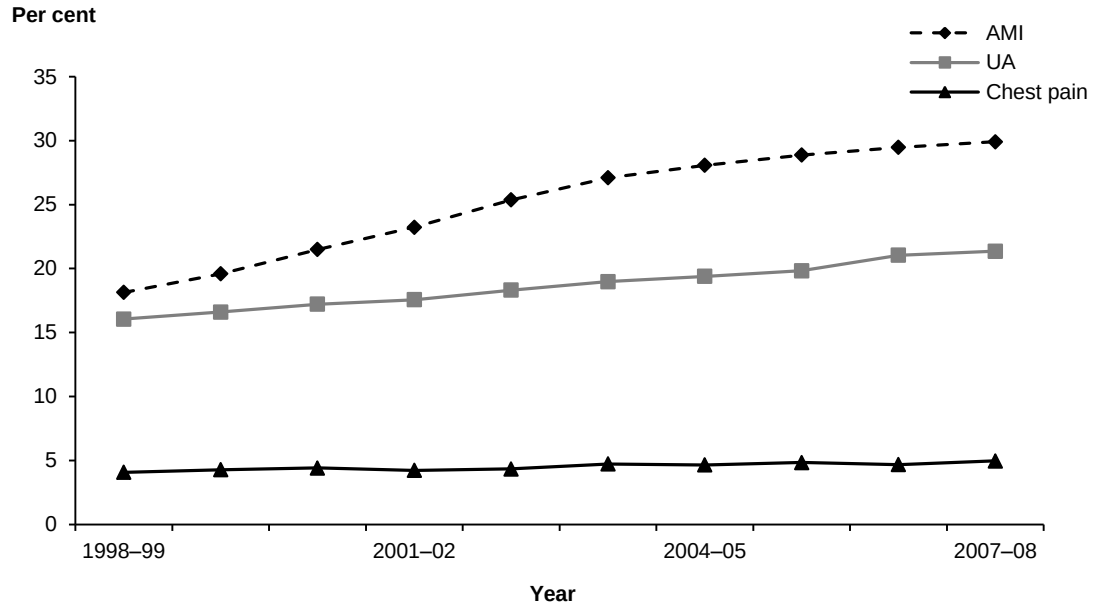
There are two main variables in the NHMD that provide information on whether a transfer to another acute hospital is associated with the hospitalisation—mode of separation and mode of admission. The mode of admission variable is reported to be of lower quality than separation mode in the NHMD. Both of these variables are analysed below.

Transfers to another acute care hospital

Acute myocardial infarction

The proportion of AMI hospitalisations that ended in a transfer to another acute hospital increased from 18.1% in 1998–99 to 29.9% in 2007–08 (Table C16 and Figure 5.17). This is as

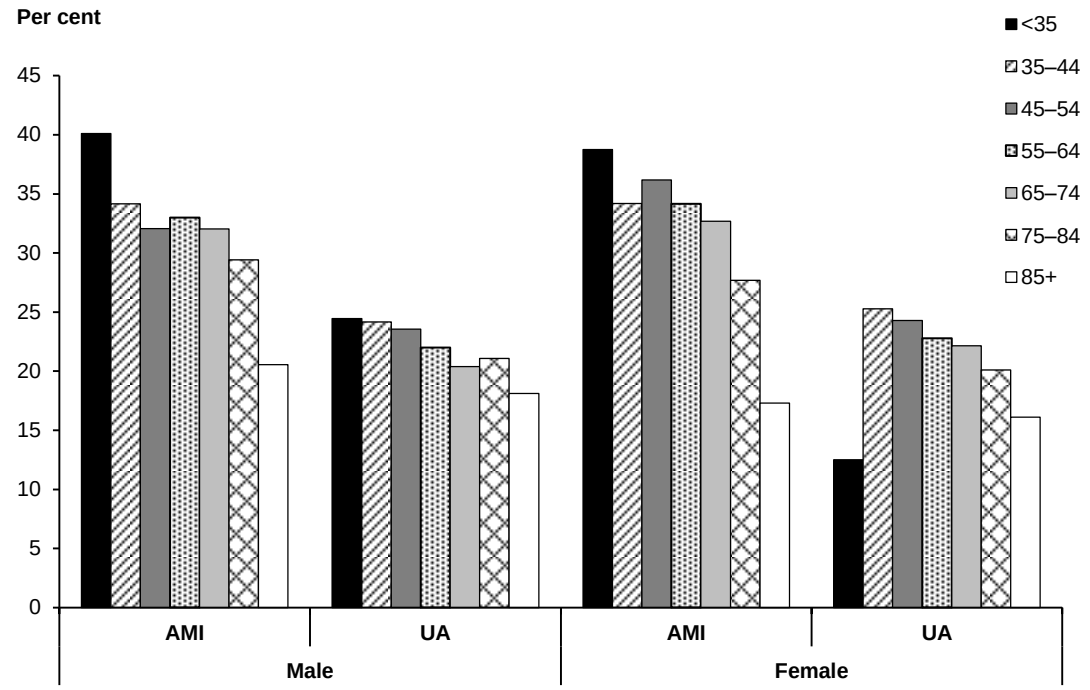
would be expected given the increase in cardiac procedures and improved inter-hospital transport facilities for patients to receive these treatments.



Source: AIHW National Hospital Morbidity Database.

Figure 5.17: Proportion of hospitalisations for AMI, UA and chest pain ending in a transfer to another acute hospital, Australia, 1998–99 to 2007–08

The proportion of AMI hospitalisations for males that ended in a transfer was higher than that for female hospitalisations (30.9% and 28.0%, respectively, in 2007–08) (Table C17). Differences in severity of AMI, clinical presentation and the age of male and female AMI patients may account for at least part of the difference in transfer rates between the sexes. The rate of transfer also varies with age, with AMI hospitalisations for younger people more likely to end in a transfer than those for older people. In 2007–08, 39.9% of AMI hospitalisations for people aged less than 35 ended in a transfer to another hospital. In comparison, 28.7% of AMI hospitalisations for people aged 75–84 years and 18.7% for those aged 85 and over ended in a transfer (Table C17 and Figure 5.18).

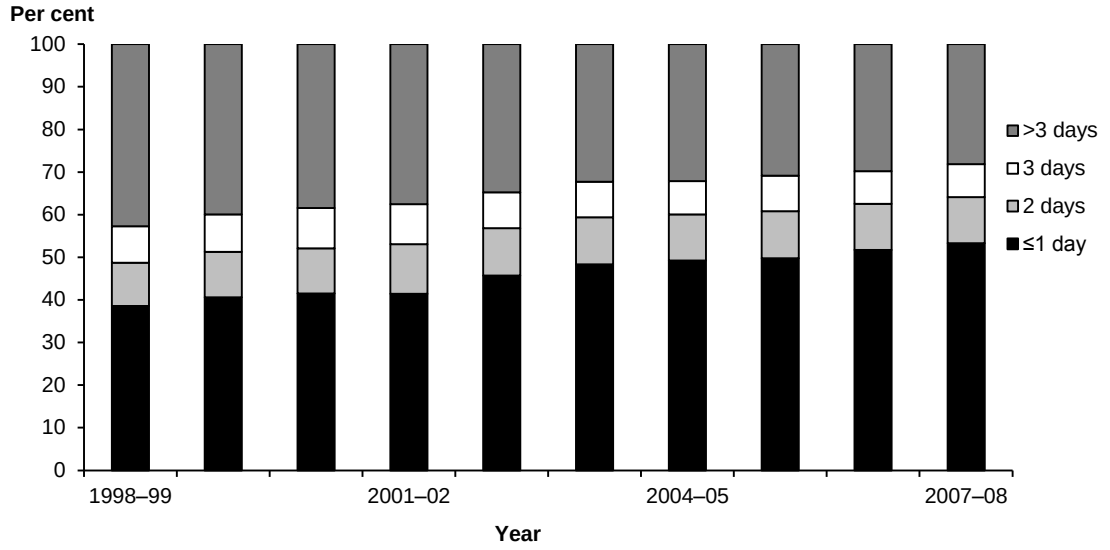


Source: AIHW National Hospital Morbidity Database.

Figure 5.18: Proportion of hospitalisations with a principal diagnosis of AMI or UA that ended in a transfer to another acute hospital by age and sex of patient, Australia, 2007–08 (per cent of total hospitalisations)

The length of stay before transfer for AMI hospitalisations is declining (Table C18 and Figure 5.19). In 1998–99, 42.7% of AMI hospitalisations that ended in a transfer had a length of stay of more than 3 days. By 2007–08 this had declined to 28.2%. The proportion with a length of stay of 1 day or less increased from 38.6% to 53.3%.

This indicates that patients with AMI are now being transferred more often, and more quickly, than they were a decade ago.



Source: AIHW National Hospital Morbidity Database.

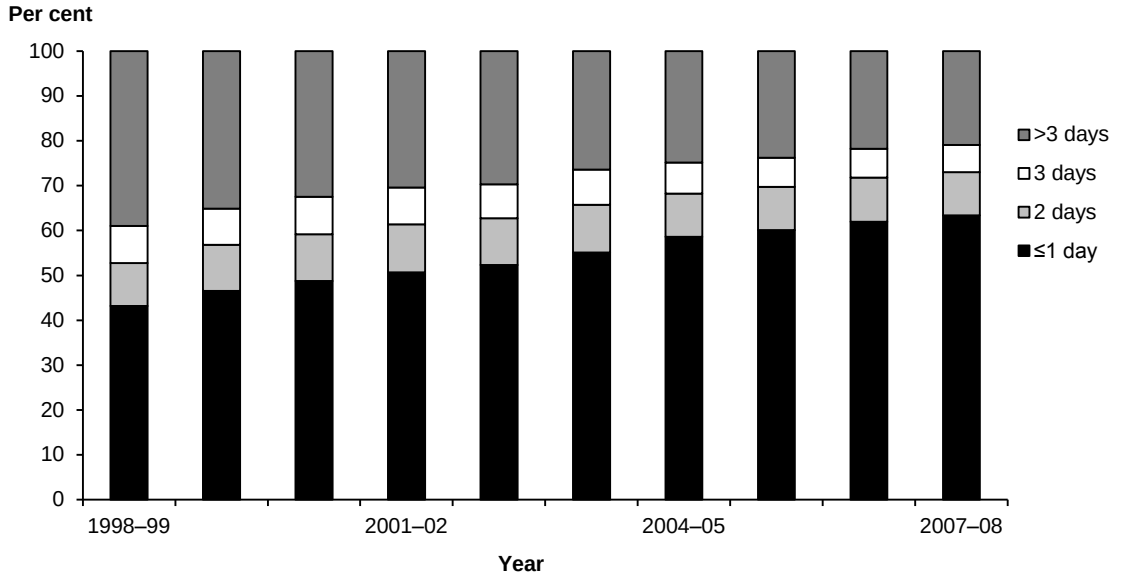
Figure 5.19: Hospitalisations with a principal diagnosis of AMI with separation mode of 'transferred to another acute hospital' by length of stay before transfer, Australia, 1998–99 to 2007–08

Unstable angina

The proportion of hospitalisations for UA that end in a transfer to another acute hospital is lower than for AMI hospitalisations (21.4% compared to 29.9%, respectively, in 2007–08). However, as with AMI, the rate of transfer is increasing. The proportion of UA hospitalisations that ended in a transfer to another acute hospital increased from 16.0% in 1998-99 to 21.4% in 2007–08 (Table C16 and Figure 5.17).

The rate of transfer is similar for males and females (21.5% and 21.2%, respectively, in 2007–08) (Table C17 and Figure 5.18). Unlike AMI, the difference in transfer rate by age is not as marked. In 2007–08, it ranged from 24.5% of UA hospitalisations for people aged 35–44 years to 17.0% for people aged 85 and over (Table C17 and Figure 5.18).

As with AMI, the length of stay before transfer for UA hospitalisations is declining (Table C18 and Figure 5.20). In 1998–99, 39.0% of UA hospitalisations that ended in a transfer had a length of stay of more than 3 days. By 2007–08 this had declined to 21.0%. The proportion with a length of stay of 1 day or less increased from 43.2% to 63.4%.

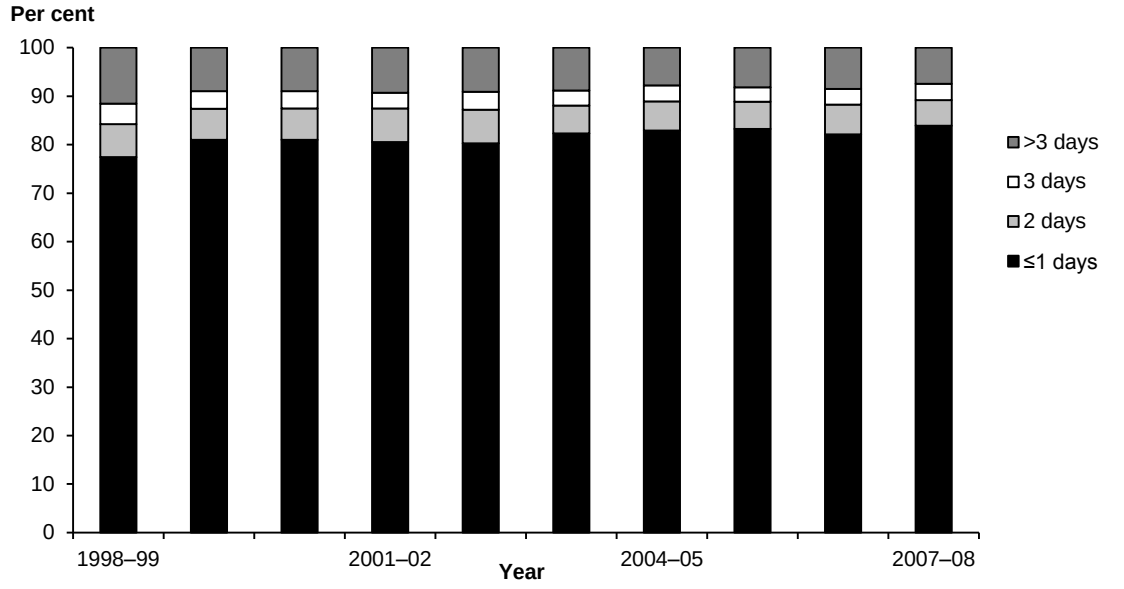


Source: AIHW National Hospital Morbidity Database.

Figure 5.20: Hospitalisations with a principal diagnosis of UA with separation mode of 'transferred to another acute hospital' by length of stay before transfer, Australia, 1998–99 to 2007–08

Chest pain

A very low proportion of hospitalisations with a principal diagnosis of chest pain ends in a transfer (5.0% in 2007–08) (Table C16 and Figure 5.17). It is slightly higher for males than females (5.4% compared to 4.5%, respectively, in 2007–08) and increases with age (7.4% for people aged 85 and over compared to 3.3% for people aged less than 45 (Table C17). Most chest pain hospitalisations that end in transfer are 1 day or less in duration, and this has increased over time—from 77.5% in 1998–99 to 83.9% in 2007–08 (Table C18 and Figure 5.21).



Source: AIHW National Hospital Morbidity Database.

Figure 5.21: Hospitalisations with a principal diagnosis of chest pain with separation mode of 'transferred to another acute hospital' by length of stay before transfer, Australia, 1998–99 to 2007–08

Transfers from another acute care hospital

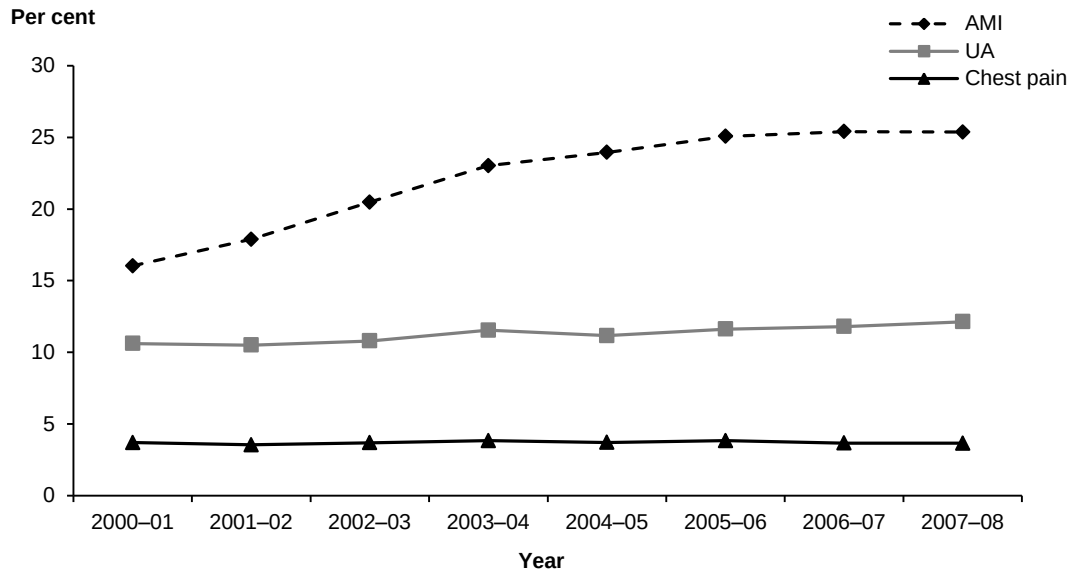
The previous section examined ACS hospitalisations that ended in a transfer to another acute care hospital. This section looks at ACS hospitalisations that were recorded as beginning with a transfer from another acute care hospital. As would be expected, these show similar trends. The differences are most likely due to the poor quality of the data for the 'admission mode' variable in the NHMD. It should also be noted that it is possible that the initial episode was not coded as ACS.

Data on admission mode are only of reasonable quality from 2000–01 onwards.

Acute myocardial infarction

The proportion of AMI hospitalisations that began with a transfer increased from 16.0% in 2000–01 to 25.4% in 2007–08 (Table C19 and Figure 5.22).

Of those AMI hospitalisations that began with a transfer in 2007–08, 43.5% were coded as emergency admissions. This is lower than in 2001–02 to 2004–05 when it was over 50% (Table C20). In comparison, 77.2% of all AMI hospitalisations in 2007–08 were coded as emergency admissions (Table C21).



Source: AIHW National Hospital Morbidity Database.

Figure 5.22: Proportion of hospitalisations for AMI, UA and chest pain beginning with a transfer from another acute hospital, Australia, 2001–02 to 2007–08

Unstable angina

The proportion of UA hospitalisations that began with a transfer increased from 10.6% in 2000–01 to 12.1% in 2007–08 (Table C19 and Figure 5.22). In 2007–08, 38.2% were coded as emergency admissions. This is lower than in previous years (Table C20). In comparison, 74.9% of all UA hospitalisations in 2007–08 were coded as emergency admissions (Table C21).

Chest pain

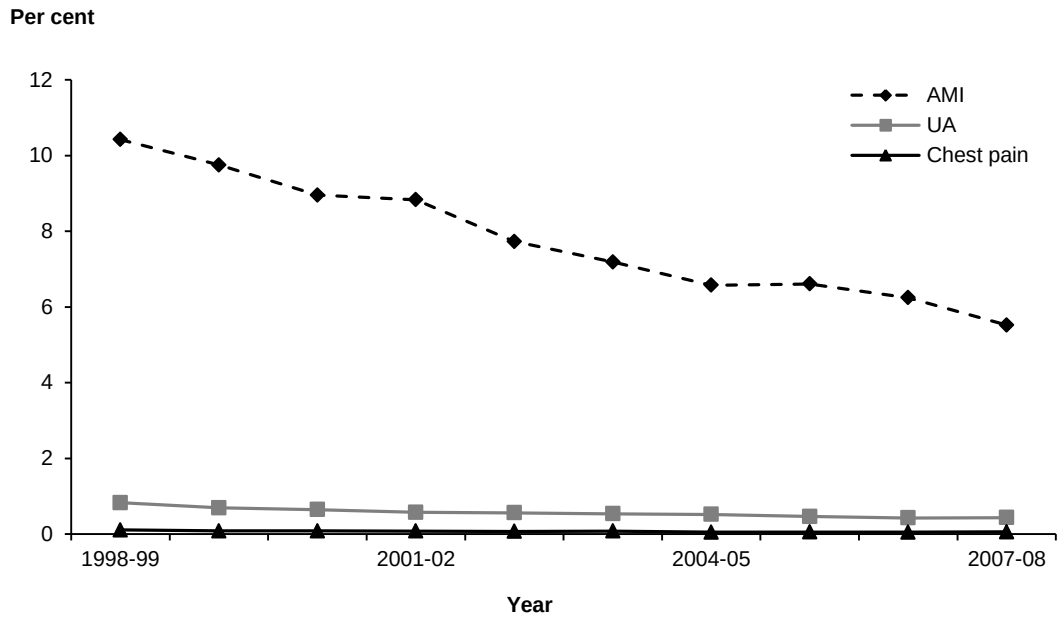
Only around 4% of chest pain hospitalisations were recorded as having an admission mode of 'transferred from another acute hospital'. This remained stable from 2000–01 to 2007–08 (Table C19 and Figure 5.22).

5.5 ACS hospitalisations ending in death

Hospitalisations ending in death in the NHMD are identified through the 'separation mode' data element. It only records deaths in hospital, not deaths after discharge.

In 2007–08 there were 3,091 deaths in hospital coded with a principal diagnosis of AMI, 168 with a principal diagnosis of UA and 68 with a principal diagnosis of chest pain.

The proportion of AMI and UA hospitalisations that ended in death in hospital almost halved over the period from 1998–99 to 2007–08, from 10.4% to 5.5% for AMI and from 0.8% to 0.4% for UA (Table C16 and Figure 5.23). Only 0.1% of hospitalisations for chest pain ended in death, and this remained stable over that time.



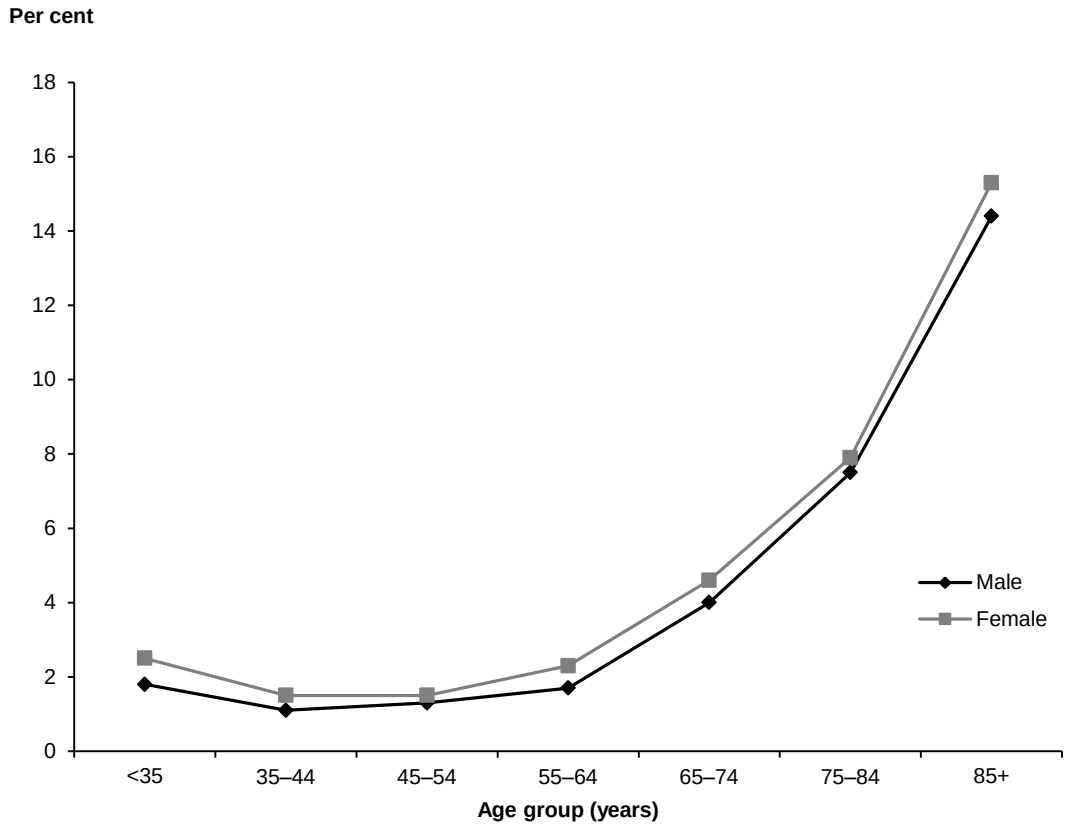
Source: AIHW National Hospital Morbidity Database.

Figure 5.23: Proportion of hospitalisations for AMI, UA and chest pain ending in death, Australia, 1998-99 to 2007–08

The proportion of AMI hospitalisations that ended in death was higher for females than for males (7.5% compared with 4.5%) (Table C22 and Figure 5.24). This was the case across all age groups. It should be remembered in interpreting this figure that it is not indicating the proportion of people hospitalised for AMI that died in hospital but, rather, the proportion of hospitalisations that ended in a death. Males with AMI may have a slightly higher transfer rate than females (Table C17) which means that they may have a higher average number of hospitalisations per event than females. This will affect the relative rates of death per hospitalisation.

The proportion of UA hospitalisations that ended in death was similar for males and females (0.5% and 0.4%, respectively) (Table C22).

The proportion of AMI and UA hospitalisations that end in death are strongly associated with age of the patient (Table C22 and Figure 5.24). Almost 15% of 2007–08 AMI hospitalisations for people aged 85 and over ended in death, compared to less than 2% for people aged less than 65. For UA hospitalisations the pattern is similar, but much lower, with 1.7% of UA hospitalisations for people aged 85 and over ending in death.

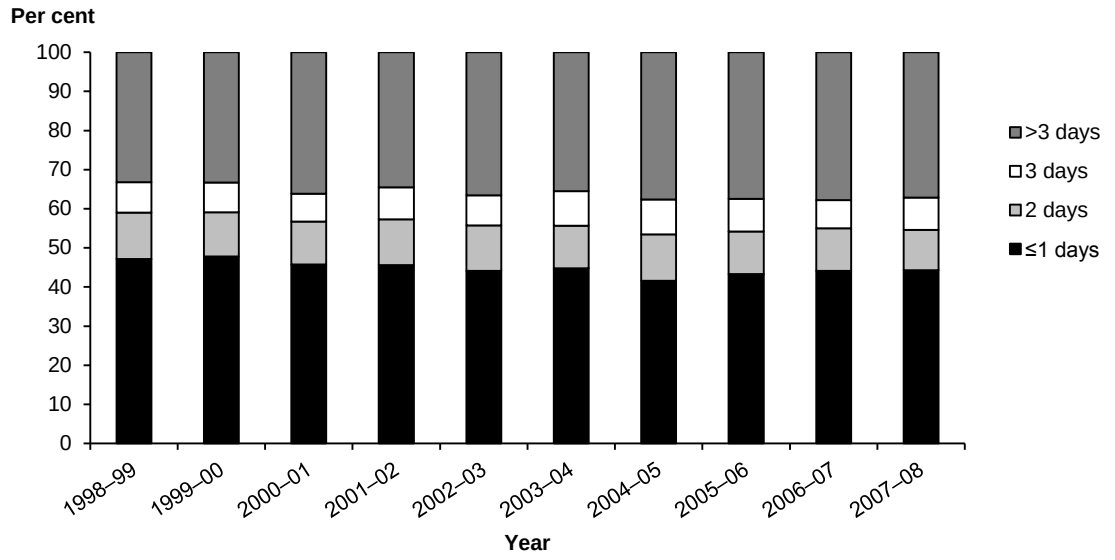


Source: AIHW National Hospital Morbidity Database.

Figure 5.24: Proportion of hospitalisations with a principal diagnosis of AMI that ended in death by age and sex of patient, Australia, 2007–08 (per cent of total hospitalisations)

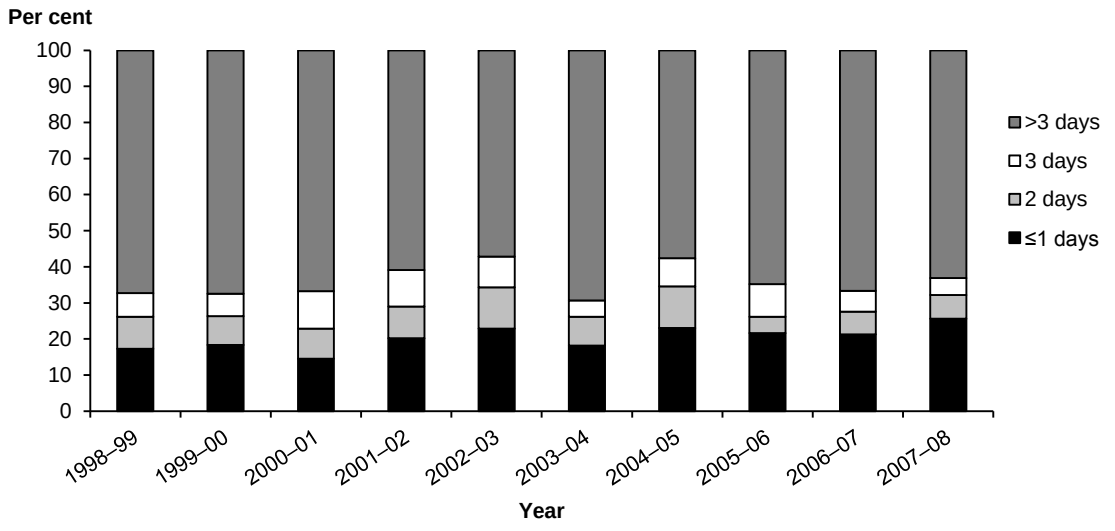
Over the period from 1998–99 to 2007–08 there has been a slight shift in the proportion of AMI hospitalisations that end in death with a length of stay of 1 day or less to greater than 3 days (Table C23 and Figure 5.25). In 1998–99, 47.1% of hospitalisations that ended in death were 1 day or less in duration. This had declined to 44.3% in 2007–08. The increased emphasis on early reperfusion treatment (such as thrombolysis and PCI), the increased use of cardiac procedures and the increased rates of transfers within the first day may be contributing to this decline in the deaths of AMI patients soon after arrival in hospital.

The trend for deaths in hospital from UA by length of stay is not clear (Table C23 and Figure 5.26). The numbers of deaths in hospital associated with a UA diagnosis are relatively small.



Source: AIHW National Hospital Morbidity Database.

Figure 5.25: Hospitalisations with a principal diagnosis of AMI with separation mode of 'died' by length of stay, Australia, 1998–99 to 2007–08



Source: AIHW National Hospital Morbidity Database.

Figure 5.26: Hospitalisations with a principal diagnosis of UA with separation mode of 'died' by length of stay, Australia, 1998–99 to 2007–08

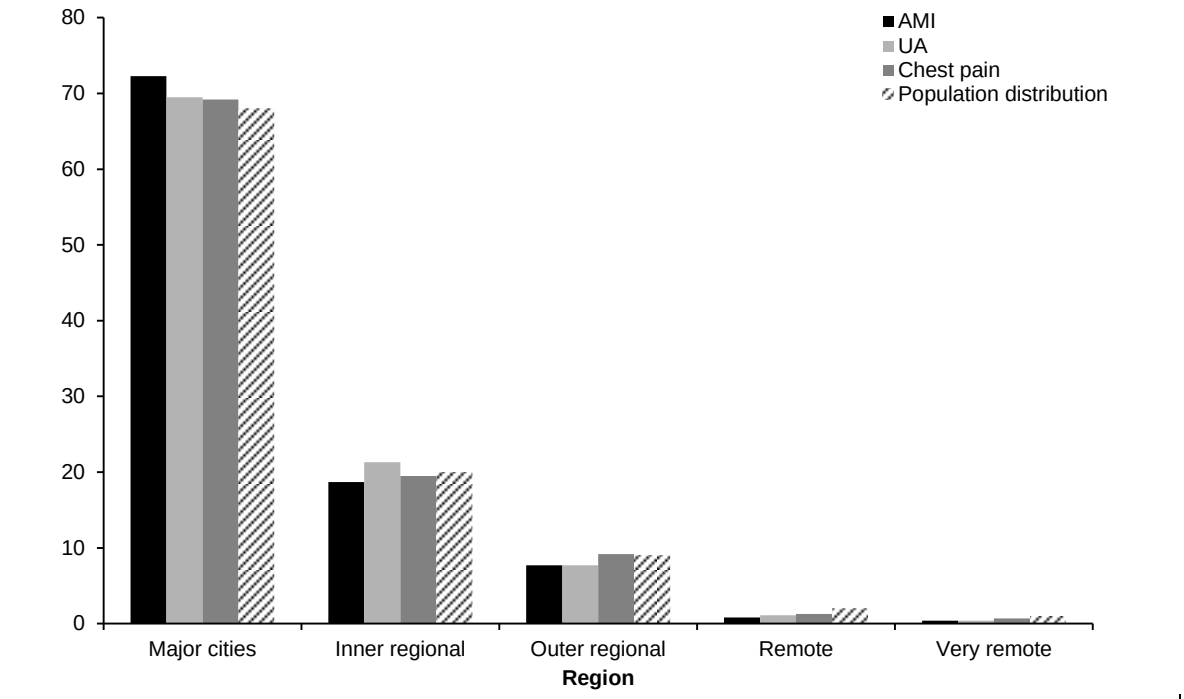
5.6 Region of hospital

The following section examines the hospital region in which ACS hospitalisations occurred in Australia. The region of the hospital is defined using the Australian Bureau of Statistics (ABS) Australian Standard Geographical Classification (ASGC) Remoteness Area (RA). This classification is based on distance to services (Accessibility/Remoteness Index of Australia (ARIA) score) (see Glossary and Figure G1). Some care should be taken in interpreting the

trends presented by region of hospital as the quality of the information recorded on hospital region in the NHMD is variable over time.

The region of the hospital is used in this analysis, rather than the region of the patient, as the availability of cardiac services, and the protocols and practices for the treatment of ACS will vary by hospital and will be affected by the region in which the hospital is located (for example, distance from a major centre with a catheterisation laboratory). These differences are expected to be reflected in the NHMD in transfer rates and length of stay.

As would be expected, given the population distribution in Australia, most ACS hospitalisations are in hospitals located in *Major cities* and very few are in *Very remote* regions (Table C24 and Figure 5.27). In 2007–08, 72.3% of AMI hospitalisations, and just over 69% of UA and chest pain hospitalisations were in hospitals in *Major cities*. Less than 1% of AMI, UA and chest pain hospitalisations were in *Very remote* regions.



Note: 'Population distribution' refers to the per cent of the total Australian population living in each region.

Sources: AIHW National Hospital Morbidity Database; ABS Estimated Residence Population data.

Figure 5.27: Hospitalisations with a principal diagnosis of AMI, UA and chest pain, by region of hospital, Australia, 2007–08 (per cent distribution by region)

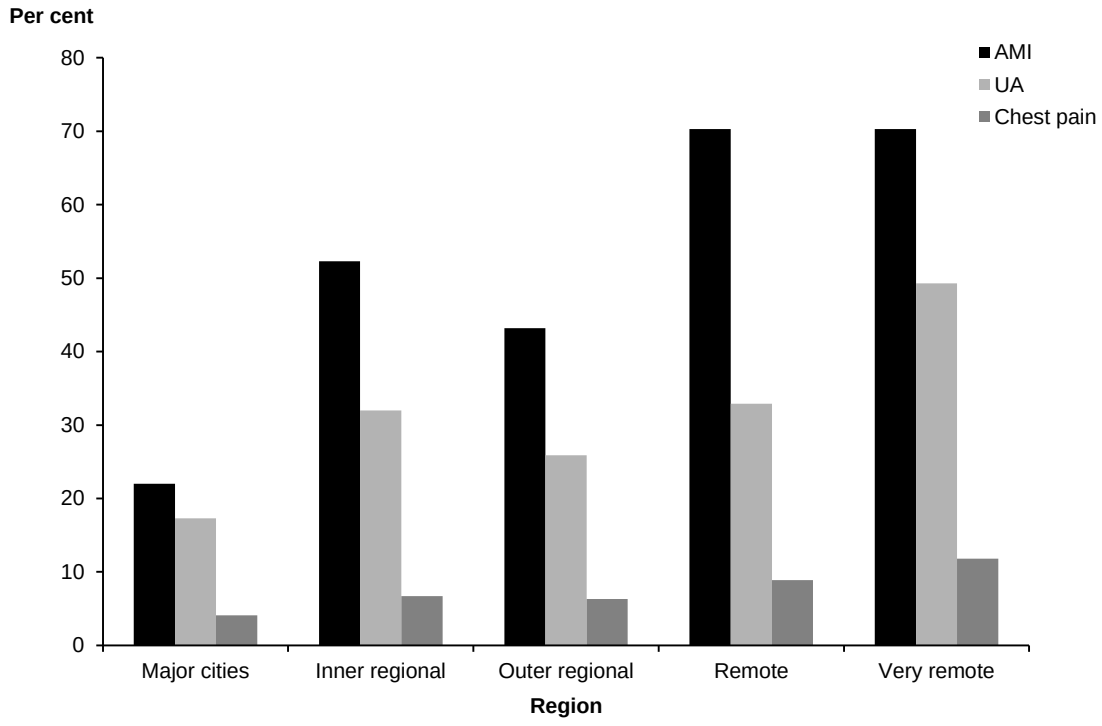
Transfers by region

The transfer rates for AMI, UA and chest pain for 2007–08 hospitalisations are shown in tables C25 and C26 and figures 5.28 and 5.29.

It should also be noted that only those hospitalisations coded with the appropriate principal diagnosis (for example, AMI or UA) will be identified and counted. So, if a patient is transferred after treatment to another hospital for further care, and if this latter episode is not coded with a principal diagnosis of AMI or UA, it will not be identified when looking at AMI or UA hospitalisations.

ICD-10-AM Australian Coding Standard 0940 states that if the AMI code is assigned in the first hospital to which the patient is admitted for treatment, it should also be assigned in any other acute care facility to which the patient is transferred (for ongoing or further care of the AMI) within 28 days or less from onset of the infarction. However, other health conditions may develop or reoccur and there are also other coding standards relating to rehabilitation and after-care (2103 and 2104) that may affect the coding of subsequent AMI hospitalisations (NCCH 2008). Unpublished analysis from Western Australian linked morbidity data for Western Australia indicate that the coding of AMI in second episodes may be affected by length of stay for that episode, with longer episodes of post-operative care in a second hospital possibly being less likely to be coded as AMI than shorter ones.

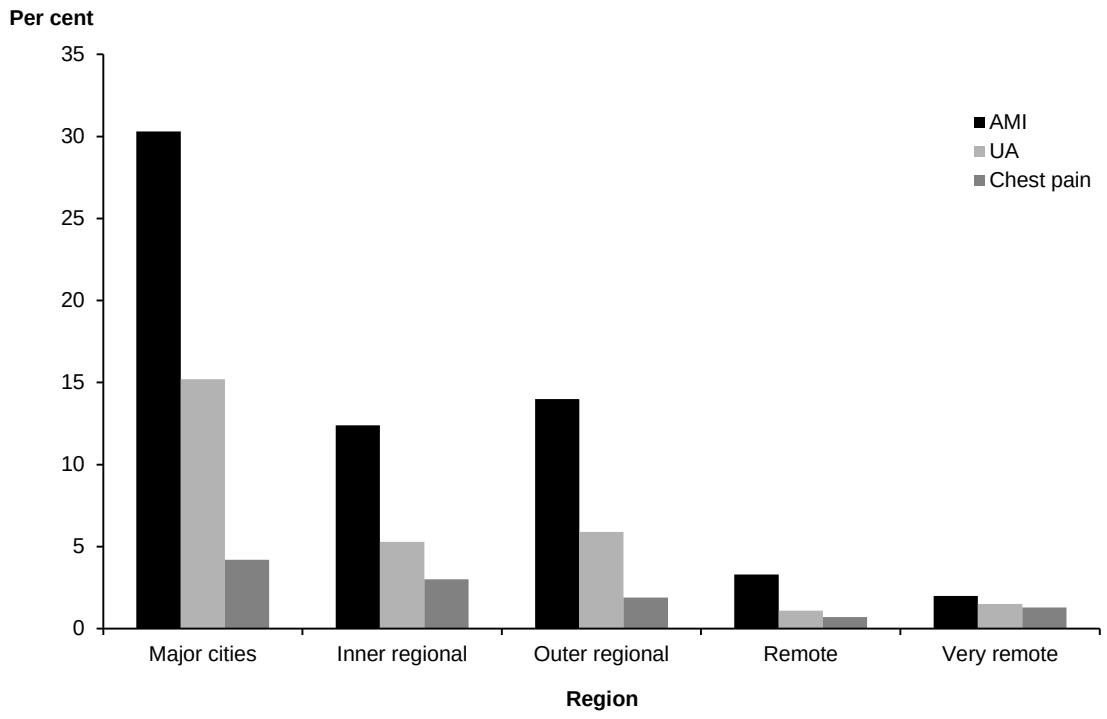
Over 70% of AMI hospitalisations in *Remote* and *Very remote* regions ended in a transfer (Table C25 and Figure 5.28) while only a very small proportion began with a transfer from another acute hospital (Table C26 and Figure 5.29). In comparison, 22.0% of AMI hospitalisations in *Major cities* ended in a transfer and 30.3% began with a transfer.



Source: AIHW National Hospital Morbidity Database.

Figure 5.28: Proportion of hospitalisations with a principal diagnosis of AMI, UA and chest pain that ended in a transfer, by region of hospital, Australia, 2007–08

The rate of transfer is less for UA hospitalisations than for AMI hospitalisations, overall and within each region. However, there is still the pattern of transfer from *Remote* and *Very remote* regions to more urbanised areas for UA hospitalisations. In 2007–08, 49.3% of UA hospitalisation in *Very remote* regions and 32.9% in *Remote* regions ended in a transfer compared with 17.3% of UA hospitalisations in *Major cities* (Table C25 and Figure 5.28). Less than 2% of UA hospitalisations in *Remote* and *Very remote* regions began with a transfer from an acute hospital, compared with 15.2% of UA hospitalisations in *Major cities* (Table C26 and Figure 5.29).



Source: AIHW National Hospital Morbidity Database.

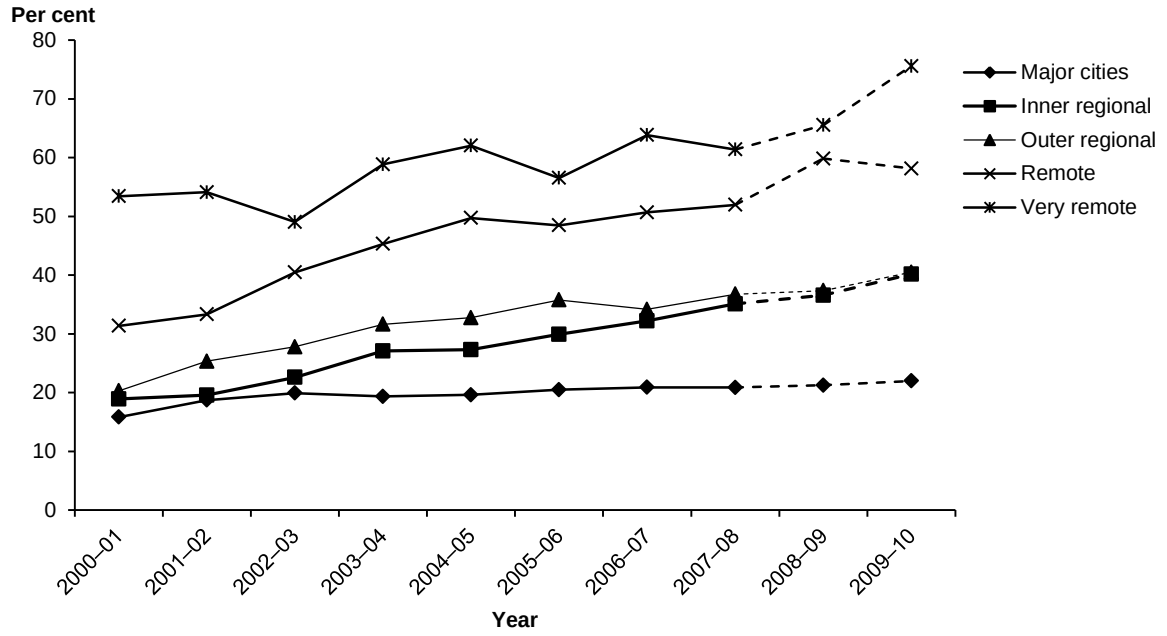
Figure 5.29: Proportion of hospitalisations with a principal diagnosis of AMI, UA and chest pain that began with a transfer, by region of hospital, Australia, 2007–08

Length of stay by region

The length of the hospital episode varies markedly by region, for both AMI and UA, with the proportion of stays of 1 day or less increasing with remoteness (Table C27 and figures 5.28 to 5.31). In 2007–08, 61.4% of AMI hospitalisations and 72.1% of UA hospitalisations in *Very remote* regions were for 1 day or less. For *Major cities* the proportions were 20.9% and 40.5%, respectively. This is consistent with a pattern of quick transfer of patients from more remote regions to hospitals in major centres with cardiac treatment facilities.

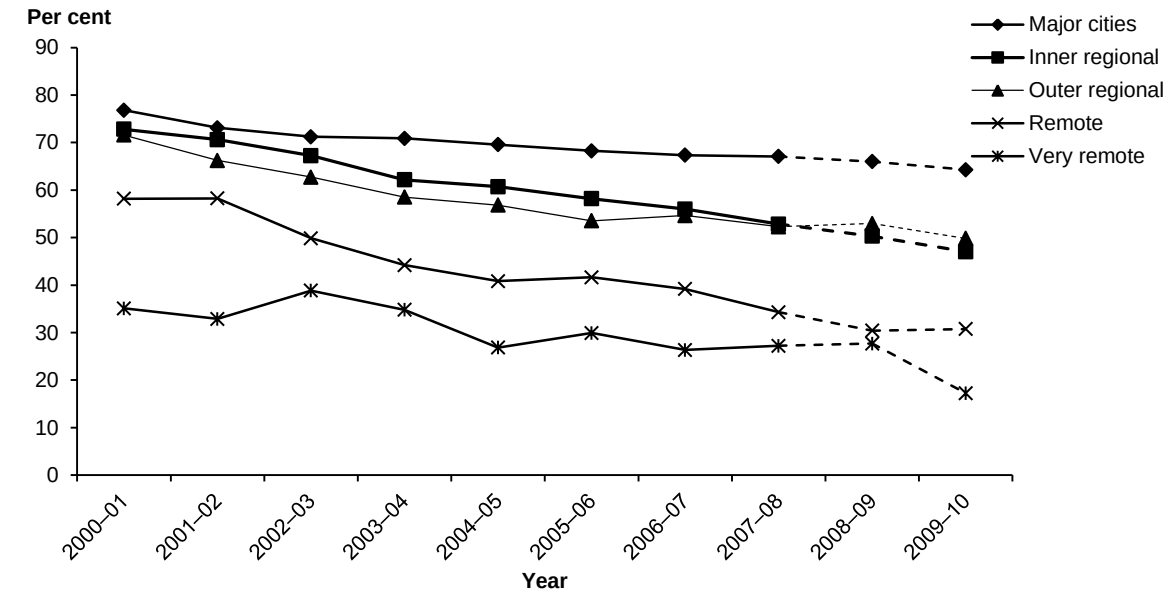
For chest pain, the distribution of hospitalisations by length of stay is relatively consistent across regions (Table C27). Only a small proportion of hospitalisations with a principal diagnosis of chest pain results in a transfer, with patients admitted mainly for diagnosis and observation.

Trends in the length of hospitalisation vary by region (tables C28 and C29 and figures 5.30 to 5.33). For AMI hospitalisations in *Major cities* there was a slight rise in the proportion of stays of 1 day or less and a slight decline in the proportion with 3 days or more from 2000–01 to 2007–08. In other regions the trends are far more marked with relatively large increases in the proportion of shorter stays and associated declines in longer stays. This would be expected given the increase in the number of transfers and cardiac procedures associated with AMI hospitalisations over that time. The trends for UA by region show a similar pattern to that found for AMI, although with less marked differences between the regions.



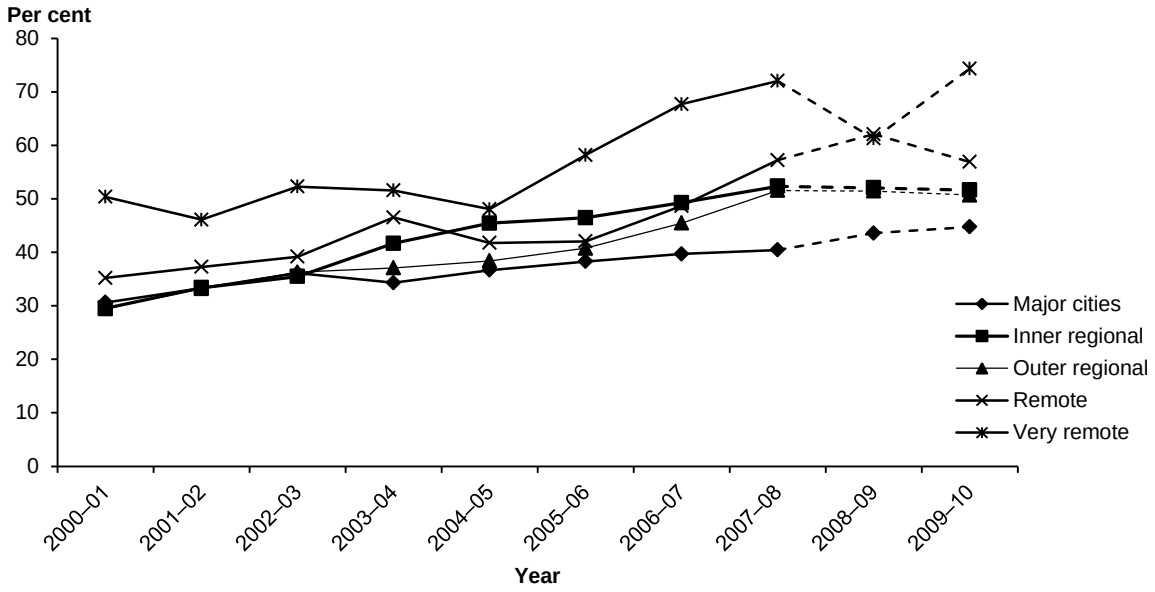
Source: AIHW National Hospital Morbidity Database.

Figure 5.30: Proportion of AMI hospitalisations with a length of stay of 1 day or less, by region of hospital, Australia, 2000–01 to 2009–10



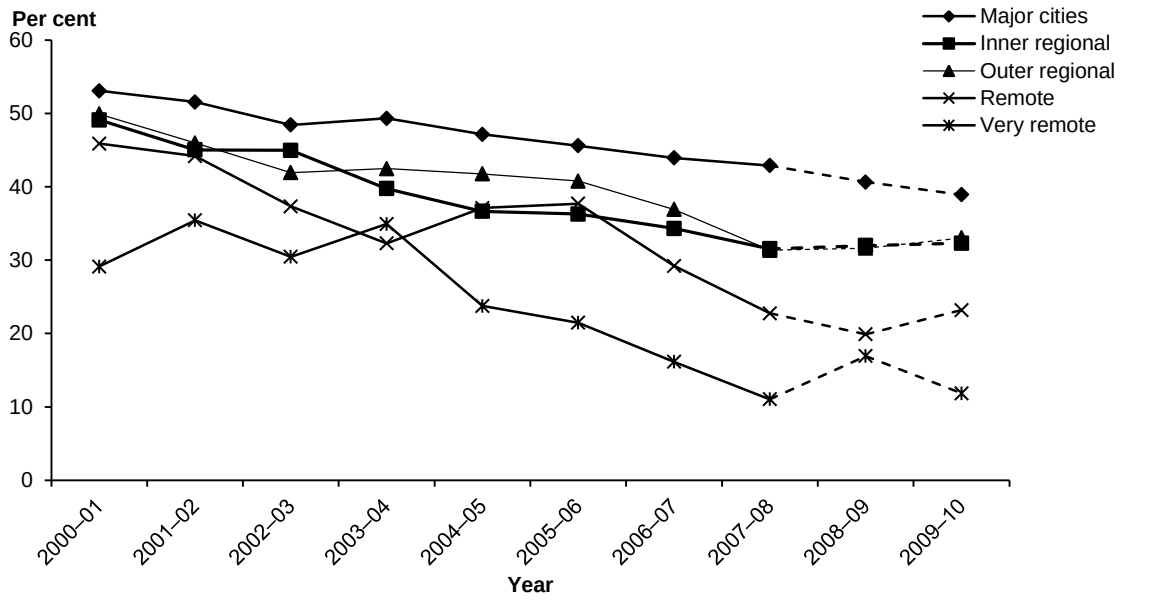
Source: AIHW National Hospital Morbidity Database.

Figure 5.31: Proportion of AMI hospitalisations with a length of stay of 3 days or more, by region of hospital, Australia, 2000–01 to 2009–10



Source: AIHW National Hospital Morbidity Database.

Figure 5.32: Proportion of UA hospitalisations with a length of stay of 1 day or less, by region of hospital and length of stay, Australia, 2000–01 to 2009–10



Source: AIHW National Hospital Morbidity Database.

Figure 5.33: Proportion of UA hospitalisations with a length of stay of 3 days or more, by region of hospital and length of stay, Australia, 2000–01 to 2009–10

Length of stay for transfers by region

Over 80% of AMI hospitalisations in *Very remote* regions that ended in a transfer to another acute hospital were transferred within 1 day or less (Table C30). This was much higher than in other regions. Around half of AMI hospitalisations in *Major cities* and *Inner regional* areas that ended in a transfer had a length of stay of 1 day or less.

In 2007–08, 77.6% of UA hospitalisations in *Very remote* regions that ended in a transfer to another hospital were of 1 day or less duration. For *Major cities* this proportion was lower, at 65.7%.

Looking at AMI hospitalisations that began with a transfer, almost half were for greater than 3 days (Table C31). Longer lengths of stay were more common in *Outer regional* hospitals than in *Major cities* (59.7% compared with 49.2%, respectively). For UA, 39.2% of hospitalisations that began with a transfer were for longer than 3 days. The longer lengths of stay were more common in *Outer regional* areas than in *Major cities* (48.3% compared with 39.1%, respectively).

5.7 Procedures for ACS events

This section examines the main procedures currently used to treat ACS in hospital. These are angiography, percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG), described in Box 5.1. These procedures are major interventions and are performed by specialists at major hospitals with a catheterisation laboratory (specialist cardiac facility).

Box 5.1: Procedures used for acute coronary syndrome

Diagnostic

Coronary angiography (also known as coronary arteriography) gives a picture of the heart's arteries, known as the coronary arteries, to find out if and where the coronary arteries are narrowed or blocked. A catheter is guided to the heart where a special dye is released into the coronary arteries before X-rays are taken. The resulting X-ray images provide detailed information about the health of the heart and arteries. This is an important diagnostic test that informs medical professionals on treatment options.

Therapeutic

Percutaneous coronary interventions (PCIs) are used to restore adequate blood flow to blocked coronary arteries. Two types of procedure are used: coronary angioplasty without stent, and coronary stenting. Coronary angioplasty uses a small balloon to clear the arteries. Coronary stenting is similar, but involves the insertion of stents (expandable mesh tubes) into the affected coronary arteries.

Note that for this report open transluminal angioplasty and stenting procedures have been included with PCIs. Only a very few of these procedures are conducted.

Coronary artery bypass grafting (CABG) is a surgical procedure using blood vessel grafts to bypass blockages in the coronary arteries and restore adequate blood flow to the heart muscle. The surgery involves taking a blood vessel from the patient's leg, arm or inner chest and using it to attach to vessels on the outside of the heart to bypass a blocked artery.

See Appendix A for Australian Classification of Health Interventions (ACHI) codes.

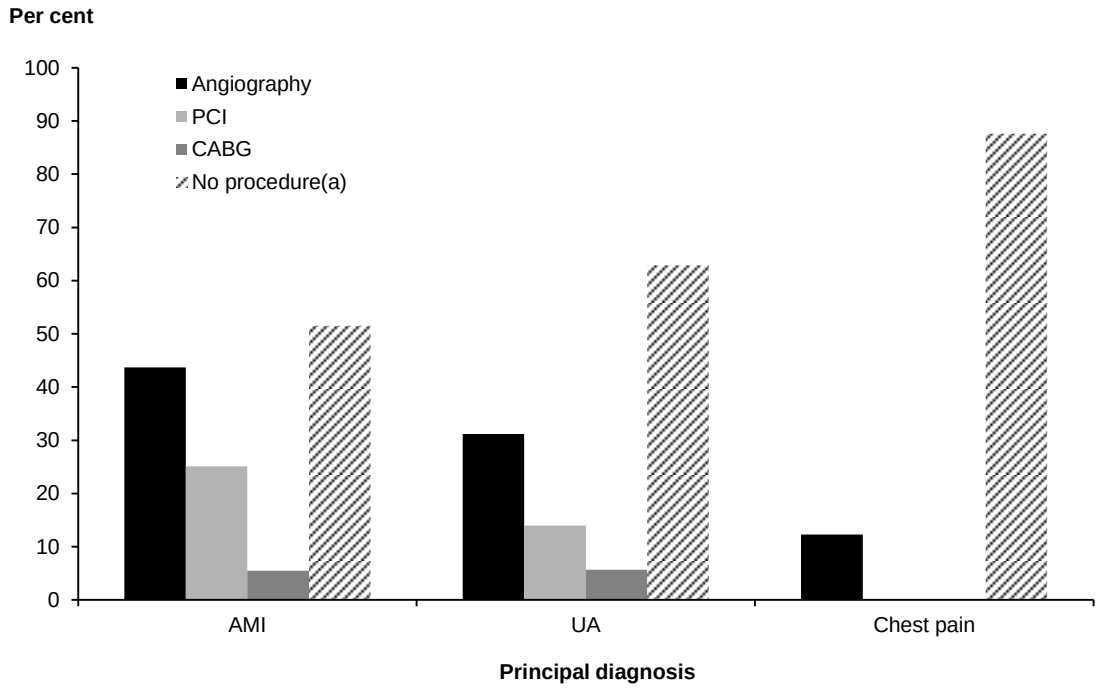
The analysis looks at whether or not one of angiography, PCI or CABG was performed as part of a hospital episode. A person may have an angiography and either a PCI or CABG and each will be counted. As a result, the total for the three procedures will be larger than the

count of 'any procedure'. It should also be noted that, in the NHMD, procedures are reported only against the hospital episode in which they were undertaken.

In 2007–08, 27,167 AMI hospitalisations, 14,375 UA hospitalisations and 14,297 chest pain hospitalisations had at least one of angiography, PCI or CABG. This was equivalent to 48.5%, 37.1% and 12.4%, respectively, of total hospitalisations for each disease (Table C32 and Figure 5.34).

Angiography was the most common procedure, as would be expected given that it is a diagnostic procedure. In 2007–08, 43.7% of AMI hospitalisations, 31.2% of UA hospitalisations and 12.3% of chest pain hospitalisations had angiography.

PCI was also relatively common, with 25.1% of AMI hospitalisations and 14.0% of UA hospitalisations having this procedure. CABG is much less common, with 5.5% of AMI hospitalisations and 5.7% of UA hospitalisations receiving this treatment.



(a) No angiography, PCI or CABG.

Source: AIHW National Hospital Morbidity Database.

Figure 5.34: Proportion of hospitalisations with a principal diagnosis of AMI, UA and chest pain that had a cardiac procedure, Australia, 2007–08

By length of stay

Procedures were associated with longer lengths of hospital episodes, for AMI, UA and chest pain hospitalisations (Table C33). In 2007–08, 55.9% of AMI hospitalisations with at least one of the three procedures had a length of stay of 3 or more days, compared with 44.4% of AMI hospitalisations with no procedure. The longest stays were associated with CABG.

A similar pattern was found for UA but lengths of stay were generally shorter than for AMI. This difference in length of stay with the same procedures between AMI and UA may be associated with the greater heart tissue damage caused by an AMI compared to a UA, requiring longer term recovery and care.

In 2007-08, 68.9% of AMI hospitalisations and 73.3% of UA hospitalisations, of 1 day or less duration, did not have any of these cardiac procedures (Table C34).

Transfers

Of AMI hospitalisations in 2007–08 that began with a transfer from another hospital, 76.7% had at least one of angiography, PCI or CABG procedures undertaken after admission by transfer (Table C35). The proportion was highest in *Major cities* (83.1%) and *Outer regional* areas (67.1%), reflecting the availability of specialist services. A similar pattern was found for UA.

Trends in procedure use

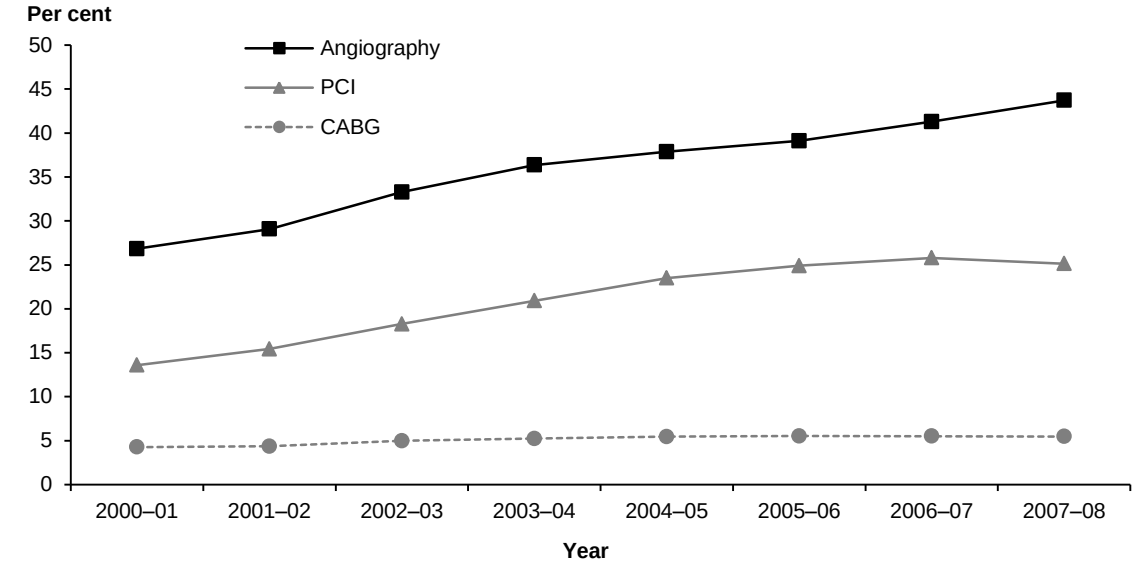
The proportion of AMI hospitalisations with an associated angiography, PCI or CABG procedure increased from 32.9% in 2000–01 to 48.5% in 2007–08 (Table C36). Most of the increase was due to an increase in angiography and PCI (Table C37 and Figure 5.35). In 2000–01, 26.8% of AMI hospitalisations had an angiography procedure. By 2007–08 this had risen to 43.7%. The actual number of AMI hospitalisations with an angiography rose from 10,241 to 24,481.

Similarly, the proportion of AMI hospitalisations with a PCI almost doubled from 13.6% in 2000–01 to 25.1% in 2007–08, although there does appear to be some flattening of the rise from 2006–07 onwards. The number of AMI hospitalisations with a PCI rose from around 5,000 to 14,000 over the period 2000-01 to 2007–08.

The proportion of AMI hospitalisations with a CABG procedure remained relatively stable over the period at around 4% to 5%. In 2008–09 over 3,000 AMI hospitalisations had a CABG.

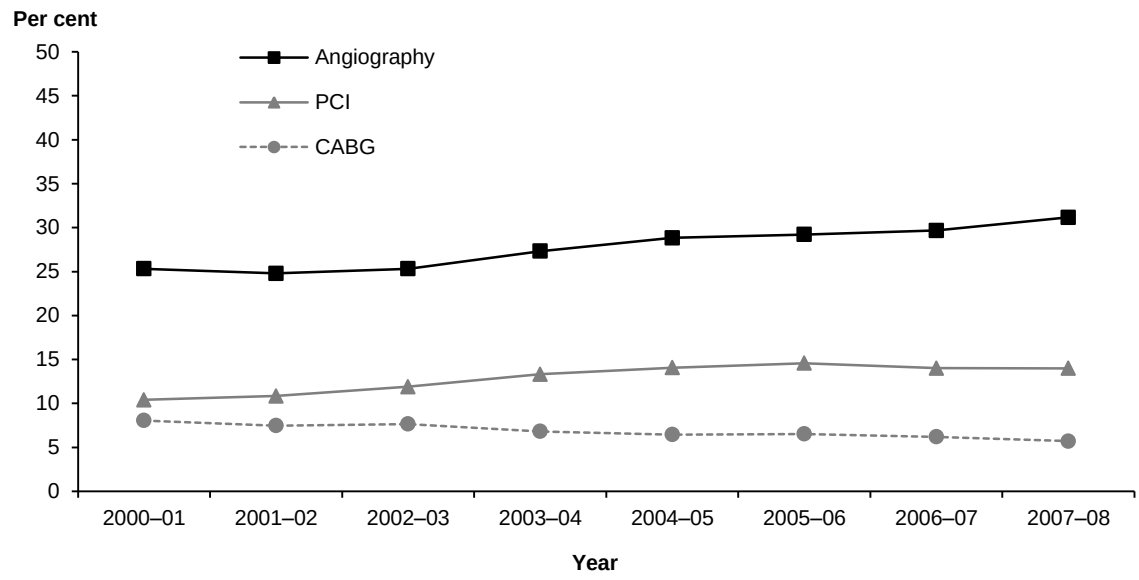
The increase in the rates of procedures per hospital episode is less dramatic for UA (table C36 and C38 and Figure 5.36). The proportion of UA hospitalisations that had an angiography procedure rose from 25.3% to 31.2% between 2000–01 and 2007–08. The actual number fell, from around 14,000 to around 12,000. For PCI, while the numbers stayed relatively stable, the proportion of UA hospitalisations with a PCI rose from 10.4% to 14.0%. For CABG, there was a decline from 8.1% to 5.7%.

For chest pain, the only main procedure performed is angiography. While the actual number of angiographies for chest pain increased by almost 50% between 2000–01 and 2007–08, the proportion of chest pain hospitalisations that had an angiography procedure declined from 13.9% to 12.3% (Table C39 and Figure 5.37).



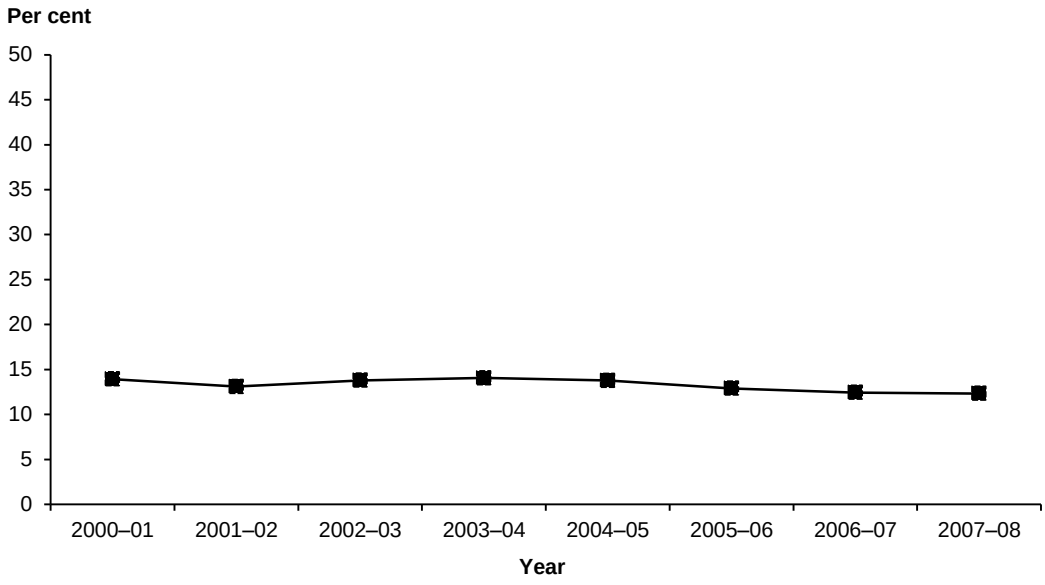
Source: AIHW National Hospital Morbidity Database.

Figure 5.35: Proportion of hospitalisations with a principal diagnosis of AMI that had a cardiac procedure, Australia, 2000–01 to 2007–08



Source: AIHW National Hospital Morbidity Database.

Figure 5.36: Proportion of hospitalisations with a principal diagnosis of UA that had a cardiac procedure, Australia, 2000–01 to 2007–08



Source: AIHW National Hospital Morbidity Database.

Figure 5.37: Proportion of hospitalisations with a principal diagnosis of chest pain that had an angiography, Australia, 2000–01 to 2007–08

6 Deaths

The current algorithm to estimate the incidence of acute coronary events sums non-fatal hospitalisations for AMI with a length of stay of 3 or more days and all CHD deaths. The non-fatal hospitalisations are extracted from the NHMD while CHD deaths are extracted from the NMD.

While the focus of this report is on hospitalisations, the mortality data have a major impact on the estimates of ACS events and case-fatality rates.

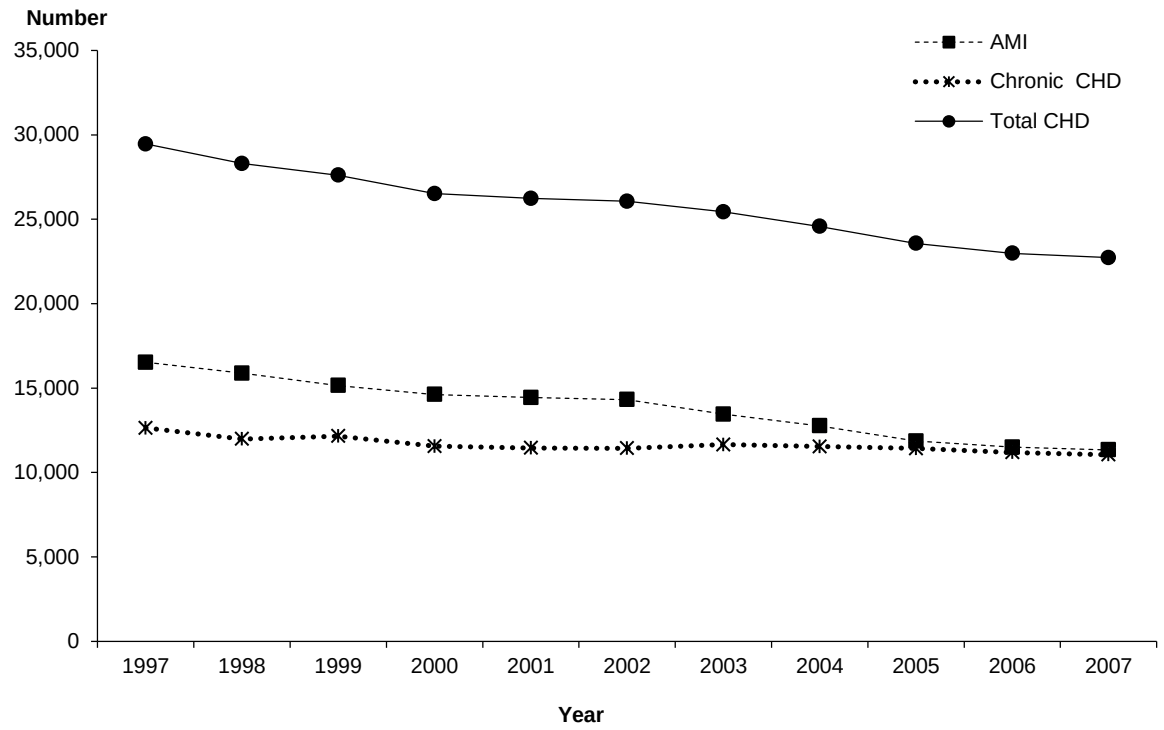
The current algorithm uses all deaths from CHD for the fatal component, not just deaths from AMI. From validation at the time of development, it was found that not all deaths from AMI were captured if the NMD was restricted to only those deaths with an underlying cause of AMI. Some deaths that were considered to be AMI deaths were found to be coded in other categories of CHD (Jamrozik et al. 2001).

Since the algorithm was developed and validated there have been changes in the coding of the cause of death (from ICD-9 to ICD-10) and in coding practices (from manual to electronic). Awareness and treatment of ACS has changed considerably. It is timely to question what deaths we should be including in our estimates of the incidence of acute coronary events.

There has been a gradual and long-term decline in the proportion of CHD deaths coded with an underlying cause of AMI, and an associated increase in the proportion coded with an underlying cause of chronic CHD. This is a result of a greater decline in the number of AMI deaths than in the number of deaths from chronic CHD (Table C40 and Figure 6.1). In 1997, 56.1% of CHD deaths were coded as AMI and 42.9% as chronic CHD. By 2007 the AMI proportion had fallen to 50.0% and the chronic CHD proportion had risen to 48.6%. AMI deaths declined by 31.3% over this period, while chronic CHD deaths declined by 12.6%. This is the continuation of a trend that started in the late 1970s (in 1979, 73.4% of CHD deaths were coded as AMI).

Between 1997 and 2007, both AMI and CHD death rates declined across all age groups (Table C41).

In the absence of a validation study it is not possible to determine if all CHD deaths should be used in the estimate of acute coronary events, or if it should be limited to only AMI and UA deaths. The options for both are presented in the alternative algorithms for consideration in Chapter 7 of this report.



Note: Trends are not shown for Angina pectoris (which includes UA) and Other acute AMI as numbers are relatively small. See Table C40.

Source: AIHW National Mortality Database.

Figure 6.1: Deaths with an underlying cause of CHD, by disease, 1997–2007

7 Alternative algorithms

The following presents alternative options for consideration for monitoring the incidence of ACS events using the NHMD and NMD. ACS case-fatality rates calculated from the derived number of ACS events are also presented.

7.1 Options for consideration

A range of options for estimating the incidence of ACS events and case-fatality rates are provided for consideration, based on the findings from the analysis of the NHMD presented in this report. As there is no current independent source of national data on the number of ACS events to validate the alternatives (such as WHO MONICA data which were used in the development of the current algorithm), these options are presented for discussion and to illustrate the sensitivity of different assumptions.

ACS events per 100,000 population and case-fatality rates are presented for Australia, for people aged 35 and over, for the period 1994–95 to 2007–08.

The options are presented at the national level only. There is considerable variation across Australia in the management of ACS patients, illustrated by differences in transfer rates. Dealing with transfers would be problematic at a regional or state level. There would be a risk of overcounting in some regions and undercounting in others.

The rate of ACS events has been calculated by dividing the estimated number of non-fatal and fatal ACS events by the Australian population (for people aged 35 and over). It is calculated per 100,000 population and has been age-standardised to the 2001 Australian population to account for changes in the age structure over time.

Case-fatality rates have been calculated by dividing the estimated number of fatal ACS events by the estimated total number of ACS events (fatal and non-fatal) and multiplying by 100 to give a percentage. Case-fatality rates have also been age-standardised, but to the age distribution of acute coronary events in 2001 (calculated using the existing algorithm).

The options for consideration are plotted against the current algorithm for comparative purposes.

The existing algorithm includes only AMI hospitalisations. To better measure the incidence of all ACS events, the alternatives for consideration include both AMI and UA hospitalisations. The inclusion of UA hospitalisations leads to a higher estimate for ACS events and lower case-fatality than with the existing method (which includes non-fatal AMI hospitalisations and CHD deaths).

The impact of removing hospitalisations that end in a transfer (to help reduce the double counting from transfers) is shown in one of the options; another shows the impact of removing hospitalisations with a stay of less than 2 days (to simulate removal of possible transfers); and another shows the impact of restricting the analysis to hospitalisations with an 'emergency' mode of admission.

Two sets of options are presented for ACS events and case-fatality to show the impact of using all CHD deaths or the more restricted AMI and UA deaths in the algorithm.

All the algorithms are based on the following formula:

$$Incidence\ of\ ACS\ events = \frac{Non\text{-}fatal\ hospitalisations\ (A) + Deaths\ (B)}{Estimated\ resident\ population\ Australia} \times 100{,}000$$

$$Case\text{-}fatality = \frac{Deaths\ (B)}{[Non\text{-}fatal\ hospitalisations\ (A) + Deaths\ (B)]} \times 100$$

with A and B defined as indicated in Table 7.1.

The first four alternative algorithms (options 1a–4a) use four different definitions for hospitalisations, and deaths from AMI or UA. The second set of alternative algorithms (options 1b–4b) use the same four hospitalisation options as for 1a–4a, but deaths from all CHD.

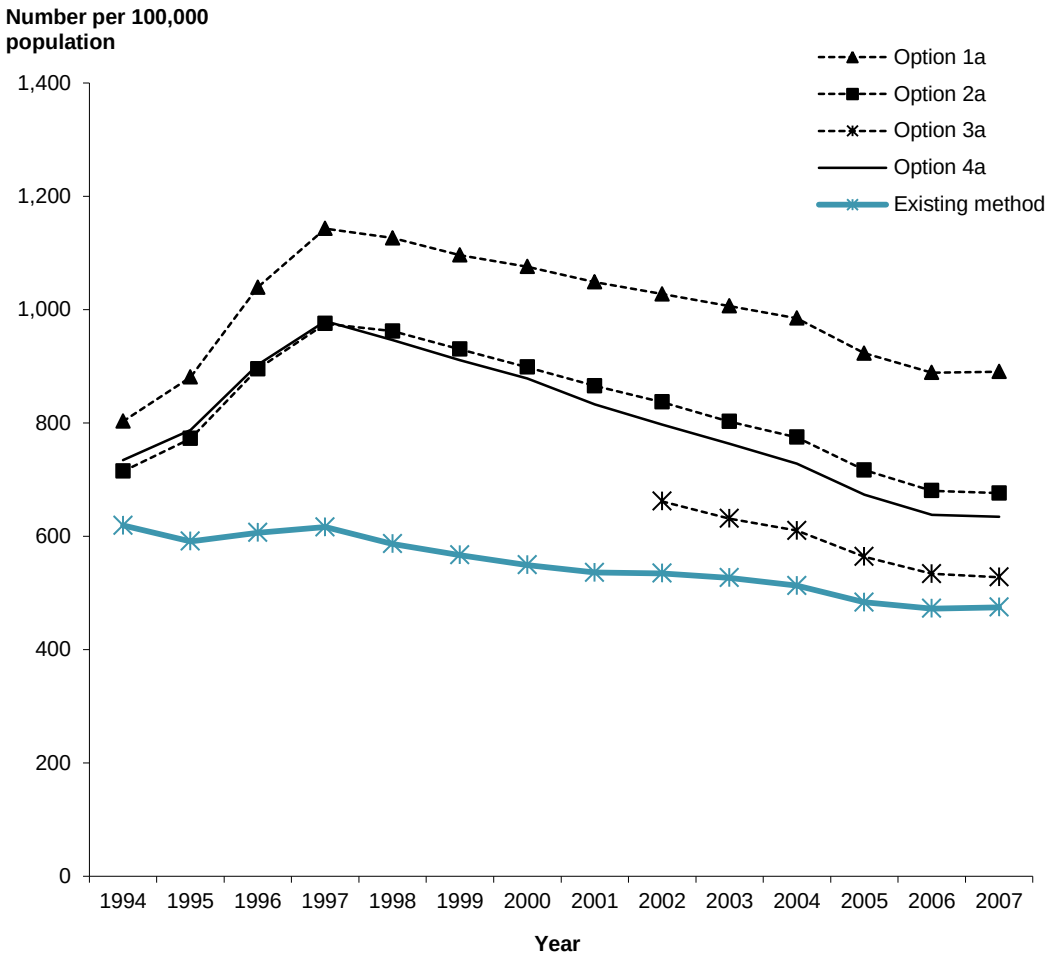
Table 7.1: Alternative algorithms for monitoring ACS events and case-fatality rates

Method	A: Hospitalisations (from NHMD)	B: Deaths (from NMD)
Existing algorithm	Non-fatal AMI with LOS>3	CHD
Option 1a	Non-fatal AMI+UA	AMI+UA
Option 2a	Non-fatal AMI+UA excluding hospitalisations ending in a transfer	AMI+UA
Option 3a	Non-fatal emergency AMI+UA excluding hospitalisations ending in a transfer	AMI+UA
Option 4a	Non-fatal emergency AMI+UA excluding hospitalisations with a LOS<2 days	AMI+UA
Option 1b	Non-fatal AMI+UA	CHD
Option 2b	Non-fatal AMI+UA excluding hospitalisations ending in a transfer	CHD
Option 3b	Non-fatal emergency AMI+UA excluding hospitalisations ending in a transfer	CHD
Option 4b	Non-fatal emergency AMI+UA excluding hospitalisations with a LOS<2 days	CHD

Note: LOS = length of stay.

7.2 ACS events

Results for the alternative algorithms for ACS events are presented in tables 7.2, 7.3 and 7.4 and figures 7.1, 7.2 and 7.3 (presented as an age-standardised rate per 100,000 population, for persons aged 35 and over).



Exisiting method: Non-fatal AMI hospitalisations + CHD deaths (35+ yr)
Option 1a: Non-fatal AMI+UA hospitalisations + AMI+UA deaths (35+ yr)
Option 2a: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 3a: Non-fatal emergency AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 4a: Non-fatal AMI+UA hospitalisations excl LOS<2 days + AMI+UA deaths (35+ yr)

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.1: Comparison of algorithm options for ACS events (age-standardised) using AMI and UA deaths, Australia, 1994 to 2007

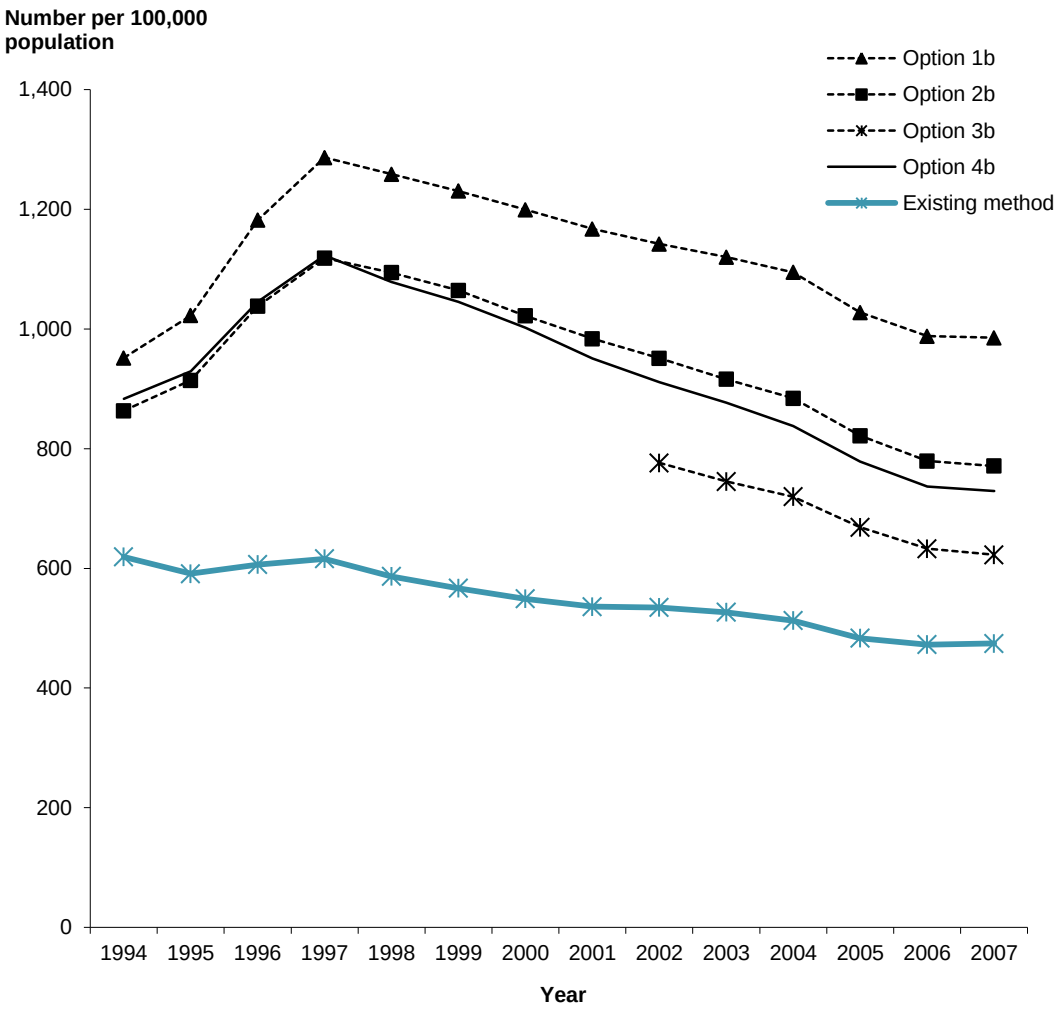
Table 7.2: Alternative algorithms for estimating the incidence of ACS events using AMI and UA deaths, Australia, 1994 to 2007, number per 100,000 population (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	619	591	606	616	587	567	549	536	535	527	513	483	472	475
Option 1a	803	881	1,039	1,143	1,126	1,096	1,076	1,049	1,027	1,006	985	923	889	890
Option 2a	715	772	895	975	962	930	898	865	837	802	775	717	680	676
Option 3a[(a)]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	662	631	610	564	534	528
Option 4a	735	788	903	980	946	911	879	832	797	763	728	674	638	634

(a) Urgency of admission is only available from 2001–02 in the NHMD.

n.a. Not available.

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.



Exisiting method - Non-fatal AMI hospitalisations + CHD deaths (35+ yr)
Option 1b: Non-fatal AMI+UA hospitalisations + CHD deaths (35+ yr)
Option 2b: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+ yr)
Option 3b: Non-fatal emergency AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.2: Comparison of algorithm options for ACS events (age-standardised) using CHD deaths, Australia, 1994 to 2007

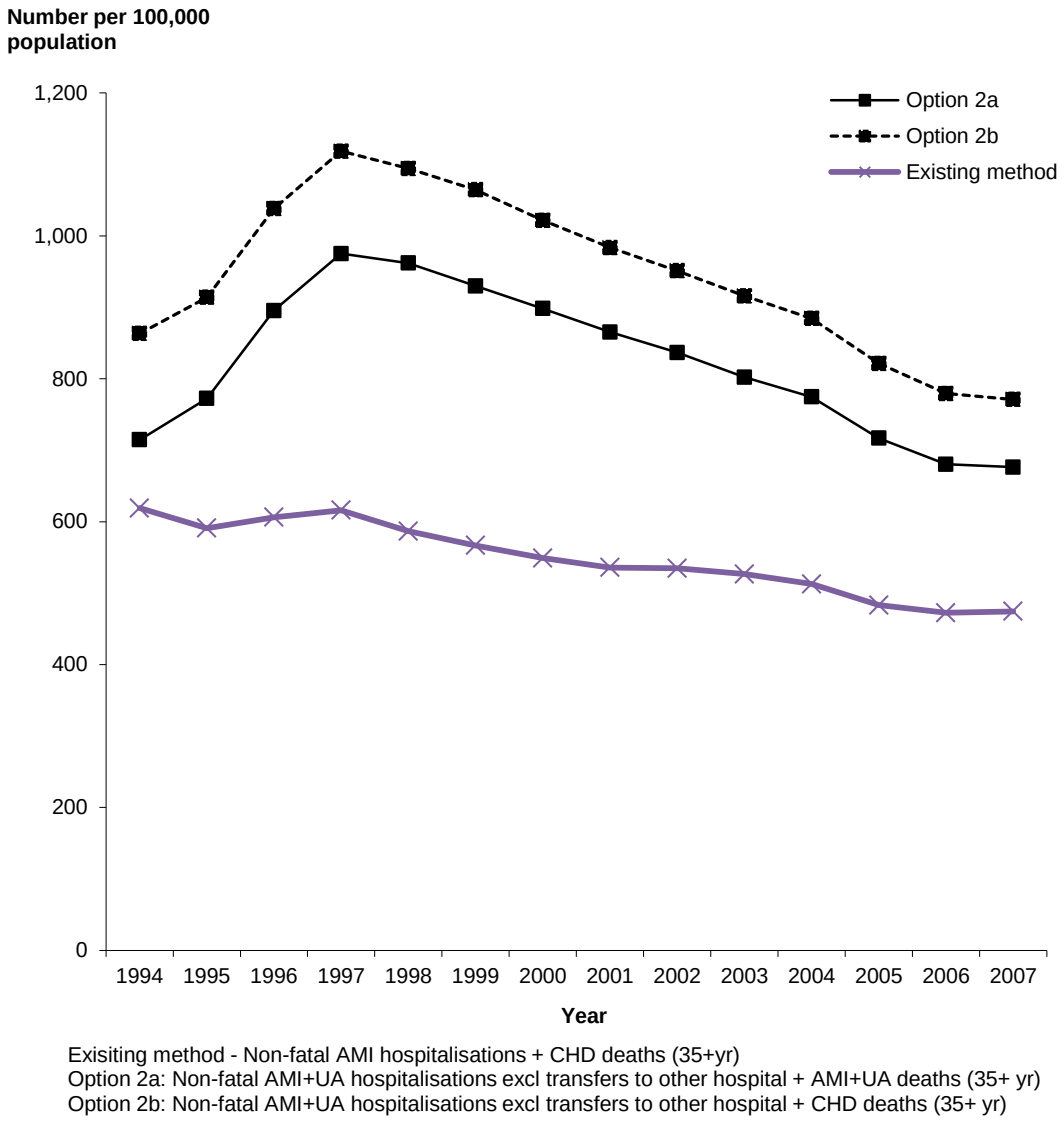
Table 7.3: Alternative algorithms for estimating the incidence of ACS events using CHD deaths, Australia, 1994 to 2007, number per 100,000 population (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	619	591	606	616	587	567	549	536	535	527	513	483	472	475
Option 1b	952	1,022	1,182	1,286	1,259	1,230	1,199	1,167	1,142	1,120	1,095	1,028	988	985
Option 2b	863	914	1,038	1,118	1,094	1,064	1,022	984	951	916	884	821	779	771
Option 3b[(a)]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	776	745	720	669	633	623
Option 4b	883	929	1,045	1,123	1,078	1,045	1,002	951	911	877	838	778	737	729

(a) Urgency of admission is only available from 2001–02 on the NHMD.

n.a. Not available.

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.



Exisiting method - Non-fatal AMI hospitalisations + CHD deaths (35+yr)
Option 2a: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 2b: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+ yr)

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.3: Age-standardised ACS events comparing AMI+UA and CHD deaths, Australia, 1994 to 2007

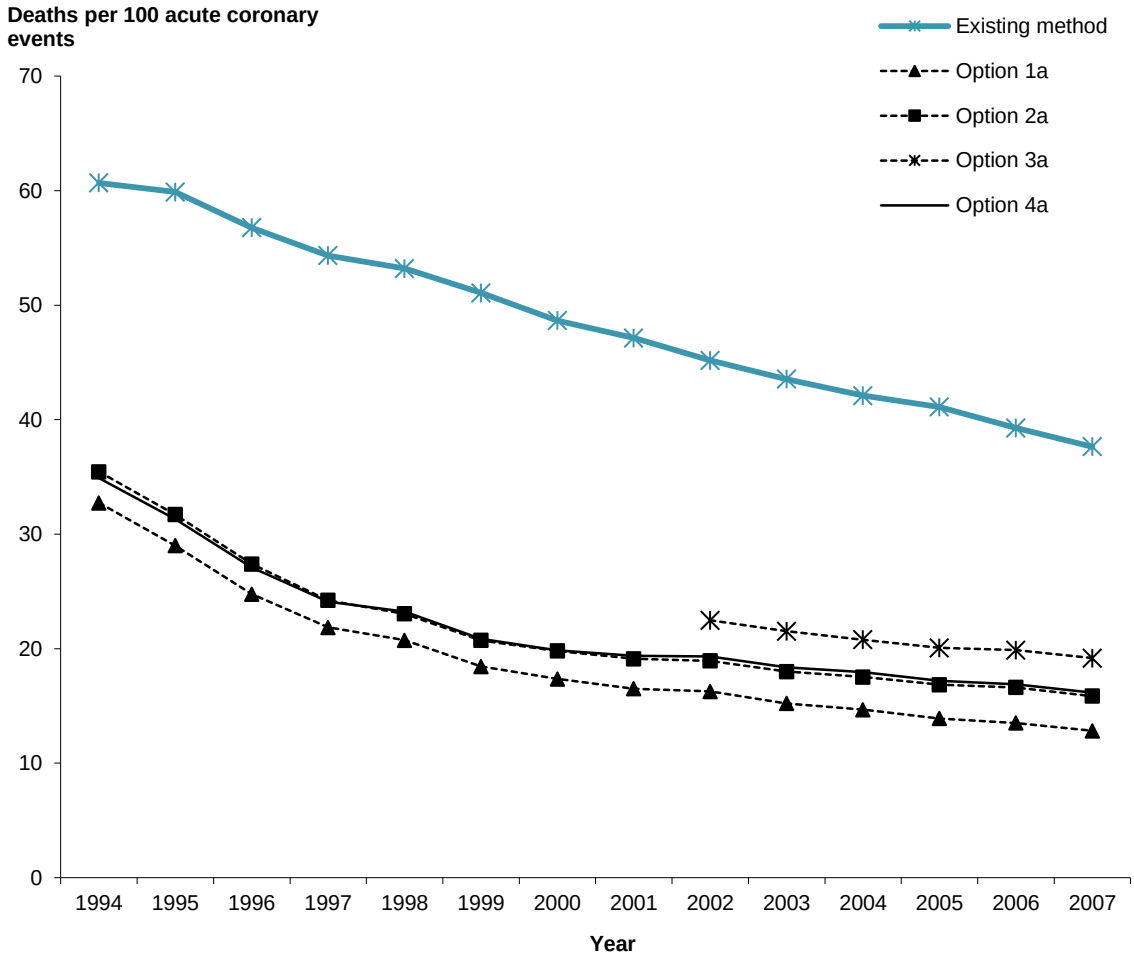
Table 7.4: Alternative algorithms for estimating the incidence of ACS events comparing AMI+UA and CHD deaths, Australia, 1994 to 2007, number per 100,000 population (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	619	591	606	616	587	567	549	536	535	527	513	483	472	475
Option 2a	715	772	895	975	962	930	898	865	837	802	775	717	680	676
Option 2b	863	914	1,038	1,118	1,094	1,064	1,022	984	951	916	884	821	779	771

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

7.3 Case-fatality

Tables 7.5, 7.6 and 7.7 and figures 7.4, 7.5 and 7.6 show the case-fatality rates for the same alternative options as shown in Section 7.1. The case-fatality rate is the proportion of events that result in death. The rates (shown in per cent) have been age-standardised to ACS events in 2001 (derived using the existing algorithm).



Exisiting method: Non-fatal AMI hospitalisations + CHD deaths (35+ yr)
Option 1a: Non-fatal AMI+UA hospitalisations + AMI+UA deaths (35+ yr)
Option 2a: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 3a: Non-fatal emergency AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 4a: Non-fatal AMI+UA hospitalisations excl LOS<2 days + AMI+UA deaths (35+ yr)

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.4: Comparison of algorithm options for case-fatality rates (age-standardised) using AMI and UA deaths, Australia, 1994 to 2007

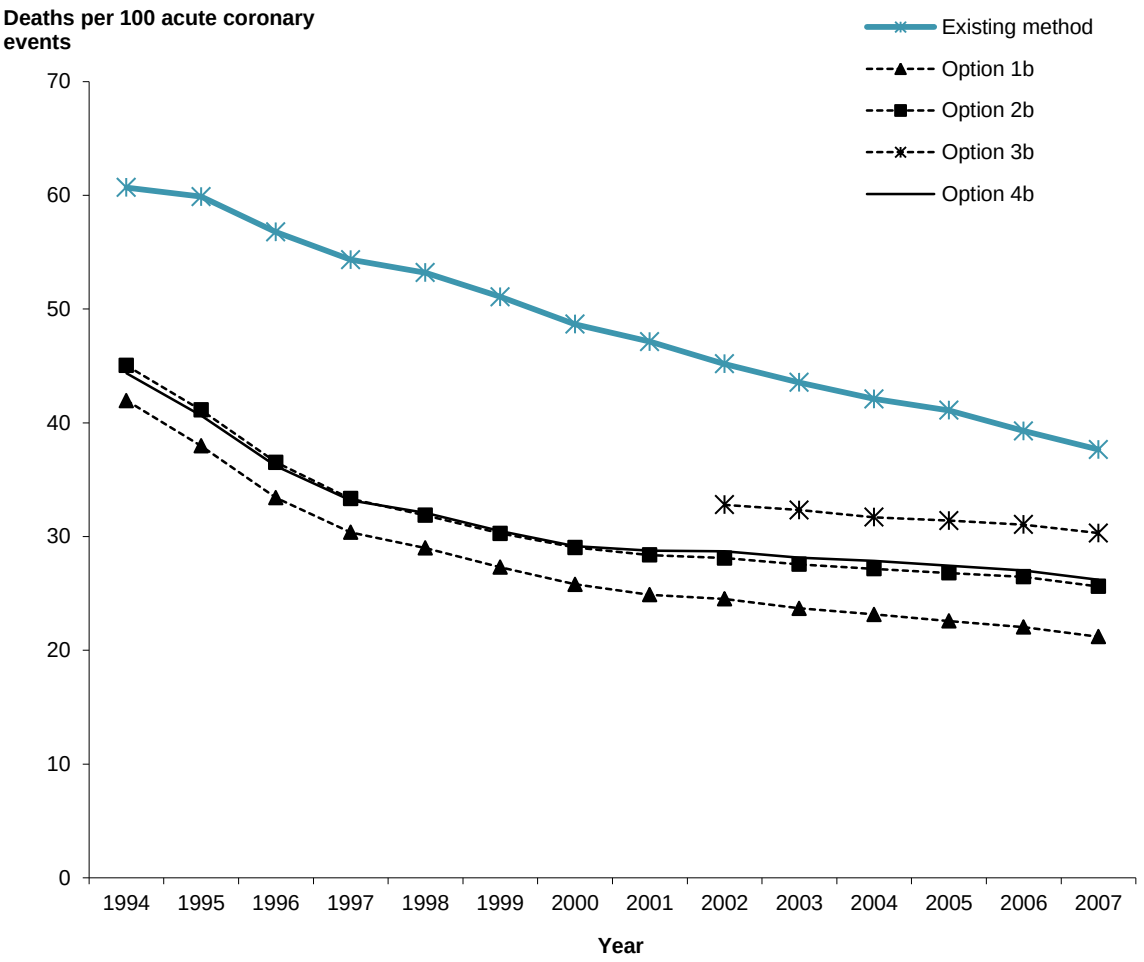
Table 7.5: Alternative algorithms for case-fatality rates using AMI and UA deaths, Australia, 1994 to 2007, number of deaths per 100 acute coronary events (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	60.7	59.9	56.8	54.3	53.2	51.1	48.7	47.1	45.2	43.5	42.1	41.1	39.3	37.6
Option 1a	32.7	29.0	24.8	21.9	20.7	18.5	17.4	16.5	16.3	15.2	14.7	13.9	13.5	12.8
Option 2a	35.4	31.7	27.4	24.2	23.0	20.7	19.8	19.1	18.9	18.0	17.5	16.8	16.6	15.9
Option 3a[(a)]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	22.5	21.5	20.8	20.1	19.9	19.2
Option 4a	34.9	31.3	27.1	24.1	23.2	20.9	19.9	19.4	19.3	18.4	17.9	17.2	16.9	16.2

(a) Urgency of admission is only available from 2001–02 on the NHMD.

n.a. Not available.

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.



Exisiting method: Non-fatal AMI hospitalisations + CHD deaths (35+ yr)
Option 1b: Non-fatal AMI+UA hospitalisations + CHD deaths (35+ yr)
Option 2b: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+ yr)
Option 3b: Non-fatal emergency AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+ yr)
Option 4b: Non-fatal AMI+UA hospitalisations excl LOS<2 days + CHD deaths (35+ yr)

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.5: Comparison of algorithm options for case-fatality rates (age-standardised) using CHD deaths, Australia, 1994 to 2007

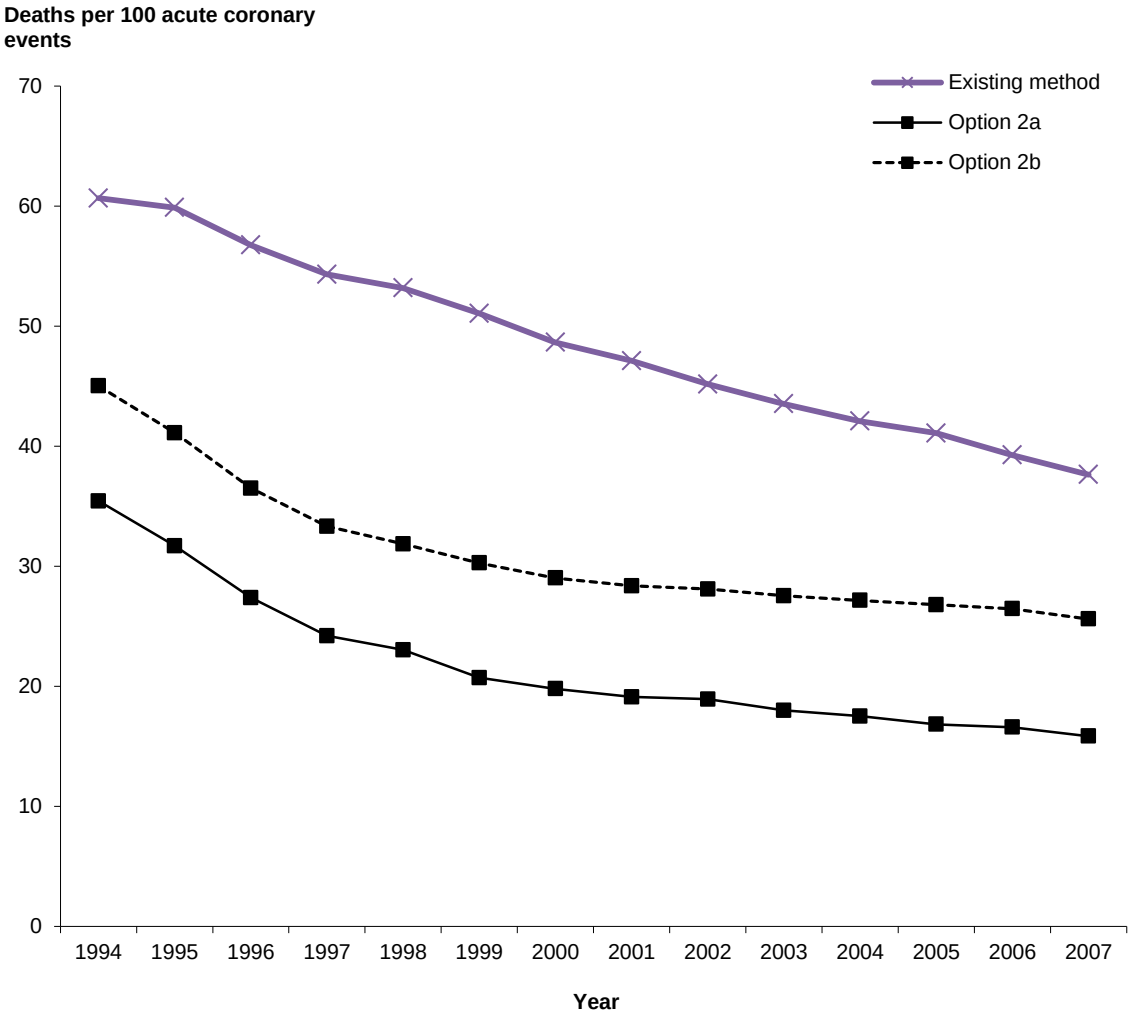
Table 7.6: Alternative algorithms for case-fatality rates using CHD deaths, Australia, 1994 to 2007, number of deaths per 100 acute coronary events (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	60.7	59.9	56.8	54.3	53.2	51.1	48.7	47.1	45.2	43.5	42.1	41.1	39.3	37.6
Option 1b	42.0	38.0	33.4	30.4	29.0	27.3	25.8	24.9	24.5	23.7	23.2	22.6	22.0	21.2
Option 2b	45.0	41.1	36.5	33.3	31.9	30.3	29.0	28.4	28.1	27.6	27.2	26.8	26.5	25.6
Option 3b[(a)]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	32.8	32.3	31.7	31.4	31.1	30.3
Option 4b	44.4	40.6	36.2	33.2	32.1	30.5	29.2	28.8	28.7	28.1	27.8	27.5	27.0	26.2

(a) Urgency of admission is only available from 2001–02 on the NHMD.

n.a. Not available.

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.



Exisiting method: Non-fatal AMI hospitalisations + CHD deaths (35+yr)
Option 2a: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + AMI+UA deaths (35+ yr)
Option 2b: Non-fatal AMI+UA hospitalisations excl transfers to other hospital + CHD deaths (35+ yr)

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

Figure 7.6: Age-standardised case-fatality rates comparing AMI+UA and CHD deaths, Australia, 1994 to 2007

Table 7.7: Alternative algorithms for case-fatality rates comparing AMI+UA and CHD deaths, Australia, 1994 to 2007, number of deaths per 100 acute coronary events (age-standardised)

Algorithm	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Existing method	60.7	59.9	56.8	54.3	53.2	51.1	48.7	47.1	45.2	43.5	42.1	41.1	39.3	37.6
Option 2a	35.4	31.7	27.4	24.2	23.0	20.7	19.8	19.1	18.9	18.0	17.5	16.8	16.6	15.9
Option 2b	45.0	41.1	36.5	33.3	31.9	30.3	29.0	28.4	28.1	27.6	27.2	26.8	26.5	25.6

Sources: AIHW National Hospital Morbidity Database; AIHW National Mortality Database.

7.4 Main points to note from the alternative algorithms

- All options and the existing method show trends for age-standardised ACS events per 100,000 population and case-fatality rates going in the same direction.
- However, the size and slope of the declining trend in ACS events and case-fatality vary.
- The existing method gives lower estimates for the number of ACS events than the other options as it only counts AMI hospitalisations, but all CHD deaths. The inclusion of UA hospitalisations increases the incidence estimates.
- The increase in the incidence trend lines for the options from 1994 to 1997 is due to a dramatic increase in the number of hospitalisations coded with a principal diagnosis of UA in those years. This is probably due to a change in codes and coding standards.
- The impact of removing hospitalisations that ended in a transfer from Option 1 (to limit double counting episodes for the one event) increases over the period as the proportion of transfers has increased.
- Removing non-emergency admissions in addition to hospitalisations that ended in a transfer lowers the incidence estimates further.
- The impact of removing hospitalisations with a length of stay of <2 days from Option 1 (a second possible means of limiting double counting episodes for the one event) increases over the period as the length of episodes has shortened.
- Case-fatality estimates based on the existing method are higher than those derived using the alternative methods as it only counts AMI hospitalisations but all CHD deaths.
- Case-fatality estimates based on the alternatives show a similar curve that is tending to flatten, while the existing method shows a more linear decline.

8 Discussion and recommendations

Monitoring ACS events at a national level

There is a need to monitor the incidence of ACS events at a national level due to its impact on the health of Australians. It is a costly disease in terms of both lives lost and expenditure. Data on the number of ACS events are also necessary to allow us to monitor trends in outcomes, using survival or case-fatality, to inform policy development and service planning and provision.

Currently there is no register of ACS in Australia and the only national estimates are derived from two administrative data sets held by the AIHW—the NHMD for non-fatal ACS and the NMD for fatal ACS. For the past 10 years, the estimates have been derived using an algorithm developed in the late 1990s and validated against data collected independently in Perth and Newcastle (MONICA study).

The impact of change on national hospital data

However, since the development and validation of the algorithm, there have been considerable changes in the coding of ACS, data collection practices, diagnostic techniques for identifying ACS, clinical practice and protocols. These are reflected in the NHMD, although not in a simple way. While we can get a reasonably accurate count of individuals who have died from ACS from the NMD (as individuals who died will have only one record), it is much more complex to obtain estimates of non-fatal ACS events from the NHMD as it an 'episode of care' based collection and episodes relating to the one event or individual cannot be identified.

Given the changes that have occurred since the algorithm was developed, it is timely to examine how these may have impacted on hospitalisation data for ACS and to review the algorithm accordingly.

This report presents trends in ACS hospitalisations over the past 10–15 years, briefly outlines the main issues that may be behind some of the changes, and presents a range of options for algorithms to monitor ACS in the future.

Hospitalisations for both AMI and UA are examined, as they are part of a continuum of acute coronary disease. As diagnostic tests have become more sensitive it is likely that there has been some substitution between the diseases, particularly UA and NSTEMI AMI. In addition, these diseases have similar hospital protocols for treatment and patients with UA are increasingly receiving similar procedures to those with AMI.

Trends in deaths that affect the estimation of fatal ACS events

Counts of fatal ACS events are currently derived from the NMD. All deaths with an underlying cause of CHD have been included to date, rather than deaths from AMI and UA. Deaths from this broader disease group were included in the algorithm based on validation at the time (Jamrozik et al. 2001). However, a brief analysis of the trends in deaths indicates a declining proportion of CHD deaths being coded as AMI deaths and a greater proportion being coded as chronic ischaemic heart disease. This is mostly due to a decline in the number of AMI-coded deaths and little change in the number of deaths coded as chronic ischaemic heart disease. The reason for the changing proportions is not explored in any detail in this

report but it could reflect a shift away from deaths from the acute disease to more chronic CHD; it could be related to the ageing of the population; or it could be a coding artefact.

Alternative algorithms for estimating ACS events and case-fatality rates from existing administrative data

Analysis of the NHMD suggests that the current algorithm for estimating ACS events is not as valid as when it was first developed. This is consistent with findings from the analysis of Western Australian linked health data (Hobbs 2009).

Several alternative algorithms are presented for monitoring ACS events at a national level in the future, using data from the NMHD and the NMD. These have been developed considering the results of the analysis of trends in ACS hospitalisations presented in this report. Alternatives for including either all CHD deaths, or only deaths from AMI and UA, are presented.

Further work required

Unfortunately there are no current available studies against which alternative algorithms can be benchmarked or validated (such as was done previously using MONICA data). However, some jurisdictions have well developed health data linkage systems (in particular New South Wales and Western Australia, with emerging capacity in South Australia and Victoria). While linked hospital and mortality data from these jurisdictions do not take account of interstate movements and transfers, they could be used to provide some indication of the accuracy of the alternative algorithms for those particular jurisdictions.

It is recommended that, as a next step to validating the proposed algorithms, available linked health data be analysed.

Appendix A: ICD-10-AM and ACHI codes[1]

ICD-10-AM (6th edition) codes for AMI and unstable angina (UA)

I21 Acute myocardial infarction (AMI)

Includes: myocardial infarction specified as acute or with a stated duration of 4 weeks (28 days) or less from onset

Excludes: certain current complications following acute myocardial infarction (I23.–) myocardial infarction: old (I25.2); specified as chronic or with a stated duration of more than 4 weeks (more than 28 days) from onset (I25.8); subsequent (I22.–); postmyocardial infarction syndrome (I24.1).

ICD-10-AM code	Description
I21.0	**Acute transmural myocardial infarction of anterior wall** Transmural infarction (acute)(of)(STEMI): • anterior (wall) NOS • anteroapical • anterolateral • anteroseptal
I21.1	**Acute transmural myocardial infarction of inferior wall** Transmural infarction (acute)(of)(STEMI): • diaphragmatic wall • inferior (wall) NOS • inferolateral • inferoposterior
I21.2	**Acute transmural myocardial infarction of other sites** Transmural infarction (acute)(of)(STEMI): • apical-lateral • basal-lateral • high lateral • lateral (wall) NOS • posterior (true) • posterobasal • posterolateral • posteroseptal • septal NOS
I21.3	**Acute transmural myocardial infarction of unspecified site** ST elevation myocardial infarction [STEMI] NOS Transmural myocardial infarction
I21.4	**Acute subendocardial myocardial infarction** Non-ST elevation myocardial infarction [NSTEMI] Nontransmural myocardial infarction NOS
I21.9	**Acute myocardial infarction, unspecified** Myocardial infarction (acute) NOS

Note: The letters NOS are an abbreviation for 'not otherwise specified', meaning 'unspecified' or 'unqualified'.

[1] ICD-10-AM = International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification; ACHI = Australian Classification of Health Interventions.

I22 Subsequent myocardial infarction

Includes: recurrent myocardial infarction

Note: This category should be assigned for infarction of any myocardial site, occurring within 4 weeks (28 days) from onset of a previous infarction.

Excludes: specified as chronic or with a stated duration of more than 4 weeks (more than 28 days) from onset (I25.8)

ICD-10-AM code	Description
I22.0	**Subsequent myocardial infarction of anterior wall** Subsequent infarction (acute)(of): • anterior (wall) NOS • anteroapical • anterolateral • anteroseptal
I22.1	**Subsequent myocardial infarction of inferior wall** Subsequent infarction (acute)(of): • diaphragmatic wall • inferior (wall) NOS • inferolateral • inferoposterior
I22.8	**Subsequent myocardial infarction of other sites** Subsequent myocardial infarction (acute)(of): • apical-lateral • basal-lateral • high lateral • lateral (wall) NOS • posterior (true) • posterobasal • posterolateral • posteroseptal • septal NOS
I22.9	**Subsequent myocardial infarction of unspecified site**

ICD-10-AM code	Description
I20.0	**Unstable angina** Angina: • crescendo • de novo effort • worsening effort Impending infarction Intermediate coronary syndrome Preinfarction syndrome

ACHI (ICD-10-AM 6th edition) codes for cardiac procedures

ACHI code	Description
Block 668	Coronary angiography
Block 670, 671	Percutaneous coronary interventions (PCI)
Block 672–679	Coronary artery bypass grafting (CABG)

Appendix B: Statistical methods

Rates

Crude rates and age-specific rates are calculated by dividing the number of events in a specified time period by the total number of individuals in the population (in the same age group). Age-specific rates are not age-standardised.

The Australian Estimated Resident Population as at 30 June was used to calculate age-specific rates for each year.

Age-standardised rates

Age-standardisation is a technique used to take account of the effect of differences in population age structures when comparing rates across different population groups (such as men and women) or across time. The direct method of standardisation was used to calculate age-standardised rates (ASRs) in this report, including ASRs for length of stay.

Direct age-standardisation

Age-standardised proportions have been calculated using the following formula:

$$\text{Age-standardised proportion (ASR)} = \sum(r_i P_i)/\sum P_i$$

where:

r_i is the sex- and age group-specific rate for sex and age group i in the population being studied

P_i is the population of age group i in the standard population

Five-year age groups were used in the standardisation.

Population for standardisation

The Australian population as at 30 June 2001 was the standard population (except for case-fatality presented in Chapter 7).

Case-fatality was standardised to the age distribution of all acute coronary events in 2001.

Totals

Totals in some tables may not add due to missing sex or age values.

Appendix C: Detailed tables

Overview

Table C1: Hospitalisations for CHD and ACS, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
CHD	90,265	94,625	99,549	101,749	104,888	102,898	14.0
AMI	20,188	20,332	21,817	21,728	22,064	22,270	10.3
UA	17,013	21,033	30,500	33,785	34,331	35,262	107.3
Chest pain	20,330	21,195	24,083	25,761	27,797	29,196	43.6
Female							
CHD	48,036	50,508	53,163	54,223	54,951	55,205	14.9
AMI	11,009	11,292	11,182	11,081	11,197	11,638	5.7
UA	12,141	14,580	19,552	21,146	21,538	22,104	82.1
Chest pain	17,558	18,998	21,594	23,159	25,521	26,939	53.4
Persons							
CHD	138,301	145,133	152,712	155,975	159,839	158,104	14.3
AMI	31,197	31,624	32,999	32,810	33,261	33,908	8.7
UA	29,154	35,613	50,052	54,932	55,869	57,367	96.8
Chest pain	37,888	40,193	45,677	48,924	53,318	56,135	48.2

(continued)

Table C1 (continued): Hospitalisations for CHD and ACS, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
CHD	102,929	103,300	103,048	103,390	105,417	107,349	106,249	106,173	107,246	106,705	102,327	101,732	3.7	18.2
AMI	22,270	23,660	24,933	26,487	28,847	31,051	31,371	32,565	34,085	36,871	36,302	36,166	65.6	82.6
UA	35,281	34,515	34,065	32,778	30,654	30,421	29,041	27,066	25,812	24,315	22,402	21,441	–31.1	42.9
Chest pain	29,296	31,879	35,226	39,108	41,618	44,773	49,083	51,479	58,322	59,450	57,734	62,015	102.9	192.4
Female														
CHD	55,226	54,612	55,362	56,169	56,376	56,876	56,028	55,194	55,079	54,710	52,481	52,101	–0.9	13.9
AMI	11,638	12,393	13,225	14,270	15,268	16,193	16,550	17,263	17,891	19,126	19,128	19,053	64.3	73.7
UA	22,118	21,401	21,349	20,623	19,343	18,904	17,665	16,021	15,322	14,480	13,026	12,606	–34.5	19.3
Chest pain	27,059	29,350	33,039	37,287	40,156	43,583	46,908	50,085	54,618	56,232	56,579	60,795	107.8	220.3
Persons														
CHD	158,156	157,913	158,410	159,561	161,794	164,226	162,283	161,367	162,328	161,417	154,808	153,833	2.1	16.7
AMI	33,908	36,053	38,158	40,759	44,116	47,245	47,923	49,828	51,977	55,997	55,430	55,219	65.1	79.5
UA	57,400	55,916	55,414	53,401	49,997	49,325	46,710	43,087	41,135	38,795	35,428	34,047	–32.4	33.1
Chest pain	56,355	61,230	68,266	76,395	81,775	88,357	95,993	101,564	112,940	115,684	114,314	122,812	105.3	205.3

Note: CHD = coronary heart disease; ACS = acute coronary syndrome; AMI = acute myocardial infarction; UA = uncontrolled angina.

Source: AIHW National Hospital Morbidity Database.

Table C2: Age-standardised hospitalisation rates for CHD and ACS, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
CHD	1,213.6	1,240.8	1,278.8	1,276.7	1,281.3	1,229.5	1.3
AMI	281.0	274.8	288.0	277.8	274.5	269.9	–3.9
UA	236.0	282.6	396.4	428.3	423.6	425.3	80.2
Chest pain	260.8	265.3	295.3	308.3	325.5	334.5	28.3
Female							
CHD	549.8	565.6	582.8	581.4	574.0	562.2	2.3
AMI	124.9	124.8	121.1	117.1	114.8	116.4	–6.8
UA	138.4	162.6	214.0	226.6	224.9	224.9	62.5
Chest pain	209.1	222.1	247.4	259.0	278.3	286.5	37.0
Persons							
CHD	867.0	889.8	916.1	914.6	912.5	880.8	1.6
AMI	198.4	196.0	199.8	193.6	190.9	189.7	–4.4
UA	184.0	219.5	300.9	322.7	319.4	319.9	73.8
Chest pain	234.2	243.1	270.7	283.4	301.5	310.1	32.4

(continued)

Table C2 (continued): Age-standardised hospitalisation rates for CHD and ACS, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
CHD	1,229.9	1,206.6	1,174.8	1,145.9	1,137.5	1,130.7	1,091.3	1,066.0	1,049.7	1,015.7	949.7	917.4	–17.4	–16.3
AMI	269.9	280.7	289.2	298.7	315.8	331.4	326.6	331.4	337.5	354.7	340.1	329.7	31.4	26.2
UA	425.5	407.0	391.5	364.8	332.1	321.3	298.8	272.2	252.9	231.6	208.2	193.5	–45.6	–1.9
Chest pain	335.6	357.8	386.5	419.7	436.8	461.0	494.8	509.1	564.7	562.8	534.4	560.8	67.7	115.8
Female														
CHD	562.4	541.7	535.2	526.9	517.7	510.8	492.5	474.1	463.2	447.6	419.7	407.1	–20.4	–18.6
AMI	116.4	120.4	124.7	129.9	136.1	141.2	141.3	143.9	145.6	151.4	148.1	144.6	30.1	21.2
UA	225.0	212.2	206.5	193.8	177.9	170.4	156.0	138.4	129.9	119.7	105.3	99.9	–46.8	–13.5
Chest pain	287.8	304.8	335.0	368.6	388.3	412.4	435.9	456.0	487.4	490.7	482.5	506.9	70.5	134.7
Persons														
CHD	881.1	858.2	839.1	821.9	813.1	805.9	778.4	755.9	742.5	718.7	672.4	650.9	–18.4	–17.1
AMI	189.7	196.6	202.5	209.9	221.6	231.6	229.5	232.8	236.8	248.2	239.6	232.9	30.8	25.1
UA	320.1	304.2	293.7	275.1	251.2	242.0	224.0	201.8	188.3	172.8	154.2	144.5	–46.0	–6.1
Chest pain	311.2	330.5	360.2	393.5	412.2	436.1	464.5	481.7	524.9	525.8	507.9	533.5	69.0	124.5

Note: CHD = coronary heart disease; ACS = acute coronary syndrome; AMI = acute myocardial infarction; UA = uncontrolled angina.

Source: AIHW National Hospital Morbidity Database.

Table C3: Hospitalisations for AMI by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	194	255	234	260	230	261	34.5
35–44	1,160	1,325	1,403	1,453	1,478	1,565	34.9
45–54	3,304	3,294	3,919	3,881	3,971	4,001	21.1
55–64	4,749	4,737	5,017	5,076	5,204	5,215	9.8
65–74	5,993	6,029	6,159	6,073	6,049	5,929	–1.1
75–84	3,960	3,863	4,133	4,103	4,146	4,228	6.8
85+	827	828	952	881	986	1,071	29.5
Total	**20,188**	**20,332**	**21,817**	**21,728**	**22,064**	**22,270**	**10.3**
Female							
<35	48	49	47	58	59	60	25.0
35–44	196	215	258	216	251	291	48.5
45–54	645	638	750	779	755	775	20.2
55–64	1,529	1,537	1,545	1,546	1,507	1,580	3.3
65–74	3,255	3,379	3,298	3,071	3,084	3,107	–4.5
75–84	3,946	3,947	3,770	3,849	3,834	3,967	0.5
85+	1,389	1,527	1,514	1,562	1,707	1,858	33.8
Total	**11,009**	**11,292**	**11,182**	**11,081**	**11,197**	**11,638**	**5.7**

(continued)

Table C3 (continued): Hospitalisations for AMI by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	261	284	263	283	318	334	349	356	342	394	340	305	51.0	103.1
35–44	1,565	1,473	1,637	1,611	1,719	1,873	1,840	1,873	1,881	2,240	2,096	2,030	43.1	93.1
45–54	4,001	4,306	4,407	4,460	4,869	5,321	5,265	5,427	5,648	5,973	5,763	5,937	49.3	80.8
55–64	5,215	5,525	5,627	6,189	6,618	7,411	7,507	7,518	8,190	8,755	8,713	8,817	67.9	84.4
65–74	5,929	5,962	6,143	6,376	7,064	7,226	7,395	7,539	7,819	8,340	8,339	8,254	40.7	39.2
75–84	4,228	4,808	5,207	5,633	6,264	6,613	6,753	7,273	7,306	7,940	7,691	7,369	87.8	100.5
85+	1,071	1,302	1,649	1,934	1,995	2,273	2,262	2,579	2,899	3,229	3,360	3,454	201.5	290.4
Total	**22,270**	**23,660**	**24,933**	**26,487**	**28,847**	**31,051**	**31,371**	**32,565**	**34,085**	**36,871**	**36,302**	**36,166**	**65.6**	**82.6**
Female														
<35	60	61	66	64	65	72	71	93	80	80	108	73	33.3	66.7
35–44	291	304	314	296	395	433	495	500	474	477	527	596	63.9	143.4
45–54	775	894	926	1,069	1,043	1,153	1,155	1,294	1,381	1,448	1,599	1,552	86.8	124.5
55–64	1,580	1,557	1,689	1,769	1,951	2,137	2,237	2,300	2,349	2,736	2,580	2,783	73.2	78.9
65–74	3,107	3,160	3,108	3,055	3,426	3,498	3,484	3,544	3,691	3,806	3,873	3,784	22.5	16.9
75–84	3,967	4,179	4,565	4,955	5,160	5,435	5,587	5,699	5,780	6,080	5,891	5,792	53.3	54.1
85+	1,858	2,238	2,557	3,062	3,228	3,465	3,521	3,833	4,136	4,499	4,550	4,473	142.1	223.9
Total	**11,638**	**12,393**	**13,225**	**14,270**	**15,268**	**16,193**	**16,550**	**17,263**	**17,891**	**19,126**	**19,128**	**19,053**	**64.3**	**73.7**

Note: AMI = acute myocardial infarction.

Source: AIHW National Hospital Morbidity Database.

Table C4: Age-specific hospitalisation rates for AMI by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	4.1	5.3	4.9	5.4	4.8	5.5	34.4
35–44	86.6	97.8	101.9	103.6	103.8	108.6	25.4
45–54	314.2	301.8	346.3	331.2	328.7	320.8	2.1
55–64	640.4	632.3	659.9	656.1	653.6	635.1	–0.8
65–74	1,032.5	1,011.2	1,017.6	989.8	976.5	950.5	–7.9
75–84	1,543.8	1,475.4	1,518.9	1,437.4	1,387.8	1,357.3	–12.1
85+	1,642.5	1,554.0	1,677.0	1,461.0	1,542.9	1,570.0	–4.4
Female							
<35	1.0	1.1	1.0	1.2	1.3	1.3	24.5
35–44	14.7	15.9	18.7	15.3	17.5	20.0	36.3
45–54	64.1	60.8	68.6	68.5	64.0	63.2	–1.3
55–64	207.9	207.0	205.4	202.3	192.0	196.0	–5.7
65–74	494.0	503.0	487.0	450.5	452.9	456.8	–7.5
75–84	1,016.2	999.3	929.0	915.6	878.7	879.9	–13.4
85+	1,140.0	1,197.6	1,127.1	1,103.1	1,142.9	1,185.3	4.0

(continued)

Table C4 (continued): Age-specific hospitalisation rates for AMI by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	5.5	5.9	5.5	5.9	6.5	6.8	7.1	7.2	6.8	7.8	6.5	5.7	41.8	90.2
35–44	108.6	101.1	111.5	109.2	115.8	125.9	123.2	124.6	123.8	145.9	135.3	129.9	34.3	68.5
45–54	320.8	337.3	338.6	335.9	364.6	393.9	383.9	389.9	398.7	414.0	392.9	398.0	29.1	31.8
55–64	635.1	646.9	631.5	667.7	677.9	726.3	709.6	686.0	723.6	750.9	724.2	715.6	18.2	17.3
65–74	950.5	948.8	972.6	997.6	1,090.9	1,102.8	1,112.4	1,114.3	1,133.7	1,172.5	1,139.0	1,084.2	23.4	13.6
75–84	1,357.3	1,480.2	1,538.0	1,584.1	1,694.4	1,719.4	1,693.9	1,776.2	1,744.3	1,862.0	1,776.4	1,677.0	37.2	20.6
85+	1,570.0	1,788.4	2,127.2	2,360.8	2,337.5	2,584.6	2,495.6	2,646.1	2,777.5	2,863.8	2,800.5	2,708.4	82.4	74.4
Female														
<35	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.9	1.7	1.6	2.2	1.4	23.1	60.0
35–44	20.0	20.6	21.1	19.8	26.3	28.7	32.7	32.8	30.8	30.6	33.5	37.6	53.0	108.2
45–54	63.2	70.8	71.4	80.3	77.7	84.5	83.2	91.7	96.0	98.6	106.9	102.0	56.0	53.8
55–64	196.0	186.0	194.1	195.7	204.2	213.4	214.4	211.5	208.1	234.2	213.1	223.6	19.5	12.7
65–74	456.8	465.1	457.9	448.1	498.8	505.1	497.1	498.5	510.8	512.2	506.9	476.7	12.1	3.7
75–84	879.9	900.8	955.5	1,003.4	1,021.4	1,049.9	1,056.8	1,064.4	1,071.5	1,122.6	1,084.4	1,063.5	27.6	10.5
85+	1,185.3	1,347.3	1,459.9	1,670.4	1,704.3	1,786.8	1,776.3	1,845.8	1,899.5	1,963.9	1,907.9	1,806.3	65.7	72.3

Note: AMI = acute myocardial infarction.

Source: AIHW National Hospital Morbidity Database.

Table C5: Hospitalisations for AMI by type of AMI, Australia, 1998–99 to 2009–10 (number and per cent)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10
							Number					
I21.0 Acute transmural myocardial infarction of anterior wall (STEMI)	9,042	8,659	8,707	8,879	8,354	7,629	6,924	6,471	6,309	6,012	5,730	5,342
I21.1 Acute transmural myocardial infarction of inferior wall (STEMI)	10,593	10,327	10,449	10,245	9,945	9,361	8,321	8,080	7,681	7,546	7,047	7,017
I21.2 Acute transmural myocardial infarction of other sites (STEMI)	1,669	1,518	1,517	1,555	1,506	1,072	842	829	793	791	734	710
I21.3 Acute transmural myocardial infarction of unspecified site (STEMI)	345	706	787	928	312	199	719	908	1,459	1,723	2,584	2,153
I21.4 Acute subendocardial myocardial infarction (NSTEMI)	5,813	7,437	7,676	8,076	11,814	18,907	23,818	27,343	30,492	35,123	35,616	36,357
I21.9 Acute myocardial infarction, unspecified	6,088	6,771	8,536	10,650	11,836	9,717	7,009	5,903	4,933	4,481	3,522	3,424
I21 Acute myocardial infarction	**33,550**	**35,418**	**37,672**	**40,333**	**43,767**	**46,885**	**47,633**	**49,534**	**51,667**	**55,676**	**55,233**	**55,003**

(continued)

Table C5 (continued): Hospitalisations for AMI by type of AMI, Australia, 1998–99 to 2009–10 (number and per cent)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10
							Per cent					
I21.0 Acute transmural myocardial infarction of anterior wall (STEMI)	27.0	24.4	23.1	22.0	19.1	16.3	14.5	13.1	12.2	10.8	10.4	9.7
I21.1 Acute transmural myocardial infarction of inferior wall (STEMI)	31.6	29.2	27.7	25.4	22.7	20.0	17.5	16.3	14.9	13.6	12.8	12.8
I21.2 Acute transmural myocardial infarction of other sites (STEMI)	5.0	4.3	4.0	3.9	3.4	2.3	1.8	1.7	1.5	1.4	1.3	1.3
I21.3 Acute transmural myocardial infarction of unspecified site (STEMI)	1.0	2.0	2.1	2.3	0.7	0.4	1.5	1.8	2.8	3.1	4.7	3.9
I21.4 Acute subendocardial myocardial infarction (NSTEMI)	17.3	21.0	20.4	20.0	27.0	40.3	50.0	55.2	59.0	63.1	64.5	66.1
I21.9 Acute myocardial infarction, unspecified	18.1	19.1	22.7	26.4	27.0	20.7	14.7	11.9	9.5	8.0	6.4	6.2
I21 Acute myocardial infarction	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes

1. The terms ST segment elevation myocardial infarction (STEMI) and non-ST segment elevation myocardial infarction (NSTEMI) were introduced into the ICD-10-AM codes in July 2004.

2. Excludes subsequent acute myocardial infarction (AMI).

Source: AIHW National Hospital Morbidity Database.

Table C6: Hospitalisations for UA by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	74	120	141	141	186	185	150.0
35–44	750	989	1,515	1,655	1,590	1,682	124.3
45–54	2,493	3,198	4,802	5,481	5,420	5,575	123.6
55–64	4,029	5,012	7,586	8,297	8,336	8,269	105.2
65–74	5,626	6,912	9,942	10,875	10,977	10,978	95.1
75–84	3,427	4,113	5,622	6,272	6,717	7,257	111.8
85+	614	689	892	1,063	1,105	1,316	114.3
Total	**17,013**	**21,033**	**30,500**	**33,785**	**34,331**	**35,262**	**107.3**
Female							
<35	22	34	51	48	68	53	140.9
35–44	223	277	405	457	512	531	138.1
45–54	901	1,101	1,632	1,826	1,943	1,993	121.2
55–64	1,980	2,395	3,351	3,721	3,753	3,613	82.5
65–74	4,052	4,798	6,504	6,647	6,690	6,769	67.1
75–84	3,980	4,645	5,901	6,560	6,567	6,851	72.1
85+	983	1,330	1,707	1,887	2,005	2,294	133.4
Total	**12,141**	**14,580**	**19,551**	**21,146**	**21,538**	**22,104**	**82.1**

(continued)

Table C6 (continued): Hospitalisations for UA by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	185	151	131	128	149	175	154	137	164	135	118	128	–27.0	82.4
35–44	1,683	1,611	1,551	1,407	1,347	1,449	1,400	1,237	1,120	1,047	922	883	–37.8	39.6
45–54	5,577	5,363	5,333	5,022	4,519	4,504	4,296	3,859	3,684	3,487	3,091	3,032	–37.5	39.9
55–64	8,273	8,340	8,181	8,057	7,547	7,705	7,470	6,877	6,681	6,310	5,682	5,565	–23.7	56.6
65–74	10,983	10,249	9,806	9,399	8,749	8,289	7,836	7,356	6,985	6,525	6,163	5,887	–40.6	16.0
75–84	7,261	7,257	7,445	7,242	6,869	6,759	6,491	6,117	5,714	5,354	4,980	4,583	–26.3	56.2
85+	1,319	1,544	1,618	1,523	1,474	1,540	1,394	1,483	1,464	1,457	1,446	1,363	10.5	137.3
Total	**35,281**	**34,515**	**34,065**	**32,778**	**30,654**	**30,421**	**29,041**	**27,066**	**25,812**	**24,315**	**22,402**	**21,441**	**–31.1**	**42.9**
Female														
<35	53	51	57	56	70	57	49	47	58	48	42	40	–9.4	118.2
35–44	533	485	531	572	488	548	517	497	479	475	391	448	–10.9	113.0
45–54	1,994	1,935	2,039	1,988	1,851	1,905	1,808	1,637	1,604	1,532	1,408	1,459	–23.2	70.0
55–64	3,615	3,514	3,532	3,391	3,399	3,281	3,197	2,879	2,838	2,756	2,425	2,371	–23.8	39.2
65–74	6,772	6,186	6,026	5,416	4,986	4,847	4,374	3,970	3,833	3,546	3,172	3,036	–47.6	–12.5
75–84	6,853	6,766	6,599	6,670	6,113	5,984	5,578	4,955	4,550	4,248	3,891	3,625	–38.0	6.7
85+	2,298	2,464	2,565	2,529	2,436	2,282	2,142	2,036	1,960	1,875	1,697	1,627	–18.4	90.7
Total	**22,118**	**21,401**	**21,349**	**20,622**	**19,343**	**18,904**	**17,665**	**16,021**	**15,322**	**14,480**	**13,026**	**12,606**	**–34.5**	**19.3**

Note: UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C7: Age-specific hospitalisation rates for UA by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	1.5	2.5	2.9	2.9	3.9	3.9	160.0
35–44	56.0	73.0	110.1	118.0	111.7	116.7	108.4
45–54	237.1	293.0	424.4	467.8	448.6	447.0	88.5
55–64	543.3	669.0	997.9	1,072.4	1,047.0	1,007.1	85.4
65–74	969.3	1,159.2	1,642.7	1,772.5	1,772.0	1,759.9	81.6
75–84	1,336.0	1,570.9	2,066.1	2,197.2	2,248.4	2,329.7	74.4
85+	1,219.5	1,293.1	1,571.3	1,762.8	1,729.1	1,929.1	58.2
Female							
<35	0.5	0.7	1.1	1.0	1.5	1.1	120.0
35–44	16.7	20.4	29.3	32.5	35.7	36.5	118.6
45–54	89.5	105.0	149.4	160.6	164.7	162.5	81.6
55–64	269.3	322.5	445.4	486.9	478.2	448.3	66.5
65–74	615.0	714.2	960.5	975.0	982.5	995.3	61.8
75–84	1,024.9	1,176.0	1,454.1	1,560.4	1,505.1	1,519.5	48.3
85+	806.8	1,043.1	1,270.7	1,332.6	1,342.4	1,463.5	81.4

(continued)

Table C7 (continued): Age-specific hospitalisation rates for UA by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	3.9	3.2	2.7	2.7	3.1	3.6	3.1	2.8	3.3	2.7	2.3	2.4	–30.8	80.0
35–44	116.8	110.6	105.7	95.3	90.8	97.4	93.8	82.3	73.7	68.2	59.5	56.5	–41.6	21.8
45–54	447.2	420.2	409.7	378.3	338.4	333.4	313.3	277.2	260.0	241.7	210.7	203.3	–46.0	1.9
55–64	1,007.6	976.5	918.2	869.3	773.1	755.1	706.1	627.5	590.3	541.2	472.3	451.7	–46.3	–0.4
65–74	1,760.7	1,631.0	1,552.5	1,470.6	1,350.9	1,265.0	1,178.7	1,087.2	1,012.8	917.4	841.8	773.3	–47.9	–5.4
75–84	2,331.0	2,234.2	2,199.0	2,036.5	1,857.8	1,757.3	1,628.1	1,493.9	1,364.2	1,255.5	1,150.2	1,043.0	–46.1	–6.0
85+	1,933.5	2,120.8	2,087.3	1,859.1	1,727.1	1,751.1	1,538.0	1,521.6	1,402.6	1,292.2	1,205.2	1,068.8	–33.2	6.0
Female														
<35	1.1	1.1	1.2	1.2	1.5	1.2	1.0	1.0	1.2	1.0	0.8	0.8	–9.1	100.0
35–44	36.6	32.9	35.7	38.2	32.5	36.3	34.1	32.6	31.1	30.5	24.9	28.3	–16.7	82.6
45–54	162.6	153.2	157.2	149.3	137.8	139.7	130.3	115.9	111.5	104.3	94.1	95.9	–35.9	16.5
55–64	448.6	419.9	405.8	375.1	355.8	327.6	306.4	264.8	251.4	235.9	200.3	190.5	–47.4	–12.4
65–74	995.7	910.5	887.8	794.4	725.9	699.8	624.1	558.4	530.5	477.2	415.1	382.4	–52.1	–22.4
75–84	1,520.0	1,458.4	1,381.3	1,350.7	1,210.0	1,156.0	1,055.1	925.5	843.5	784.3	716.2	665.6	–48.4	–23.5
85+	1,466.1	1,483.4	1,464.5	1,379.6	1,286.2	1,176.8	1,080.6	980.5	900.2	818.5	711.6	657.0	–44.2	1.5

Note: UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C8: Hospitalisations for chest pain by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	1,859	1,915	2,029	2,253	2,350	2,452	31.9
35–44	3,510	3,668	4,043	4,383	4,489	4,788	36.4
45–54	4,945	5,193	6,018	6,459	6,938	7,059	42.8
55–64	4,258	4,460	5,106	5,448	6,036	6,185	45.3
65–74	3,707	3,904	4,432	4,612	4,941	5,294	42.8
75–84	1,709	1,726	2,089	2,203	2,576	2,852	66.9
85+	342	329	364	403	467	566	65.5
Total	**20,330**	**21,195**	**24,083**	**25,761**	**27,797**	**29,196**	**43.6**
Female							
<35	1,259	1,423	1,430	1,483	1,650	1,842	46.3
35–44	1,991	2,362	2,563	2,680	2,896	3,038	52.6
45–54	3,688	4,163	4,825	5,129	5,609	5,954	61.4
55–64	3,849	4,119	4,685	5,090	5,612	5,766	49.8
65–74	3,827	3,974	4,615	4,864	5,285	5,297	38.4
75–84	2,304	2,310	2,684	3,015	3,452	3,832	66.3
85+	640	647	792	898	1,017	1,210	89.1
Total	**17,558**	**18,998**	**21,594**	**23,158**	**25,521**	**26,939**	**53.4**

(continued)

Table C8 (continued): Hospitalisations for chest pain by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (number)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	2,481	2,693	2,928	3,228	3,426	3,668	3,792	4,110	4,590	4,546	4,450	4,889	83.2	144.5
35–44	4,802	5,271	5,604	6,222	6,422	6,883	7,521	7,951	8,917	9,134	8,462	9,033	90.2	160.2
45–54	7,078	7,597	8,442	9,098	9,555	9,925	11,130	11,303	12,915	13,290	12,705	13,968	87.8	168.8
55–64	6,204	6,790	7,672	8,419	9,242	10,097	11,286	11,785	13,481	13,674	13,250	14,206	120.4	221.1
65–74	5,307	5,520	5,996	6,865	7,158	7,722	8,206	8,641	9,748	9,958	9,973	10,628	87.6	168.6
75–84	2,857	3,312	3,802	4,280	4,795	5,237	5,867	6,166	6,896	6,964	6,909	7,138	143.8	307.5
85+	567	696	781	995	1,019	1,241	1,281	1,523	1,775	1,884	1,985	2,153	232.3	450.9
Total	**29,296**	**31,879**	**35,226**	**39,108**	**41,618**	**44,773**	**49,083**	**51,479**	**58,322**	**59,450**	**57,734**	**62,015**	**102.9**	**192.4**
Female														
<35	1,882	2,014	2,405	2,652	2,736	2,932	3,113	3,471	3,508	3,643	3,609	3,839	93.6	189.4
35–44	3,060	3,375	3,683	4,098	4,491	4,697	5,149	5,596	6,140	6,417	6,288	6,685	109.7	222.3
45–54	5,970	6,186	7,082	7,836	8,215	8,806	9,475	10,091	11,097	11,432	11,341	12,347	91.5	210.0
55–64	5,787	6,382	7,060	7,993	8,711	9,579	10,506	11,143	12,525	12,829	12,887	13,932	121.7	233.3
65–74	5,310	5,756	6,243	7,083	7,470	8,186	8,675	9,197	9,882	10,063	10,238	10,972	89.5	162.9
75–84	3,838	4,227	4,876	5,608	6,369	6,972	7,516	7,713	8,309	8,542	8,638	9,132	122.6	270.7
85+	1,212	1,410	1,690	2,016	2,167	2,411	2,473	2,874	3,157	3,306	3,578	3,888	172.8	416.6
Total	**27,059**	**29,351**	**33,041**	**37,286**	**40,159**	**43,583**	**46,908**	**50,085**	**54,618**	**56,232**	**56,579**	**60,795**	**107.8**	**220.3**

Source: AIHW National Hospital Morbidity Database.

Table C9: Age-specific hospitalisation rates for chest pain by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	Per cent change 1993–94 to 1998–99
Male							
<35	38.9	40.0	42.3	46.9	49.0	51.3	31.8
35–44	262.2	270.8	293.7	312.4	315.2	332.3	26.8
45–54	470.2	475.8	531.9	551.2	574.2	566.0	20.4
55–64	574.2	595.4	671.6	704.2	758.1	753.3	31.2
65–74	638.7	654.8	732.3	751.7	797.6	848.7	32.9
75–84	666.3	659.2	767.7	771.8	862.3	915.6	37.4
85+	679.3	617.5	641.2	668.3	730.8	829.7	22.1
Female							
<35	27.2	30.8	30.8	31.9	35.5	39.7	45.7
35–44	149.1	174.3	185.7	190.3	201.9	208.8	40.1
45–54	366.3	396.9	441.6	451.1	475.4	485.5	32.6
55–64	523.4	554.7	622.8	666.1	715.1	715.5	36.7
65–74	580.8	591.6	681.5	713.5	776.2	778.8	34.1
75–84	593.3	584.9	661.4	717.2	791.2	849.9	43.3
85+	525.3	507.4	589.6	634.2	680.9	771.9	47.0

(continued)

Table C9 (continued): Age-specific hospitalisation rates for chest pain by age and sex, Australia, 1993–94 to 1998–99 (ICD-9-CM) and 1998–99 to 2009–10 (ICD-10-AM) (per 100,000 population)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	Per cent change 1998–99 to 2007–08	Per cent change 1993–94 to 2007–08
Male														
<35	51.9	56.3	61.0	66.9	70.6	75.0	77.1	83.0	91.8	89.5	85.7	91.9	72.4	130.1
35–44	333.3	361.8	381.7	421.6	432.8	462.6	503.7	529.1	587.1	594.9	546.3	577.9	78.5	126.9
45–54	567.6	595.2	648.6	685.3	715.7	734.7	811.6	812.1	911.6	921.3	866.2	936.5	62.3	95.9
55–64	755.6	795.0	861.1	908.3	946.9	989.5	1,066.9	1,075.4	1,191.1	1,172.8	1,101.4	1,153.0	55.2	104.2
65–74	850.8	878.4	949.3	1,074.1	1,105.3	1,178.5	1,234.4	1,277.2	1,413.4	1,400.0	1,362.2	1,396.1	64.6	119.2
75–84	917.2	1,019.7	1,123.0	1,203.6	1,297.1	1,361.6	1,471.6	1,505.9	1,646.4	1,633.1	1,595.8	1,624.5	78.1	145.1
85+	831.2	956.0	1,007.5	1,214.6	1,193.9	1,411.1	1,413.3	1,562.6	1,700.6	1,670.9	1,654.5	1,688.3	101.0	146.0
Female														
<35	40.5	43.4	51.6	56.5	58.0	61.8	65.4	72.4	72.6	74.5	72.5	75.4	84.0	173.9
35–44	210.4	229.2	248.0	274.0	298.6	311.3	339.9	367.5	399.1	412.2	400.2	421.9	95.9	176.5
45–54	486.8	489.7	545.9	588.4	611.7	645.6	682.9	714.7	771.2	778.5	758.3	811.7	59.9	112.5
55–64	718.1	762.6	811.2	884.2	911.7	956.4	1,007.0	1,024.8	1,109.4	1,098.0	1,064.4	1,119.1	52.9	109.8
65–74	780.8	847.2	919.8	1,038.9	1,087.5	1,181.9	1,237.8	1,293.6	1,367.7	1,354.2	1,339.9	1,382.1	73.4	133.2
75–84	851.3	911.1	1,020.6	1,135.7	1,260.7	1,346.8	1,421.7	1,440.6	1,540.3	1,577.1	1,590.0	1,676.7	85.3	165.8
85+	773.2	848.9	964.9	1,099.8	1,144.1	1,243.3	1,247.6	1,384.0	1,449.9	1,443.2	1,500.3	1,570.1	86.7	174.7

Source: AIHW National Hospital Morbidity Database.

Length of stay

Table C10: Non-fatal hospitalisations for AMI, UA, chest pain and all hospitalisations by length of stay, Australia, 1998–99 to 2007–08 (per cent)

Length of stay	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI										
Same day	7.0	7.2	8.0	8.5	9.9	10.8	11.3	11.4	11.8	12.2
1 day	5.4	6.0	6.9	7.9	8.8	9.5	9.8	11.0	11.4	11.9
2 days	6.0	6.7	7.4	8.5	9.1	9.9	10.9	11.3	11.7	12.1
3 days	8.2	8.7	10.0	10.8	11.2	11.9	12.4	12.5	12.8	13.1
>3 days	73.4	71.4	67.8	64.2	61.1	57.9	55.6	53.7	52.3	50.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA										
Same day	9.0	9.2	10.4	12.0	12.5	13.9	15.1	15.9	17.6	18.5
1 day	14.7	15.6	17.2	19.4	21.0	22.3	23.6	24.5	25.0	25.7
2 days	16.5	16.8	17.0	17.1	17.2	17.3	16.9	16.6	16.6	16.6
3 days	13.7	14.2	13.5	13.0	12.1	12.0	11.4	11.0	10.5	10.4
>3 days	46.1	44.2	41.9	38.5	37.2	34.6	33.0	32.0	30.4	28.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain										
Same day	32.0	33.7	35.6	37.8	39.2	39.5	38.9	39.3	39.7	41.0
1 day	31.6	33.0	34.3	35.1	36.0	36.4	38.1	38.6	39.2	38.7
2 days	16.2	14.9	13.7	12.6	11.4	11.0	10.7	10.3	9.9	9.6
3 days	7.6	7.2	6.6	5.8	5.3	5.1	4.9	4.5	4.4	4.3
>3 days	12.6	11.2	9.8	8.7	8.2	8.1	7.3	7.3	6.8	6.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
All hospitalisations[(a)]										
Same day	48.3	49.7	51.3	52.8	54.2	54.7	55.3	55.7	56.2	56.7
1 day	14.2	14.1	14.0	13.8	13.5	13.6	13.7	13.8	14.0	14.0
2 days	8.1	7.8	7.5	7.1	6.8	6.7	6.6	6.5	6.4	6.3
3 days	5.7	5.6	5.4	5.1	4.9	4.8	4.7	4.7	4.6	4.5
>3 days	23.6	22.8	21.9	21.1	20.5	20.2	19.6	19.2	18.8	18.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) All hospitalisations including those with principal diagnosis other than acute myocardial infarction (AMI), unstable angina (UA) and chest pain.

Source: AIHW National Hospital Morbidity Database.

Table C11: Non-fatal hospitalisations for AMI, UA or chest pain with a length of stay greater than 3 days by age and sex, Australia, 2007–08 (number and per cent of all hospitalisations for that disease)

Sex and age group (years)	AMI		UA		Chest pain	
	Number	Per cent	Number	Per cent	Number	Per cent
Male						
<35	119	30.2	15	11.1	90	2.0
35–44	764	34.1	190	18.1	235	2.6
45–54	2,287	38.3	696	20.0	474	3.6
55–64	3,676	42.0	1,556	24.7	698	5.1
65–74	4,012	48.1	1,963	30.1	750	7.5
75–84	4,260	53.7	1,863	34.8	793	11.4
85+	1,810	56.1	583	40.0	305	16.2
Total	**16,928**	**45.9**	**6,866**	**28.2**	**3,345**	**5.6**
Female						
<35	32	40.0	8	16.7	95	2.6
35–44	194	40.7	83	17.5	242	3.8
45–54	550	38.0	266	17.4	431	3.8
55–64	1,182	43.2	633	23.0	648	5.1
65–74	1,838	48.3	1,022	28.8	839	8.3
75–84	3,439	56.6	1,505	35.4	1,226	14.4
85+	2,671	59.4	694	37.0	577	17.5
Total	**9,906**	**51.8**	**4,211**	**29.1**	**4,058**	**7.2**
Persons						
<35	151	31.9	23	12.6	185	2.3
35–44	958	35.3	273	17.9	477	3.1
45–54	2,837	38.2	962	19.2	905	3.7
55–64	4,858	42.3	2,189	24.1	1,346	5.1
65–74	5,850	48.2	2,985	29.6	1,589	7.9
75–84	7,699	54.9	3,368	35.1	2,019	13.0
85+	4,481	58.0	1,277	38.3	882	17.0
Total	**26,834**	**47.9**	**11,077**	**28.6**	**7,403**	**6.4**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C12: Age-standardised rates of non-fatal hospitalisations for AMI, UA or chest pain by length of stay, Australia, 1998–99 to 2007–08 (per 100,000 population)

Length of stay	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	Per cent change
AMI											
≤1 day	20.9	23.2	27.3	31.5	38.1	43.7	45.5	49.0	51.9	57.0	172.7
>3 days	124.7	126.6	125.0	122.9	124.8	124.4	119.1	116.6	115.9	118.5	–5.0
UA											
≤1 day	74.9	74.7	80.4	85.9	83.6	87.2	86.4	81.3	80.1	76.3	1.9
>3 days	146.6	133.7	122.4	105.2	92.9	83.1	73.3	64.2	56.8	49.2	–66.4
Chest pain											
≤1 day	197.0	219.8	251.2	286.7	309.7	331.1	358.2	375.6	414.6	420.2	113.3
>3 days	39.4	37.3	35.5	34.4	33.6	34.9	33.8	34.8	35.2	33.0	–16.2

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Urgency of admission

Table C13: Hospitalisations for AMI, UA or chest pain by urgency of admission, Australia, 2001–02 to 2007–08 (per cent)

Urgency of admission[(a)]	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI							
Emergency	80.5	80.2	79.6	79.0	78.9	78.3	77.2
Elective	17.3	16.2	16.5	17.3	17.6	17.7	18.0
Not assigned	2.1	3.4	3.5	3.4	3.2	3.9	4.6
Not reported/Unknown	0.1	0.2	0.3	0.3	0.3	0.1	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA							
Emergency	74.8	75.2	75.7	76.2	76.4	76.3	74.9
Elective	23.2	22.2	21.8	21.8	21.3	21.5	22.5
Not assigned	1.8	2.5	2.5	1.9	2.0	2.1	2.5
Not reported/Unknown	0.2	0.0	0.1	0.1	0.3	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain							
Emergency	79.3	80.1	80.0	81.1	82.8	84.3	84.3
Elective	19.7	18.5	18.6	18.0	16.3	14.7	14.5
Not assigned	0.8	1.2	1.2	0.7	0.7	0.9	1.1
Not reported/Unknown	0.2	0.1	0.1	0.2	0.2	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) The 'urgency of admission' data were only of good enough quality to analyse from 2001–02 onward.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C14: Hospitalisations for AMI, UA or chest pain with an emergency admission by age and sex, Australia, 2007–08 (number and per cent of all hospitalisations for that disease)

Sex and age group (years)	AMI		UA		Chest pain[a]	
	Number	Per cent[b]	Number	Per cent[b]	Number	Per cent[b]
Male						
<35	321	81.5	113	83.7	4,233	93.1
35–44	1,753	78.3	875	83.6	8,277	90.6
45–54	4,599	77.0	2,673	76.7	11,444	86.1
55–64	6,470	73.9	4,428	70.2	11,125	81.4
65–74	6,207	74.4	4,506	69.1	8,224	82.6
75–84	6,069	76.4	3,919	73.2	5,994	86.1
85+	2,655	82.2	1,157	79.4	1,655	87.8
Total	**28,074**	**76.1**	**17,671**	**72.7**	**50,952**	**85.7**
Female						
<35	64	80.0	44	91.7	3,338	91.6
35–44	398	83.4	419	88.2	5,767	89.9
45–54	1,114	76.9	1,245	81.3	9,555	83.6
55–64	2,113	77.2	2,148	77.9	9,979	77.8
65–74	2,908	76.4	2,661	75.0	7,757	77.1
75–84	4,763	78.3	3,284	77.3	7,157	83.8
85+	3,803	84.5	1,587	84.6	2,965	89.7
Total	**15,163**	**79.3**	**11,388**	**78.6**	**46,518**	**82.7**
Persons						
<35	385	81.2	157	85.8	7,571	92.4
35–44	2,151	79.2	1,294	85.0	14,045	90.3
45–54	5,713	77.0	3,918	78.1	20,999	84.9
55–64	8,583	74.7	6,576	72.5	21,104	79.6
65–74	9,115	75.0	7,167	71.2	15,981	79.8
75–84	10,832	77.3	7,203	75.0	13,151	84.8
85+	6,458	83.6	2,744	82.4	4,620	89.0
Total	**43,237**	**77.2**	**29,059**	**74.9**	**97,471**	**84.3**

(a) Total includes one case in which sex was not stated.

(b) Per cent of total hospitalisations.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C15: Age-standardised rates of hospitalisations for AMI, UA or chest pain by urgency of admission, Australia, 2001–02 to 2007–08 (per 100,000 population)

Urgency of admission[(a)]	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI							
Emergency	169.0	177.7	184.4	181.3	183.6	185.1	191.5
Elective	36.2	36.0	38.3	39.8	41.0	42.1	44.9
UA							
Emergency	205.9	188.9	183.2	170.5	154.3	143.6	129.4
Elective	63.8	55.8	52.7	48.8	43.0	40.6	39.0
Chest pain							
Emergency	312.0	330.4	349.2	377.3	399.6	443.5	444.0
Elective	77.5	76.3	81.1	83.1	77.8	76.4	75.5

(a) The 'urgency of admission' data were only of good enough quality to analyse from 2001–02 onward.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Transfers

Table C16: Hospitalisations with a principal diagnosis of AMI, UA or chest pain by separation mode, Australia, 1998–99 to 2007–08 (per cent)

Separation mode	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI										
Transfer to other acute hospital	18.1	19.6	21.5	23.2	25.4	27.1	28.1	28.9	29.5	29.9
Transfer to other health/aged care	1.3	1.5	1.8	1.8	1.8	2.0	1.9	2.2	2.1	2.2
Other discharge	70.1	69.1	67.7	66.2	65.1	63.7	63.4	62.4	62.2	62.3
Died	10.4	9.8	9.0	8.8	7.7	7.2	6.6	6.6	6.2	5.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA										
Transfer to other acute hospital	16.0	16.6	17.2	17.6	18.3	19.0	19.4	19.8	21.0	21.4
Transfer to other health/aged care	0.7	0.9	1.0	0.9	1.1	1.1	1.0	1.0	0.9	1.0
Other discharge	82.4	81.8	81.1	80.9	80.1	79.4	79.1	78.7	77.6	77.2
Died	0.8	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain										
Transfer to other acute hospital	4.1	4.3	4.4	4.2	4.3	4.7	4.7	4.8	4.7	5.0
Transfer to other health/aged care	0.5	0.7	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.5
Other discharge	95.3	95.0	94.9	95.2	95.0	94.6	94.8	94.6	94.8	94.4
Died	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C17: Hospitalisations for AMI, UA or chest pain with a separation mode of 'transferred to another acute hospital' by age and sex, Australia, 2007–08 (number and per cent of all hospitalisations for that disease)

Sex and age group (years)	AMI		UA		Chest pain	
	Number	Per cent	Number	Per cent	Number	Per cent
Male						
<35	158	40.1	33	24.4	162	3.6
35–44	765	34.2	253	24.2	306	3.4
45–54	1,915	32.1	822	23.6	605	4.6
55–64	2,888	33.0	1,388	22.0	820	6.0
65–74	2,672	32.0	1,331	20.4	628	6.3
75–84	2,336	29.4	1,128	21.1	520	7.5
85+	664	20.6	264	18.1	155	8.2
Total	**11,398**	**30.9**	**5,219**	**21.5**	**3,196**	**5.4**
Female						
<35	31	38.8	6	12.5	105	2.9
35–44	163	34.2	120	25.3	214	3.3
45–54	524	36.2	372	24.3	422	3.7
55–64	934	34.1	628	22.8	532	4.1
65–74	1,244	32.7	786	22.2	501	5.0
75–84	1,682	27.7	854	20.1	539	6.3
85+	778	17.3	302	16.1	231	7.0
Total	**5,356**	**28.0**	**3,068**	**21.2**	**2,544**	**4.5**
Persons						
<35	189	39.9	39	21.3	267	3.3
35–44	928	34.2	373	24.5	520	3.3
45–54	2,439	32.9	1,194	23.8	1,027	4.2
55–64	3,822	33.3	2,016	22.2	1,352	5.1
65–74	3,916	32.2	2,117	21.0	1,129	5.6
75–84	4,018	28.7	1,982	20.6	1,059	6.8
85+	1,442	18.7	566	17.0	386	7.4
Total	**16,754**	**29.9**	**8,287**	**21.4**	**5,740**	**5.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C18: Hospitalisations with a principal diagnosis of AMI, UA or chest pain with separation mode of 'transferred to another acute hospital' by length of stay before transfer, Australia, 1998–99 to 2007–08 (per cent)

Length of stay	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI										
≤ 1 day	38.6	40.6	41.5	41.4	45.7	48.3	49.2	49.7	51.7	53.3
2 days	10.1	10.7	10.6	11.7	11.1	11.1	10.9	11.1	10.8	10.8
3 days	8.6	8.8	9.5	9.3	8.4	8.3	7.8	8.3	7.7	7.7
>3 days	42.7	40.0	38.5	37.6	34.8	32.3	32.1	30.8	29.8	28.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA										
≤1 day	43.2	46.5	48.7	50.6	52.3	55.1	58.6	60.1	61.9	63.4
2 days	9.5	10.3	10.5	10.7	10.4	10.6	9.6	9.6	9.9	9.6
3 days	8.3	8.1	8.3	8.2	7.5	7.9	6.9	6.5	6.4	6.0
>3 days	39.0	35.1	32.5	30.4	29.7	26.4	24.9	23.7	21.8	21.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain										
≤1 day	77.5	81.0	81.0	80.5	80.2	82.3	82.9	83.2	82.1	83.9
2 days	6.8	6.5	6.5	7.0	7.0	5.7	6.0	5.6	6.1	5.3
3 days	4.2	3.6	3.6	3.2	3.7	3.1	3.3	3.0	3.2	3.4
>3 days	11.6	9.0	9.0	9.3	9.1	8.8	7.8	8.1	8.5	7.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C19: Hospitalisations with a principal diagnosis of AMI, UA or chest pain by admission mode, Australia, 2000–01 to 2007–08 (per cent)

Admission mode[(a)]	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI								
Admitted patient transferred from another hospital	16.0	17.9	20.5	23.0	24.0	25.1	25.4	25.4
Statistical admission—episode type change/other	83.9	81.7	79.4	76.5	75.6	74.5	74.5	74.5
Unknown	—	0.5	0.2	0.5	0.4	0.4	0.1	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA								
Admitted patient transferred from another hospital	10.6	10.5	10.8	11.5	11.2	11.6	11.8	12.1
Statistical admission—episode type change/other	89.4	89.3	89.2	88.3	88.7	88.2	88.1	87.8
Unknown	—	0.2	—	0.2	0.2	0.2	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain								
Admitted patient transferred from another hospital	3.7	3.5	3.7	3.8	3.7	3.8	3.7	3.7
Statistical admission—episode type change/other	96.2	96.2	96.2	96.0	96.1	96.0	96.3	96.3
Unknown	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) The admission mode variable was only of good enough quality to analyse from 2000–01 onward.

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C20: Hospitalisations for AMI, UA or chest pain with an admission mode of 'transferred from another hospital' by urgency of admission at second hospital, Australia, 2001–02 to 2007–08 (per cent)

Urgency of admission[(a)]	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI							
Emergency	50.5	53.1	52.1	51.7	48.9	45.5	43.5
Elective	43.3	39.3	39.7	40.4	42.4	43.0	43.1
Not assigned	6.1	7.6	8.2	7.9	8.6	11.3	13.0
Not reported/Unknown	—	—	—	—	—	0.2	0.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA							
Emergency	44.2	46.6	47.9	47.4	46.2	43.0	38.2
Elective	48.6	46.2	44.8	45.6	44.8	46.2	50.4
Not assigned	7.2	7.2	7.3	7.0	9.0	10.5	10.9
Not reported/Unknown	—	—	—	—	—	0.3	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain							
Emergency	45.0	46.9	46.6	47.6	46.9	44.1	42.3
Elective	51.5	47.3	48.1	47.8	47.4	45.7	46.6
Not assigned	3.5	5.7	5.2	4.7	5.6	9.5	10.1
Not reported/Unknown	—	—	—	—	0.2	0.7	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) The 'urgency of admission' data were only of good enough quality to analyse from 2001–02 onward.

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C21: Proportion of hospitalisations for AMI, UA or chest pain with an admission mode of 'transferred from another hospital' with 'emergency' admission mode, Australia, 2001–02 to 2007–08 (per cent)

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
			Transferred from other acute hospital				
AMI	50.5	53.1	52.1	51.7	48.9	45.5	43.5
UA	44.2	46.6	47.9	47.4	46.2	43.0	38.2
Chest pain	45.0	46.9	46.6	47.6	46.9	44.1	42.3
			All hospitalisations				
AMI	80.5	80.2	79.6	79.0	78.9	78.3	77.2
UA	74.8	75.2	75.7	76.2	76.4	76.3	74.9
Chest pain	79.3	80.1	80.0	81.1	82.8	84.3	84.3

Note: The 'urgency of admission' data were only of good enough quality to analyse from 2001–02 onward; AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Deaths in hospital

Table C22: Hospitalisations for AMI, UA or chest pain with a separation mode of 'died' by age and sex, Australia, 2007–08 (number and per cent of total hospitalisations)

Sex and age group (years)	AMI		UA		Chest pain	
Deaths	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Male						
<35	7	1.8	n.p.	n.p.	n.p.	n.p.
35–44	24	1.1	n.p.	n.p.	n.p.	n.p.
45–54	76	1.3	n.p.	n.p.	n.p.	n.p.
55–64	149	1.7	8	0.1	n.p.	n.p.
65–74	337	4.0	23	0.4	7	0.1
75–84	596	7.5	45	0.8	11	0.2
85+	465	14.4	30	2.1	17	0.9
Total	**1,654**	**4.5**	**110**	**0.5**	**41**	**0.1**
Female						
<35	n.p.	2.5	n.p.	n.p.	n.p.	n.p.
35–44	7	1.5	n.p.	n.p.	n.p.	n.p.
45–54	22	1.5	n.p.	n.p.	n.p.	n.p.
55–64	62	2.3	n.p.	n.p.	n.p.	n.p.
65–74	174	4.6	n.p.	n.p.	6	0.1
75–84	482	7.9	23	0.5	6	0.1
85+	688	15.3	26	1.4	13	0.4
Total	**1,437**	**7.5**	**58**	**0.4**	**27**	**—**
Persons						
<35	9	1.9	n.p.	n.p.	n.p.	n.p.
35–44	31	1.1	n.p.	n.p.	n.p.	n.p.
45–54	98	1.3	5	0.1	n.p.	n.p.
55–64	211	1.8	11	0.1	n.p.	n.p.
65–74	511	4.2	27	0.3	13	0.1
75–84	1,078	7.7	68	0.7	17	0.1
85+	1,153	14.9	56	1.7	30	0.6
Total	**3,091**	**5.5**	**168**	**0.4**	**68**	**0.1**

n.p. Not publishable

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C23: Hospitalisations with a principal diagnosis of AMI, UA or chest pain with separation mode of 'died' by length of stay, Australia, 1998–99 to 2007–08 (per cent)

Length of stay	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
AMI										
≤ 1 day	47.1	47.8	45.8	45.6	44.1	44.8	41.6	43.3	44.1	44.3
2 days	11.9	11.3	11.0	11.7	11.6	10.9	11.8	10.9	10.9	10.3
3 days	7.8	7.6	7.1	8.2	7.7	8.9	9.0	8.3	7.1	8.3
>3 days	33.2	33.2	36.1	34.5	36.6	35.5	37.6	37.5	37.8	37.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA										
≤1 day	17.3	18.3	14.5	20.2	22.9	18.2	23.0	21.6	21.3	25.6
2 days	8.9	8.0	8.4	8.8	11.4	8.0	11.5	4.5	6.3	6.5
3 days	6.5	6.2	10.3	10.1	8.6	4.5	7.8	9.0	5.7	4.8
>3 days	67.3	67.4	66.8	60.9	57.1	69.3	57.6	64.8	66.7	63.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain										
≤1 day	44.3	38.0	38.2	42.4	50.0	30.0	56.3	41.8	47.4	41.2
2 days	6.6	14.0	5.5	6.8	5.2	5.7	2.1	12.7	8.8	11.8
3 days	4.9	8.0	9.1	5.1	5.2	5.7	4.2	3.6	14.0	8.8
>3 days	44.3	40.0	47.3	45.8	39.7	58.6	37.5	41.8	29.8	38.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Remoteness of hospital

Table C24: Hospitalisations with a principal diagnosis of AMI, UA or chest pain by remoteness of hospital, Australia, 2007–08 (number and per cent)

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
			Number			
AMI	40,511	10,452	4,330	458	246	**55,997**
UA	26,972	8,247	3,005	435	136	**38,795**
Chest pain	80,077	22,564	10,673	1,525	845	**115,684**
			Per cent			
AMI	72.3	18.7	7.7	0.8	0.4	**100.0**
UA	69.5	21.3	7.7	1.1	0.4	**100.0**
Chest pain	69.2	19.5	9.2	1.3	0.7	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C25: Proportion of hospitalisations with a principal diagnosis of AMI, UA or chest pain that ended in a transfer, by region of hospital, Australia, 2007–08 (per cent)

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI	22.0	52.3	43.2	70.3	70.3	**29.9**
UA	17.3	32.0	25.9	32.9	49.3	**21.4**
Chest pain	4.1	6.7	6.3	8.9	11.8	**5.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C26: Proportion of hospitalisations with a principal diagnosis of AMI, UA or chest pain that began with a transfer, by region of hospital, Australia, 2007–08 (per cent)

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI	30.3	12.4	14.0	3.3	2.0	25.4
UA	15.2	5.3	5.9	1.1	1.5	12.1
Chest pain	4.2	3.0	1.9	0.7	1.3	3.7

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C27: Hospitalisations with a principal diagnosis of AMI, UA or chest pain by length of stay and remoteness of hospital, Australia, 2007–08 (per cent)

Length of stay	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI						
≤1 day	20.9	35.1	36.8	52.0	61.4	25.2
2 days	12.1	12.1	10.9	13.8	11.4	12.0
3 days	13.8	10.6	9.8	9.0	5.7	12.9
>3 days	53.2	42.2	42.4	25.3	21.5	50.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA						
≤1 day	40.5	52.4	51.6	57.2	72.1	44.2
2 days	16.7	16.1	17.1	20.0	16.9	16.6
3 days	10.8	9.6	9.6	9.2	4.4	10.4
>3 days	32.1	22.0	21.8	13.6	6.6	28.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain						
≤1 day	79.7	79.6	79.7	81.2	83.4	79.7
2 days	9.4	9.9	10.5	9.9	10.7	9.6
3 days	4.4	4.1	4.3	3.8	2.1	4.3
>3 days	6.6	6.4	5.6	5.1	3.8	6.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C28: Hospitalisations with a principal diagnosis of AMI by length of stay and remoteness of hospital, Australia, 2000–01 to 2009–10 (number)

Region and length of stay	2000-01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10
Major cities										
≤1 day	2,014	4,298	4,980	6,407	6,821	7,421	7,856	8,457	8,574	8,697
2 days	933	1,876	2,205	3,234	3,757	4,065	4,408	4,884	5,137	5,419
3 days	1,405	2,470	2,771	4,067	4,456	4,658	4,945	5,606	5,754	5,894
>3 days	8,351	14,320	15,019	19,392	19,738	20,049	20,367	21,564	20,879	19,515
Total	**12,703**	**22,964**	**24,975**	**33,100**	**34,772**	**36,193**	**37,576**	**40,511**	**40,344**	**39,525**
Inner regional										
≤1 day	771	1,316	1,600	2,400	2,458	2,758	3,169	3,668	3,665	4,312
2 days	337	660	718	952	1,079	1,096	1,158	1,261	1,316	1,373
3 days	401	725	789	958	981	1,053	1,072	1,112	1,102	1,165
>3 days	2,568	4,022	3,970	4,548	4,486	4,307	4,435	4,411	3,936	3,885
Total	**4,077**	**6,723**	**7,077**	**8,858**	**9,004**	**9,214**	**9,834**	**10,452**	**10,019**	**10,735**
Outer regional										
≤1 day	420	687	867	1,149	1,170	1,353	1,333	1,592	1,647	1,714
2 days	167	228	296	357	371	404	435	474	426	409
3 days	173	231	285	300	340	352	385	426	439	382
>3 days	1,307	1,565	1,672	1,825	1,690	1,673	1,746	1,838	1,895	1,727
Total	**2,067**	**2,711**	**3,120**	**3,631**	**3,571**	**3,782**	**3,899**	**4,330**	**4,407**	**4,232**
Remote										
≤1 day	117	119	151	199	179	206	225	238	289	325
2 days	39	30	36	46	34	42	45	63	47	62
3 days	34	28	33	43	33	29	32	41	43	52
>3 days	183	180	153	151	114	148	142	116	104	120
Total	**373**	**357**	**373**	**439**	**360**	**425**	**444**	**458**	**483**	**559**
Very remote										
≤1 day	70	79	77	93	134	121	143	151	116	127
2 days	15	19	19	10	24	29	22	28	12	12
3 days	8	10	4	11	10	15	16	14	16	9
>3 days	38	38	57	44	48	49	43	53	33	20
Total	**131**	**146**	**157**	**158**	**216**	**214**	**224**	**246**	**177**	**168**

Note: AMI = acute myocardial infarction.

Source: AIHW National Hospital Morbidity Database.

Table C29: Hospitalisations with a principal diagnosis of UA by length of stay and remoteness of hospital, Australia, 2000–01 to 2009–10 (number)

Region and length of stay	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10
Major cities										
≤1 day	5,636	9,716	9,643	11,670	12,276	11,586	11,145	10,912	10,975	10,624
2 days	3,000	4,418	4,128	5,564	5,409	4,867	4,595	4,492	3,969	3,880
3 days	2,491	3,574	3,064	4,021	3,788	3,259	2,970	2,920	2,615	2,505
>3 days	7,275	11,468	9,872	12,761	11,992	10,535	9,366	8,648	7,616	6,734
Total	**18,402**	**29,176**	**26,707**	**34,016**	**33,465**	**30,247**	**28,076**	**26,972**	**25,175**	**23,743**
Inner regional										
≤1 day	1,686	2,872	2,974	3,967	4,177	4,202	4,512	4,319	3,611	3,698
2 days	1,218	1,858	1,641	1,766	1,648	1,561	1,504	1,327	1,108	1,151
3 days	876	1,266	1,100	1,158	1,047	1,028	922	788	705	726
>3 days	1,926	2,609	2,669	2,625	2,322	2,253	2,220	1,813	1,513	1,588
Total	**5,706**	**8,605**	**8,384**	**9,516**	**9,194**	**9,044**	**9,158**	**8,247**	**6,937**	**7,163**
Outer regional										
≤1 day	762	1,038	1,123	1,375	1,314	1,298	1,495	1,550	1,451	1,299
2 days	534	649	674	757	678	588	579	513	477	417
3 days	396	453	405	430	425	373	344	288	283	262
>3 days	896	982	892	1,144	1,003	925	870	654	609	584
Total	**2,588**	**3,122**	**3,094**	**3,706**	**3,420**	**3,184**	**3,288**	**3,005**	**2,820**	**2,562**
Remote										
≤1 day	175	195	187	268	188	183	220	249	231	243
2 days	94	97	112	122	95	88	100	87	67	85
3 days	92	95	75	70	60	62	50	40	37	38
>3 days	136	136	103	116	107	102	82	59	37	61
Total	**497**	**523**	**477**	**576**	**450**	**435**	**452**	**435**	**372**	**427**
Very remote										
≤1 day	64	95	103	65	87	103	109	98	76	113
2 days	26	38	34	17	51	36	26	23	27	21
3 days	10	33	22	15	15	13	9	6	6	10
>3 days	27	40	38	29	28	25	17	9	15	8
Total	**127**	**206**	**197**	**126**	**181**	**177**	**161**	**136**	**124**	**152**

Note: UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C30: Hospitalisations with a principal diagnosis of AMI, UA or chest pain with separation mode of 'transferred to another acute hospital' by length of stay and remoteness of hospital, Australia, 2007–08 (per cent)

Length of stay	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI						
≤1 day	51.1	51.8	63.4	65.8	80.3	53.3
2 days	9.2	13.3	10.6	15.2	9.2	10.8
3 days	6.9	9.5	7.1	7.1	2.3	7.7
>3 days	32.8	25.4	18.9	11.8	8.1	28.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA						
≤1 day	65.7	59.1	62.3	67.1	77.6	63.4
2 days	7.5	11.6	13.9	16.1	13.4	9.6
3 days	5.0	7.9	6.3	6.3	3.0	6.0
>3 days	21.8	21.4	17.6	10.5	6.0	21.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain						
≤1 day	82.7	84.4	86.8	87.4	90.0	83.9
2 days	5.3	5.5	5.2	4.4	4.0	5.3
3 days	3.8	2.9	3.0	3.0	2.0	3.4
>3 days	8.2	7.2	5.0	5.2	4.0	7.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C31: Hospitalisations with a principal diagnosis of AMI, UA or chest pain with an admission mode of 'transferred from another hospital' by length of stay and remoteness of hospital, Australia, 2007–08 (per cent)

Length of stay	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI						
≤1 day	23.1	27.4	18.1	40.0	100.0	23.3
2 days	14.5	10.9	7.9	20.0	—	13.9
3 days	13.2	9.5	14.3	6.7	—	12.9
>3 days	49.2	52.2	59.7	33.3	—	49.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA						
≤1 day	32.8	32.6	29.0	60.0	—	32.6
2 days	17.2	17.2	13.1	40.0	—	17.1
3 days	10.9	13.1	9.7	—	—	11.0
>3 days	39.1	37.0	48.3	—	—	39.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	—	**100.0**
Chest pain						
≤1 day	53.7	61.5	56.2	81.8	54.5	55.1
2 days	20.5	16.2	15.8	18.2	36.4	19.7
3 days	10.7	8.8	10.3	—	—	10.3
>3 days	15.0	13.5	17.7	—	9.1	14.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Procedures

Table C32: Hospitalisations for AMI, UA or chest pain and associated procedure, Australia, 2007–08 (number and per cent)

	Angiography	PCI	CABG	Any procedure[(a)]	No procedure[(b)]	Total[(c)]
			Number			
AMI	24,481	14,077	3,065	27,167	28,830	55,997
UA	12,093	5,430	2,215	14,375	24,420	38,795
Chest pain	14,275	164	8	14,297	101,387	115,684
Total	**50,849**	**19,671**	**5,288**	**55,839**	**154,637**	**210,476**
			Per cent			
AMI	43.7	25.1	5.5	48.5	51.5	100.0
UA	31.2	14.0	5.7	37.1	62.9	100.0
Chest pain	12.3	0.1	—	12.4	87.6	100.0
Total	**24.2**	**9.3**	**2.5**	**26.5**	**73.5**	**100.0**

(a) Any one of angiography, PCI or CABG.

(b) No angiography, PCI or CABG.

(c) Angiography, PCI, CABG and No procedure may not sum to 100% as a hospitalisation can have more than one associated procedure.

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C33: Hospitalisations for AMI, UA or chest pain and associated procedure by length of stay, Australia, 2007–08 (per cent of hospitalisations for each procedure)

Length of stay	Angiography	PCI	CABG	Any procedure[(a)]	No procedure[(b)]	Total
AMI						
≤1 day	16.4	16.0	0.4	16.2	33.7	25.2
2 days	13.3	16.3	0.2	12.8	11.2	12.0
3 days	16.0	19.5	0.1	15.1	10.7	12.9
>3 days	54.3	48.2	99.3	55.9	44.4	50.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
UA						
≤1 day	33.5	36.0	0.1	31.8	51.4	44.2
2 days	17.0	20.5	0.1	15.3	17.4	16.6
3 days	12.5	13.9	0.1	11.0	10.1	10.4
>3 days	37.0	29.6	99.7	41.8	21.2	28.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Chest pain						
≤1 day	71.2	43.9	—	71.2	80.9	79.7
2 days	12.6	20.7	—	12.6	9.2	9.6
3 days	6.6	13.4	—	6.6	4.0	4.3
>3 days	9.7	22.0	100.0	9.7	6.0	6.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Any one of angiography, PCI or CABG.

(b) No angiography, PCI or CABG.

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention; UA = unstable angina.

Source: AIHW National Hospital Morbidity Database.

Table C34: Hospitalisations for AMI, UA or chest pain and associated procedure by length of stay, Australia, 2007–08 (per cent of hospitalisations with each length of stay)

Length of stay	Angiography	PCI	CABG	Any procedure[(a)]	No procedure[(b)]	Total[(c)]
AMI						
≤1 day	28.5	16.0	—	31.1	68.9	**100.0**
2 days	48.6	34.3	—	52.0	48.0	**100.0**
3 days	54.3	38.1	—	57.0	43.0	**100.0**
>3 days	47.5	24.2	10.9	54.3	45.7	**100.0**
UA						
≤1 day	23.7	11.4	—	26.7	73.3	**100.0**
2 days	31.9	17.3	—	34.2	65.8	**100.0**
3 days	37.3	18.7	—	39.2	60.8	**100.0**
>3 days	40.0	14.4	19.7	53.8	46.2	**100.0**
Chest pain						
≤1 day	11.0	—	—	11.0	89.0	**100.0**
2 days	16.2	—	—	16.2	83.8	**100.0**
3 days	18.9	—	—	18.9	81.1	**100.0**
>3 days	18.6	—	—	18.7	81.3	**100.0**

(a) Any one of angiography, PCI or CABG.

(b) No angiography, PCI or CABG.

(c) Angiography, PCI, CABG and No procedure may not sum to 100% as a hospitalisation can have more than one associated procedure.

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; UA = unstable angina; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Source: AIHW National Hospital Morbidity Database.

Table C35: Hospitalisations for AMI, UA or chest pain with admission mode 'transferred from another hospital' by remoteness of hospital and length of stay, Australia, 2007–08 (per cent with at least one of angiography, PCI or CABG procedures undertaken after admission by transfer)

Length of stay	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
AMI						
≤1 day	84.7	22.8	66.4	—	—	77.2
2 days	85.9	12.0	56.3	—	—	79.7
3 days	84.9	18.5	65.5	—	—	79.4
>3 days	81.0	25.1	69.1	—	—	75.0
Total	**83.1**	**22.4**	**67.1**	**—**	**—**	**76.7**
UA						
≤1 day	74.7	29.6	58.8	—	—	69.8
2 days	75.5	13.3	65.2	—	—	69.1
3 days	73.2	22.8	52.9	—	—	67.0
>3 days	81.8	25.5	69.4	—	—	76.3
Total	**77.5**	**24.4**	**64.2**	**—**	**—**	**71.9**
Chest pain						
≤1 day	46.5	24.9	42.1	—	—	42.2
2 days	52.3	10.2	43.8	—	—	46.1
3 days	51.5	18.6	38.1	—	—	46.5
>3 days	41.9	12.2	47.2	—	—	37.9
Total	**47.5**	**20.2**	**42.9**	**—**	**—**	**42.7**

— Nil or rounded to zero.

*Note*s

1. The length of stay, procedure and hospital region are associated with the hospitalisation that began with a transfer.

2. AMI = acute myocardial infarction; UA = unstable angina: PCI = percutaneous coronary intervention; CABG = coronary artery bypass grafting.

Source: AIHW National Hospital Morbidity Database.

Table C36: Hospitalisations with a principal diagnosis of AMI, UA or chest pain with at least one associated cardiac procedure[(a)], Australia, 2000–01 to 2007–08 (number and per cent)

	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
					Number			
AMI	12,560	14,351	17,557	20,227	21,806	23,485	25,196	27,167
UA	18,989	18,040	17,307	17,767	17,269	16,397	15,393	14,375
Chest pain	9,563	10,046	11,352	12,495	13,280	13,171	14,074	14,297
					Per cent			
AMI	32.9	35.2	39.8	42.8	45.5	47.1	48.5	48.5
UA	34.3	33.8	34.6	36.0	37.0	38.1	37.4	37.1
Chest pain	14.0	13.2	13.9	14.1	13.8	13.0	12.5	12.4

(a) Angiography, PCI or CABG.*Note:* AMI = acute myocardial infarction; UA = unstable angina; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Source: AIHW National Hospital Morbidity Database.

Table C37: Hospitalisations with a principal diagnosis of AMI, by associated cardiac procedures, Australia, 2000–01 to 2007–08 (number and per cent)

	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
					Number			
Angiography	10,241	11,852	14,686	17,177	18,147	19,489	21,467	24,481
PCI	5,189	6,288	8,062	9,882	11,259	12,405	13,405	14,077
CABG	1,633	1,776	2,198	2,479	2,613	2,751	2,864	3,065
					Per cent			
Angiography	26.8	29.1	33.3	36.4	37.9	39.1	41.3	43.7
PCI	13.6	15.4	18.3	20.9	23.5	24.9	25.8	25.1
CABG	4.3	4.4	5.0	5.2	5.5	5.5	5.5	5.5

Note: AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Source: AIHW National Hospital Morbidity Database.

Table C38: Hospitalisations with a principal diagnosis of UA, by associated cardiac procedures, Australia, 2000–01 to 2007–08 (number and per cent)

	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
				Number				
Angiography	14,035	13,238	12,663	13,477	13,469	12,591	12,205	12,093
PCI	5,768	5,788	5,951	6,573	6,569	6,284	5,766	5,430
CABG	4,471	3,996	3,828	3,367	3,015	2,814	2,548	2,215
				Per cent				
Angiography	25.3	24.8	25.3	27.3	28.8	29.2	29.7	31.2
PCI	10.4	10.8	11.9	13.3	14.1	14.6	14.0	14.0
CABG	8.1	7.5	7.7	6.8	6.5	6.5	6.2	5.7

Note: UA = unstable angina; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Source: AIHW National Hospital Morbidity Database.

Table C39: Hospitalisations with a principal diagnosis of chest pain, by associated cardiac procedures, Australia, 2000–01 to 2007–08 (number and per cent)

	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
				Number				
Angiography	9,518	10,002	11,275	12,429	13,221	13,111	14,044	14,275
PCI	58	73	143	145	158	247	183	164
CABG	8	15	21	7	15	15	12	8
				Per cent				
Angiography	13.9	13.1	13.8	14.1	13.8	12.9	12.4	12.3
PCI	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1
CABG	—	—	—	—	—	—	—	—

— Nil or rounded to zero.

Note: CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

Source: AIHW National Hospital Morbidity Database.

Deaths

Table C40: Deaths with an underlying cause of CHD, by disease, 1997–2007 (number and per cent)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Per cent change 1997 to 2007
						Number						
Angina pectoris	60	57	47	47	47	44	57	40	44	32	27	–55.0
AMI (including subsequent AMI)	16,524	16,028	15,194	14,696	14,459	14,327	13,456	12,757	11,863	11,501	11,353	–31.3
Other acute CHD	235	230	213	221	271	254	273	243	235	260	298	26.8
Chronic CHD	12,638	11,984	12,155	11,557	11,457	11,438	11,653	11,536	11,428	11,190	11,051	–12.6
Total CHD	29,457	28,299	27,609	26,521	26,234	26,063	25,439	24,576	23,570	22,983	22,729	–22.8
						Per cent						
Angina pectoris	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
AMI	56.1	56.6	55.1	55.4	55.2	54.9	52.9	51.9	50.3	50.0	50.0	
Other acute CHD	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.0	1.0	1.1	1.3	
Chronic CHD	42.9	42.3	44.0	43.6	43.7	43.9	45.8	46.9	48.5	48.7	48.6	
Total CHD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Note: AMI = acute myocardial infarction; CHD = chronic heart disease.

Source: AIHW National Mortality Database.

Table C41: Deaths with an underlying cause of AMI or CHD, by age group, 1997 and 2007 (number per 100,000 population)

Cause of death and year	Age group (years)													
	0–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
AMI 1997	—	1	3	7	13	24	45	84	170	304	495	862	1,450	2,497
AMI 2007	—	—	1	3	8	11	19	37	64	108	194	364	689	1,618
CHD 1997	—	1	4	9	15	31	57	104	200	352	627	1049	2,026	4,168
CHD 2007	—	1	2	5	11	20	33	54	87	148	266	522	1,044	2,902

— Nil or rounded to zero.

Note: AMI = acute myocardial infarction; CHD = chronic heart disease.

Source: AIHW National Mortality Database.

Glossary

acute: Coming on sharply and often brief, intense and severe.

acute myocardial infarction (AMI): Term still commonly used to mean a *heart attack*, but more correctly refers only to those heart attacks that have caused some death of heart muscle.

age-specific rate: A rate for a specific age group. The numerator and denominator relate to the same age group.

age-standardisation: A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, and then the disease rates that would have occurred with that structure are calculated and compared.

angina: Temporary chest pain or discomfort when the heart's own blood supply is inadequate to meet extra needs, as in exercise. See also *unstable angina* and *cardiovascular disease.*

atherosclerosis: A process in which fatty and fibre-like deposits build up on the inner walls of arteries, often forming *plaques* that can then cause blockages. It is the main underlying condition in *heart attack*, *angina*, stroke and peripheral vascular disease.

atrial fibrillation: A condition marked by an irregular, rapid heartbeat. It arises because the heart's collecting chambers (atria) stop beating rhythmically and quiver uselessly (fibrillate).

Australian Standard Geographical Classification (ASGC) Remoteness Areas: The ASGC-RA classification is based on the Accessibility/Remoteness Index of Australia (ARIA). ARIA is derived from the distance a place is by road from urban centres of different sizes, and therefore provides a relative indication of how difficult it might be for residents to access certain services such as health care and education. Five categories are used in this publication: 'Major cities of Australia', 'Inner regional Australia', 'Outer regional Australia', 'Remote Australia' and 'Very remote Australia'. A map showing the five regions is provided below (Figure G.1). Examples of a Major city are Sydney and Canberra; Inner regional—Hobart, Mackay, Gundagai; Outer regional—Darwin, Broken Hill, Kalgoorlie; Remote—Alice Springs, Blinman; Very remote—Wilcannia, Thursday Island.

blood cholesterol: Fatty substance produced by the liver and carried by the blood to supply the rest of the body. Its natural function is to supply material for cell walls and for steroid hormones, but if levels in the blood become too high this can lead to *atherosclerosis* and heart disease.

cardiovascular disease: Any disease of the *circulatory system*, namely the heart (cardio) or blood vessels (vascular). Includes *heart attack, angina,* stroke and peripheral vascular disease. Also known as circulatory disease.

case-fatality: The proportion of acute coronary syndrome (ACS) events that were fatal (calculated as the number of deaths from ACS divided by the number of incidents of ACS multiplied by 100).

chronic: Persistent and long lasting.

chronic diseases: Term applied to a diverse group of diseases, such as heart disease, cancer and arthritis, that tend to be long lasting and persistent in their symptoms or development.

Although these features also apply to some communicable diseases (infections), the term is usually confined to non-communicable diseases.

circulatory disease: See *cardiovascular disease* (alternative name).

circulatory system: The heart along with the blood vessels, comprising the system that circulates blood around the body to supply oxygen and nutrients to all body tissues and to carry away waste products from them. Also known as the cardiovascular system.

condition (health condition): A broad term that can be applied to any health problem, including symptoms, diseases and various risk factors such as high blood cholesterol, obesity and so forth. Often used synonymously with disorder or problem.

coronary heart disease (CHD): Disease due to blockages in the heart's own (coronary) arteries, expressed as *angina* or a *heart attack*. Also known as *ischaemic heart disease*.

coronary revascularisation: Procedures used to restore good blood supply to the heart; for example, coronary angioplasty, which involves inserting a catheter with a balloon into a narrowed coronary artery.

disease: A physical or mental disturbance involving symptoms (such as pain or feeling unwell), dysfunction or tissue damage, especially if these symptoms and signs form a recognisable clinical pattern.

dyspnoea: Difficult or laboured breathing; shortness of breath.

fatal hospitalisation: A hospital episode that ends in death (that is, where separation mode is recorded as 'died').

heart attack: Life-threatening emergency that occurs when a vessel supplying blood to the heart muscle is suddenly blocked completely by a blood clot. The medical term commonly used for a heart attack is *acute myocardial infarction*. See also *cardiovascular disease*.

hospitalisation: An episode of care for an admitted patient in a hospital which can be a total hospital stay (from admission to discharge, transfer or death), or a portion of a hospital stay beginning or ending in a change of type of care.

International Classification of Diseases: International Statistical Classification of Diseases and Related Health Problems. The World Health Organization's internationally accepted classification of death and disease. The Tenth Revision (ICD-10) is currently in use. In this report, causes of death classified before 1979 under previous revisions have been reclassified to ICD-10 by the Australian Institute of Health and Welfare (AIHW).

ischaemic heart disease: *Heart attack* and *angina* (chest pain). Also known as *coronary heart disease*.

length of stay in hospital: The length of stay for an overnight patient is calculated by subtracting the date the patient is admitted from the date of separation and deducting days the patient was on leave. A same-day patient is allocated a length of stay of 1 day.

morbidity: Ill-health in a population.

mortality: Death.

plaque (atherosclerotic): A localised area of *atherosclerosis*, especially when raised or built up, which may cause blockages in arteries.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning the patient's episode of admitted patient care.

reperfusion: The restoration of blood flow to an organ or tissue.

revascularisation: See *coronary revascularisation*.

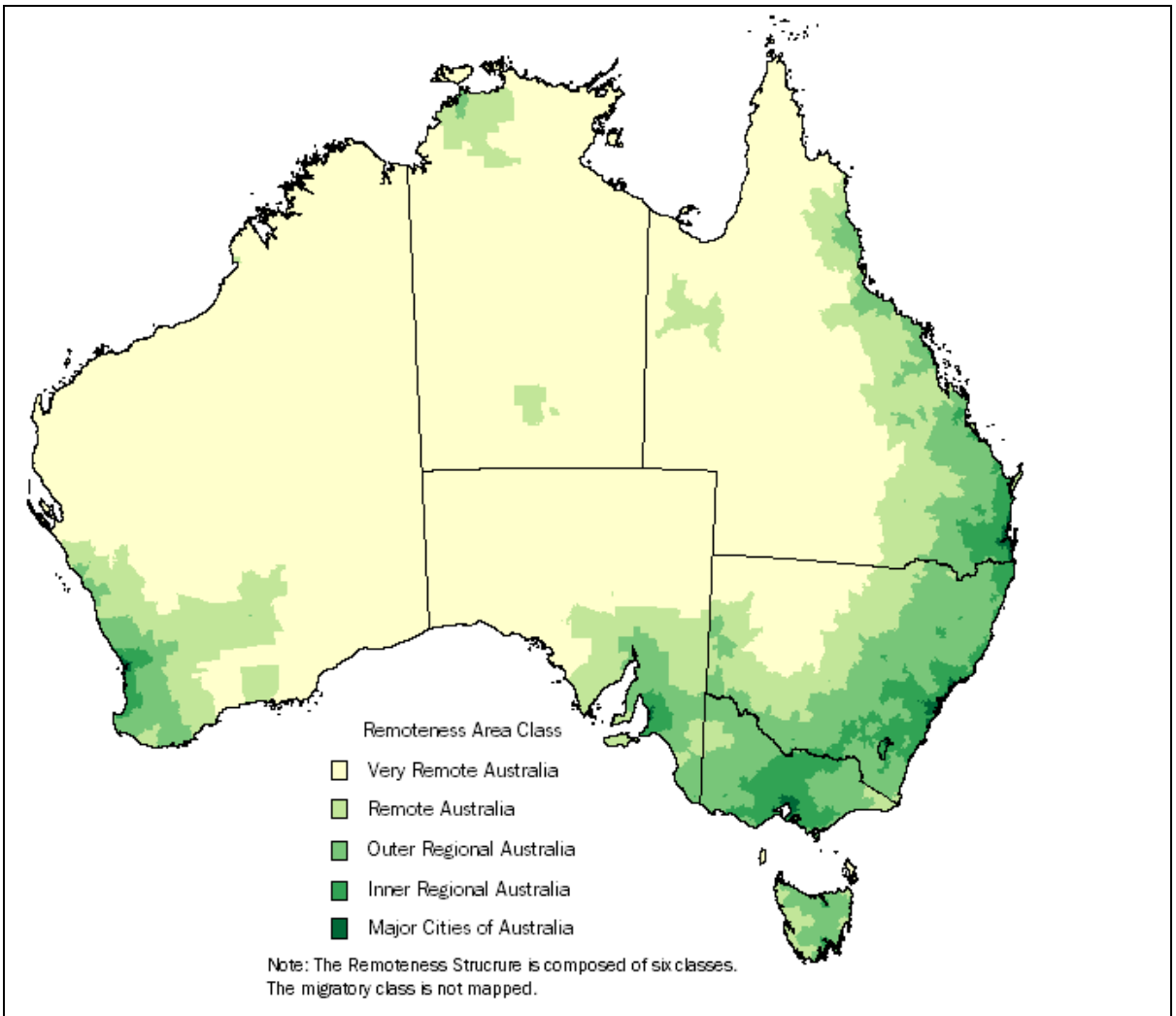
risk factor: Any factor that represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so. Along with their opposites, protective factors, risk factors are known as determinants.

separation: See *hospitalisation*.

survival rate: The proportion of acute coronary syndrome events that were not fatal (calculated as 100% minus the *case-fatality*).

thrombolysis: The breakdown of blood clots by pharmacological means. It is colloquially referred to as 'clot busting'.

unstable angina: A form of *angina* that is more dangerous than normal angina but less so than a *heart attack*. It can feature chest pain that occurs at rest; in someone who already has angina it can be marked by new patterns of onset with exertion or by pain that comes on more easily, more often or for longer than previously.



Source: Australian Bureau of Statistics.

Figure G.1: Australia by ASGC Remoteness Area, 2006

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