AIHW
AUSTRALIAN INSTITUTE OF HEALTH & WELFARE

7

bulletin

Coronary revascularisation in Australia, 2000

Highlights

Coronary revascularisation procedures are a very common treatment for coronary artery disease

- Revascularisation procedures (PCI and CABG; procedures used to restore good blood supply to the heart) are performed at a rate of over 100 per day—totalling 38,901 procedures in 2000.
- 21,784 percutaneous coronary intervention (PCI) procedures and 17,117 coronary artery bypass grafting (CABG) operations were performed in Australia in 2000.

More coronary revascularisation procedures are performed in men than women

- Rates of coronary events (heart attacks) for men are twice those of women, yet males are undergoing revascularisation procedures at more than three times the rate.
- The difference in procedure rates between men and women is most marked in the age range 35–59 (rates for men are 5–8 times those of women) but is evident across all adult ages.

Aboriginal and Torres Strait Islander people

- Indigenous males were slightly less likely to receive revascularisation procedures in 2000 than other Australian males (rate ratio of 0.9:1 for CABG and rate ratio of 0.6:1 for PCI).
- Indigenous females were slightly more likely to receive revascularisation procedures in 2000 than other Australian females (rate ratio of 1.5:1 for CABG and rate ratio of 1.2:1 for PCI).

CONTENTS

Coronary revascularisation in Australia

- In interpreting the previous points, it should be noted that Indigenous Australians have higher levels of cardiovascular disease (ABS 2002) and died from coronary heart disease at around twice the rate of other Australians in 1996–98 (AIHW 2001).

Volume of procedures per hospital

- Although there has been a sevenfold increase in the number of private hospitals performing PCI procedures during the 1990s, private hospitals tend to do only a small volume of procedures (11 out of 23 private hospitals were doing less than 100 procedures during 2000) in comparison with public hospitals.

Trends show that…

- Since 1993–94, age-standardised coronary revascularisation rates have increased by 30% overall—34% for women and 28% for men.
- During the same period, PCI rates have doubled for men and women, and CABG rates have declined by 12% for men and 11% for women.
- The increasing use of revascularisation may have several explanations. These include the ageing of the population, the increasing number of institutions catering for these procedures, advancements in techniques, the need for repeat procedures and the expansion in the range of indications for these procedures.

Australia has higher procedure rates than many OECD countries

- Australia ranks towards the higher end of the procedure rates for both PCI and CABG. These high rates are consistent with the relatively high age-standardised rates of coronary events in Australia.

Introduction

Heart disease is a major cause of morbidity and mortality in Australia, responsible for 20% of deaths in 2000. The most common form of heart disease affecting Australians is coronary heart disease. This involves blockages in the heart's own blood supply, the coronary arteries, by abnormal build-ups known as plaques.

Two main procedures can be used to overcome the blockages by either reducing or bypassing them. Jointly known as coronary revascularisation procedures, they are percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG). They are described below.

CABG was developed in the 1960s and is now a well-established procedure. A section of blood vessel is joined to the coronary artery at either side of the obstruction, bypassing it. The procedure usually requires the chest to be opened. In most cases the piece of vessel to be grafted is from the internal mammary artery in the chest or the major vein in the leg. Less invasive techniques for performing the procedure are now being introduced.

CABG is not a cure for coronary artery disease and there is a risk of recurrent blockage. Reoperations are uncommon within the first five years but become more frequent later. Although PTCA has replaced some CABG procedures since it was introduced in the early 1980s, the techniques are usually regarded as complementary. The rate of CABG has fallen in more recent years.

PTCA involves inserting a catheter, carrying a balloon near its tip, into a major artery reached via the skin ('per-cutaneously'). The catheter is threaded through the artery until it reaches the heart and then into the coronary arteries as far as the obstruction. The balloon is then inflated against the plaque to open a wider passage for blood flow.

While initial PTCA success rates are high, there is a risk of early acute closure of the coronary artery and a high recurrence rate of the obstruction (restenosis). This has led to other catheter-based techniques, including particularly the use of a stent (a tubular metal supporting structure placed at the area of the obstruction) and, much less often, atherectomy (cutting or grinding through obstructions with mechanical devices). The most successful of these newer techniques is stenting and its use has increased rapidly. More recently, drug-eluting stents (also referred to as 'coated stents') have been introduced. They have been shown to more effectively reduce the likelihood of restenosis than bare metal stents.

Over the last few years, there has been a change in terminology. The newer term PCI (percutaneous coronary intervention) has been developed to encompass all forms of percutaneous revascularisation, including PTCA and stenting.

PCI avoids the major trauma of CABG surgery because it does not require opening the patient's chest. However, the technique can not be used in all types of coronary vessel obstruction. The use of this less invasive form of revascularisation has grown considerably over the past 20 years.

This bulletin examines current patterns in coronary revascularisation procedures and explores reasons for their marked increase over the last decade. To this end, data presented in this bulletin are drawn from two data sources: the national registers on cardiac surgery and coronary angioplasty (collected by calendar year) and the Australian Institute of Health and Welfare's (AIHW) National Hospital Morbidity Database (collected by financial year). The latest information available from the national registers was 1999, so data are supplemented by hospital morbidity data and reported in calendar year for comparative purposes.

Current patterns

Coronary artery bypass grafting (CABG)

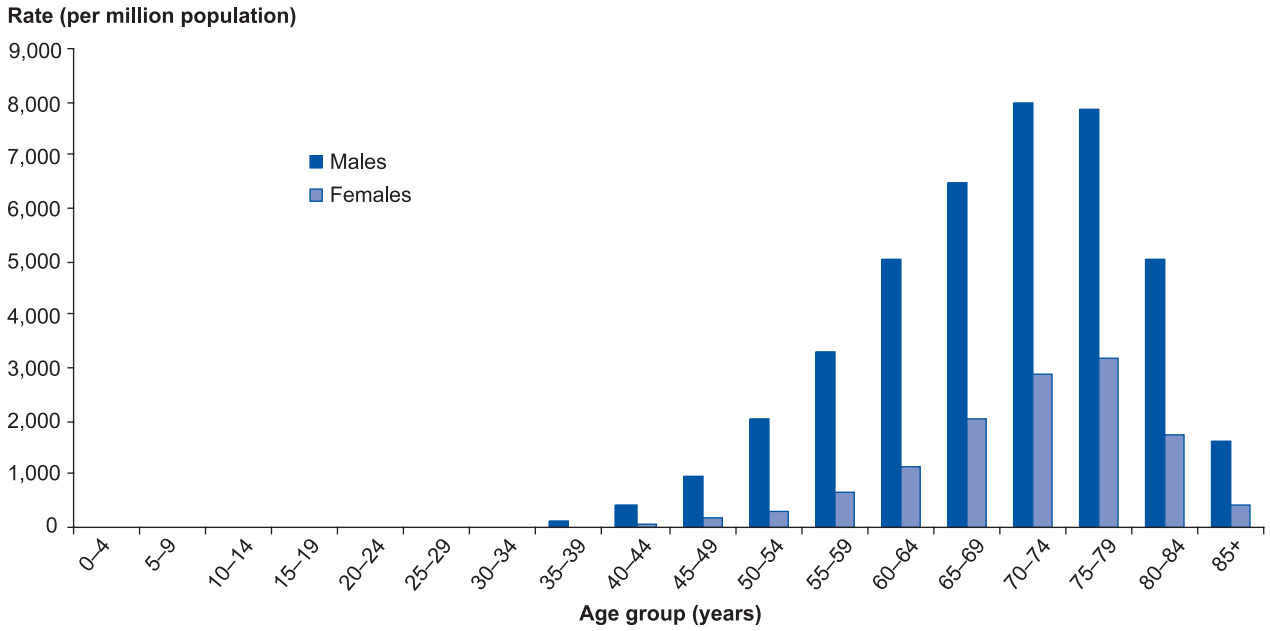
In 2000, there were 17,117 separations for coronary artery bypass grafting operations, a small decline of just over 1% in the number from the previous year. This represents an age-standardised rate of 809 per million population.

The average length of stay in hospital was 11.7 days, with a median length of stay of 9.0 days. The average length of stay for this procedure has been stable since 1994. In comparison, the average length of stay for all separations in Australia during 2000–01 was 3.6 days. Excluding same-day separations, the average length of stay was 6.2 days (AIHW 2002).

Age and sex

The age-standardised rate for CABG operations was 1,301 per million population for males and 372 per million population for females in 2000 (Table A1). This shows that age-standardised CABG rates among males are more than three times higher than females (3.5:1), despite the age-standardised incidence of coronary events (heart attacks) among males being only double female rates (AIHW: Mathur 2002).

Figure 1: Rates of coronary artery bypass grafting by age and sex, 2000



Source: AIHW National Hospital Morbidity Database.

The relative difference in procedure rates between men and women is most marked up to the 50–54 year age group, but it is evident across all adult ages (Figure 1, Table A1). Age-specific procedure rates peak at 70–74 years among males and 75–79 years among females.

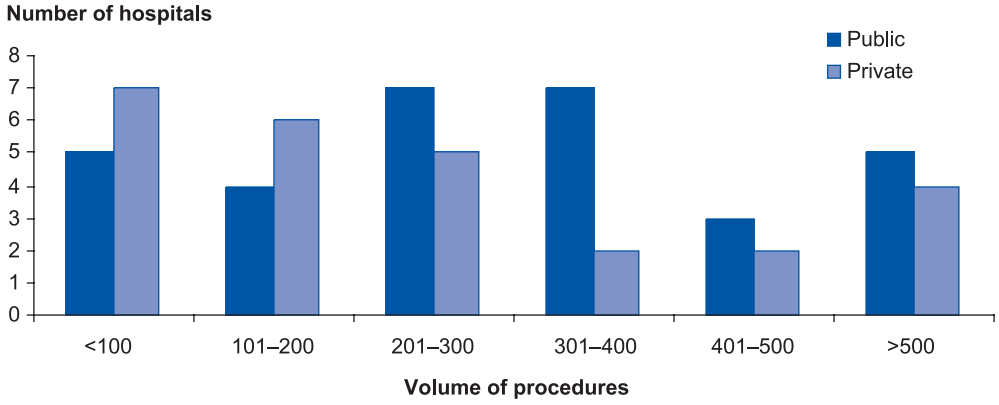
The disparity in procedures between men and women is consistent with that observed internationally (O'Toole & Grech 2003; Mark 2000; Roger 2000; Ayanian & Epstein 1991) and may have several explanations. These include differences in disease severity and associated risk factor profiles and anatomical differences (women have smaller coronary arteries).

Public vs private hospitals

There were 57 hospitals doing CABG procedures during 2000—more than double the number in 1990. In 2000, nearly 60% of CABG procedures were done in public hospitals compared with two-thirds a decade ago.

Figure 2 presents the distribution of CABG operations by public and private hospital by volume of operations based on data from the AIHW National Hospital Morbidity Database. In 2000, a similar number of public and private hospitals were in the highest procedure category (>500 procedures). However, private hospitals were more likely to have smaller volumes of CABGs at less than 200 procedures.

Figure 2: Distribution of coronary artery bypass grafting operations by volume among public and private hospitals, 2000



Source: AIHW National Hospital Morbidity Database.

In-hospital mortality

In 2000, the in-hospital mortality rate (death during the same admission as the procedure, not adjusted for risk) for CABG procedures was 2.7%. In-hospital mortality has stabilised at just below 3% in the past few years even though surgery is now performed on a wider range of patients, including some previously considered unsuitable for surgery.

Percutaneous coronary intervention (PCI)

In 2000, there were 21,784 PCI procedures in Australia—an age-standardised rate of 1,022 per million population. This is a 12% increase in the number from the previous year. Of these procedures, 89% involved placing at least one coronary stent (19,333 procedures).

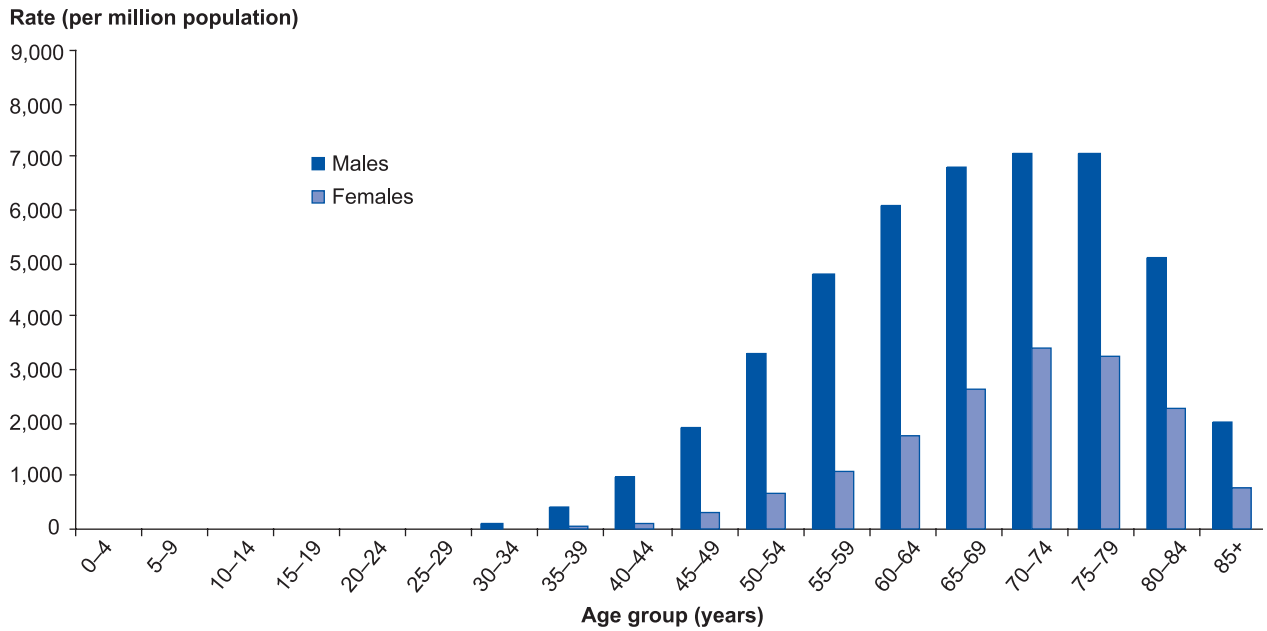
The average length of stay in hospital was 3.7 days, with a median length of stay of 2.0 days in 2000. Of these hospitalisations, 4.7% (1,015) were same-day separations and 32.6% (7,006) were overnight separations. This was similar to the pattern in previous years. The average length of stay has declined by one day since 1994, when it was 4.7 days.

Age and sex

The age-standardised rate for PCI procedures in 2000 was 1,595 per million population for males and 511 per million population for females. This is an age-standardised male:female ratio of around 3.1:1 (Table A2), despite rates of acute major coronary events (heart attacks) in men being only twice that of women (AIHW: Mathur 2002).

The difference in procedure rates between men and women is most marked in relative terms in the age range 35–49 (Table A2), but it is evident across all adult ages (Figure 3). Age-specific procedure rates peak at 70–74 years for both males and females.

Figure 3: Rates of percutaneous coronary intervention by age and sex, 2000



Source: AIHW National Hospital Morbidity Database.

Public vs private hospitals

In 2000, there were 61 hospitals undertaking PCI, a trebling of the number since 1990. The large increase has been from within the private hospital sector, from 5 private hospitals performing PCI in 1990 to 35 in 2000. Between 1993–94 and 2000–01, the number of private hospitals in Australia increased by 16% whereas public hospitals increased by only 3% (AIHW 2002).

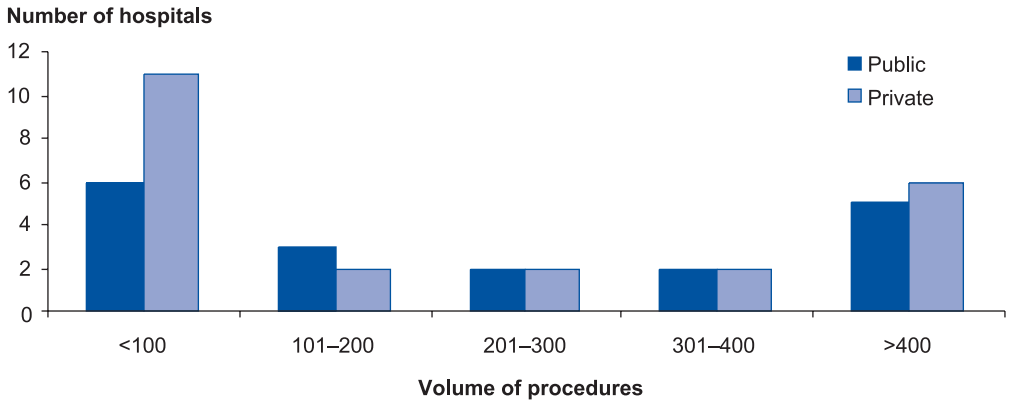
In 2000, close to half (46%) of PCI procedures were done in private hospitals compared with only 20% a decade ago. This is a substantial increase in the share of PCIs undertaken in private hospitals. It is also a much larger increase than for CABG, possibly because PCI is a less invasive procedure, requiring less time in hospital, less specialised equipment and less cost. Between 1993–94 and 2000–01, hospital separations for all procedures in Australia increased by 73% in private hospitals and 17% in public hospitals (AIHW 2002).

Figure 4 presents the distribution of PCI procedures by public and private hospital by volume of procedures. The main feature is that nearly twice as many private hospitals as public hospitals are performing relatively small volumes of PCIs (<100 in 2000).

In-hospital mortality

In 2000, the in-hospital mortality rate (death during the same admission as the procedure, not adjusted for risk) for PCI procedures was 0.9%. It has been stable at close to 1% over the last few years.

Figure 4: Distribution of percutaneous coronary intervention procedures by volume among public and private hospitals, 2000



Note: The total number of hospitals performing PCI does not sum to 61, as some private hospitals data are combined when they are submitted to the NHMD.

Source: AIHW National Hospital Morbidity Database.

Trends

CABG was developed in the 1960s and its use has increased progressively, peaking at 17,759 procedures in 1996. Since then its use has declined about 1% per year (Table A3). PCI was introduced in Australia in the 1980s and its growth has been rapid. This increase is continuing, particularly with the advent of the coronary stent (widespread in Australia since 1995). PCI replaced CABG as the most common form of 'interventional' treatment for coronary heart disease in Australia in 1998. Overall, the crude rate of coronary revascularisation has increased sixfold between 1980 and 2000.

While the overall use of PCIs has increased considerably since the 1980s, its growth has slowed in more recent years (around 12% increase between 1999 and 2000, compared with an annual rate of increase of around 21% between 1995 and 1996).

Appendix Table A3 presents numbers of revascularisation procedures and their associated crude rates over the last 20 years. It is not possible to calculate age-standardised rates as data up to the mid-1990s was sourced solely from the National Cardiac Surgery and National Coronary Angioplasty Registers which do not have age-specific information. Therefore the information in the table does not account for the effects of different age structures over the time period examined.

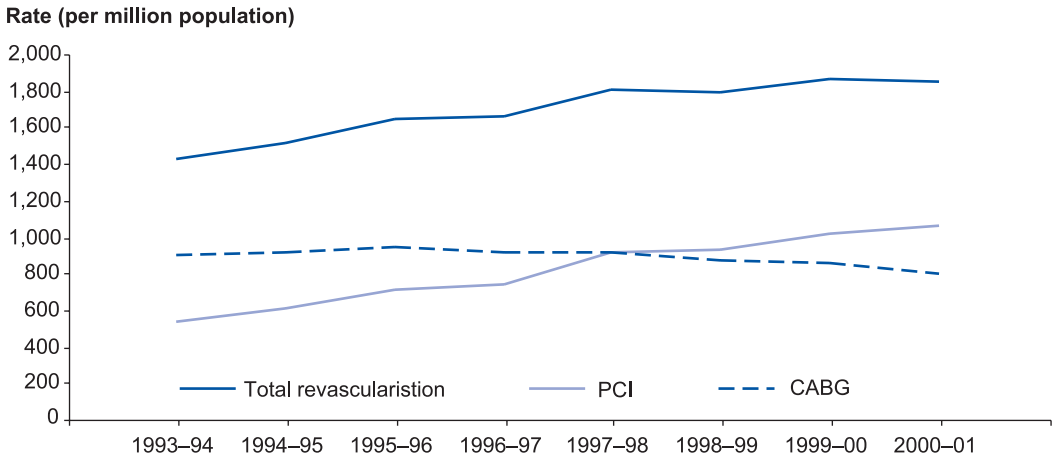
The increasing use of revascularisation may have several explanations. These include the ageing of the population, the increasing number of institutions catering for these procedures, advancements in techniques, the need for repeat procedures and the expansion in the range of indications for these procedures. We explore these here.

Effects of ageing

Coronary heart disease mainly affects middle-aged and older Australians, with most hospital admissions for heart attack and cardiac procedures occurring among the population aged 60 years and over—71% of acute myocardial infarction (AMI) hospital admissions, 73% of CABG procedures and 62% of PCI procedures. These proportions are substantial, especially as those aged 60 years and over accounted for only 17% of the total population in 2001. The burden of coronary heart disease is likely to remain large over the coming decades. In addition, the proportion of the population in which the disease is most prevalent will increase over the coming decades as the population ages (AIHW: Mathur 2002).

Figure 5 presents revascularisation rates where the ageing of the population has been taken into account. Between 1993–94 and 2000–01, overall age-standardised revascularisation rates have increased by 30%, largely due to the increase in PCI usage, with rates doubling between 1993–94 and 2000–01. In contrast, CABG rates have declined by 12% over this period. Ageing contributes to the increase in revascularisation, which is shown by the increase in the crude rate being 10 percentage points higher than the increase in the age-standardised rate.

Figure 5: Rates of coronary revascularisation, 1993–94 to 2000–01



Note: Age-standardised to the Australian population as at 30 June 1991.

Source: AIHW National Hospital Morbidity Database.

Effects of increasing number of hospitals

The capacity to perform revascularisation procedures depends upon the number of hospitals equipped and staffed to undertake CABG or PCI. The number of hospitals with this capability has increased substantially to cater for the increasing demand in revascularisation procedures.

According to the National Cardiac Surgery Register, in 2000 there were 57 cardiac surgery units throughout Australia, a 6% increase from the previous year. All surgery units are located in acute care hospitals in urban or metropolitan areas. The Medical

Labour Force Survey in 2000 reported that there were 105 practising cardiothoracic surgeons—an 11% increase from 1995 (AIHW 2003; AMWAC 2001).

According to the National Coronary Angioplasty Register there were 61 interventional cardiology units operating throughout Australia in 2000, an increase of 7% from the previous year. The Medical Labour Force Survey does not capture the number of cardiologists with PCI training.

Over the last decade, there has been a threefold increase in the number of units doing PCI and a twofold increase in the number of units doing CABG. For PCI, the increase in units has largely occurred in the private hospital sector—a sevenfold increase in private hospitals doing PCI between 1990 and 2000.

Effects of advancement in techniques: use of stents

Evidence from clinical trials emerged in the mid-1990s, highlighting the success of coronary stenting in preventing restenosis following revascularisation (Fischman et al. 1994; Serruys et al. 1994; Schomig et al. 1996). Since then, stenting use has increased considerably. For instance, in Australia in 1995, coronary stents were inserted in 30% of PTCA procedures, whereas in 2000 they were used in 89%.

The increase in stent use throughout the world has resulted from improvements in techniques and equipment, and has enabled more complex procedures to be undertaken in more acute situations (Grech 2003). Stenting has been shown to improve outcomes by reducing the incidence of recurrent ischaemic events (or episodes) and the need for repeat revascularisation (Grines et al. 1999).

Effects of repeat procedures

There is a higher rate of repeat procedures for PCI compared with CABG. This may explain the increase in revascularisation procedures to some extent, as the proportion of revascularisations that are PCIs increases. As coronary artery disease progresses, new arterial blockages can develop or restenosis may occur at the original blockage site.

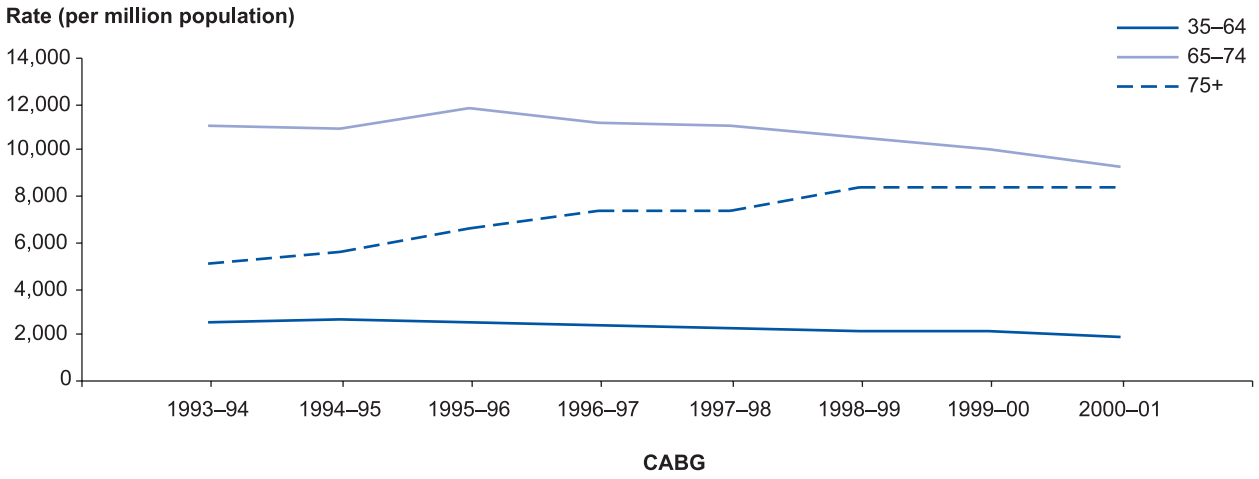
In 1999, 20% of the PCI procedures were repeats, and in 45% of such cases these repeats occurred within 12 months—the majority to the same lesion (AIHW: Davies & Senes 2002). This compares with only 6% of reoperations for CABGs in the same year (AIHW: Davies & Senes 2003).

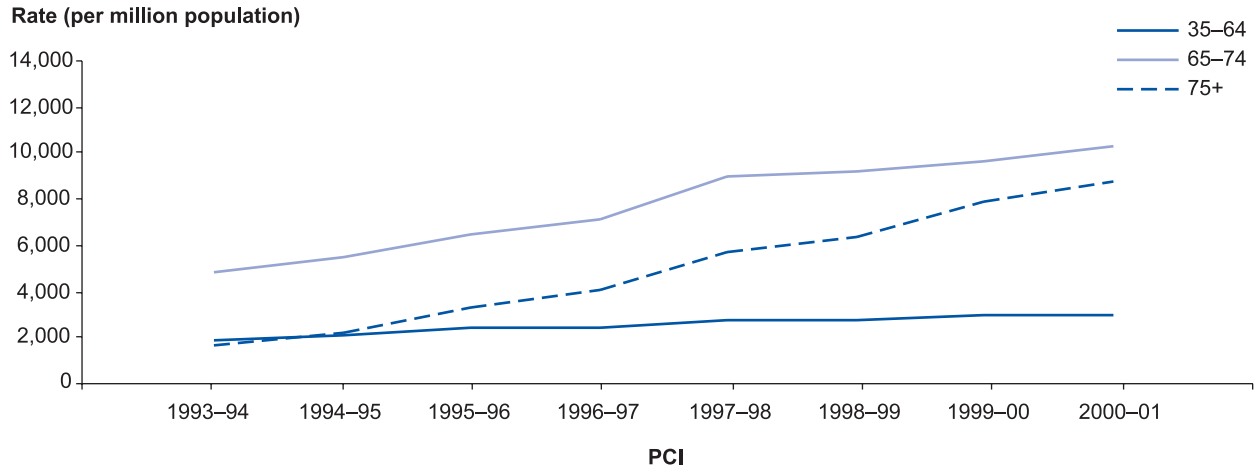
Effects of wider applications

As mentioned earlier, PCI is a less invasive procedure. It can therefore be used for a wider age range of patients or where CABG is unsuitable, such as for the frail or those with a number of other health conditions. In the absence of a patient-based register detailing clinical indications and associated risk factors, it is not possible to determine if the procedure is being used on people with a higher risk profile than previously. The development of a patient-based National Cardiac Procedures Register in Australia could provide data such as these.

However, information on changing patient profiles can be used as an indication that the procedures are being used on a wider range of patients. Data from national registers do show that PCI is increasingly being used to treat patients in the acute setting with AMI. According to the National Angioplasty Register, in 1999 the main uses of PCI were for stable angina (42% of cases), unstable angina (42% of cases) and AMI (9% of cases).

Figure 6: Rates of coronary artery bypass grafting and percutaneous coronary intervention for selected age groups, 1993–94 to 2000–01





Note: Age-standardised to the Australian population as at 30 June 1991.

Source: AIHW National Hospital Morbidity Database.

Furthermore, 13% of PCI procedures were done on patients with previous CABG, and thrombolytic therapy was used before PCI in 11% of procedures (AIHW: Davies & Senes 2002). This contrasts with data from 1990 which showed that PCI indications were unstable angina (52% of cases), stable angina (41% of cases), AMI (4% of cases) and prognostic and other (3% of cases) (NHF 1992). Between 1993–94 and 1999–00 there has been almost a fivefold increase in the rates of PCIs during acute hospital admission among AMI patients (AIHW: Mathur 2002).

Revascularisation is increasingly being used to treat older patients, which is another illustration of the expansion of the use of these procedures (Figure 6). Between 1993–94 and 2000–01, the rise in procedure rates among those aged 75 years and older has been considerable. For PCI, rates among those aged 75 years and older have increased fourfold whereas the rates for 65–74-year-olds have doubled, and those for 30–64 have increased 60%. CABG rates for younger and middle-aged age groups have declined while rates among people aged 75 and older have increased by 66% over the same period.

Revascularisation mortality rates (unadjusted for age and severity) have been relatively stable over the past 5 years at 3% for CABG and 1% for PCI. Therefore changes and improvements in techniques may have been offset by procedures being done in older and sicker patients.

Aboriginal and Torres Strait Islander people

This section compares rates of procedures among Indigenous Australians and non-Indigenous Australians. These hospital data are not risk-adjusted and therefore do not take into account the potential need for this procedure among this population in terms of disease prevalence and severity. Indigenous Australians have higher levels of cardiovascular disease (ABS 2002) and died from coronary heart disease at around twice the rate of other Australians in 1996–98 (AIHW 2001).

It should be noted that the quality of Indigenous Australian identification in the hospital data collection is not complete and as a result the rates are likely to be underestimates of the true rates. For further information on data quality issues see AIHW 2002.

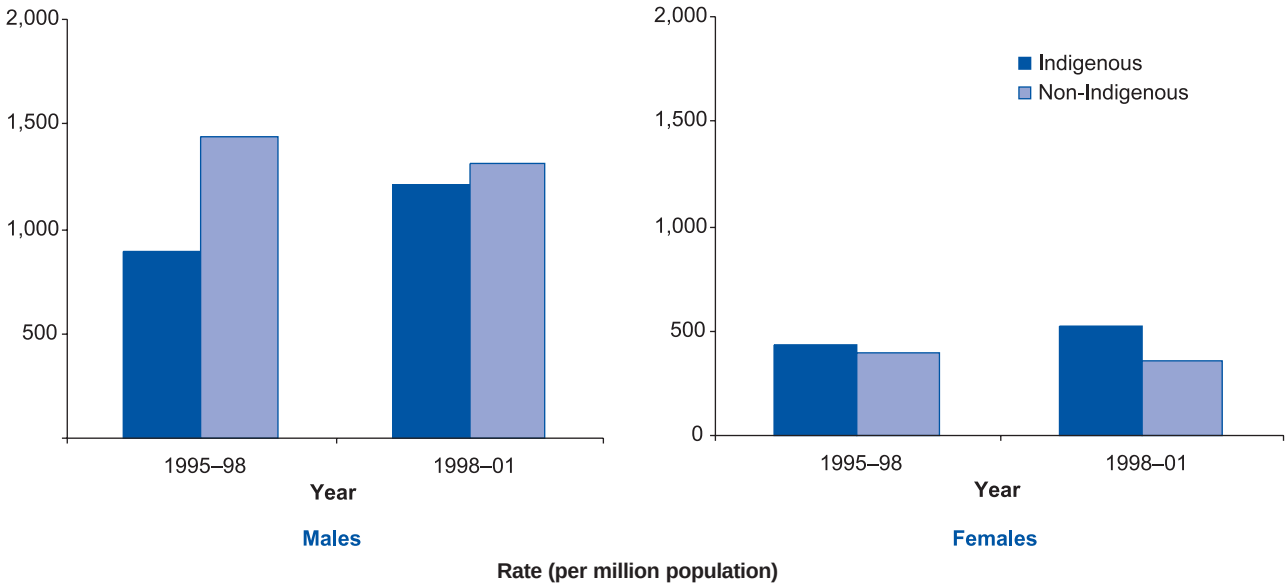
CABG

During 1998–01, Indigenous males were slightly less likely to receive CABG operations compared with non-Indigenous males—1,211 per million population and 1,307 per million population, respectively. Among Indigenous females, the reverse was true, their CABG rates being 1.5 times that of non-Indigenous females—525 per million population and 362 per million population, respectively (Figure 7).

The disparity between the sexes in operations performed is found in both the Indigenous and the non-Indigenous populations, although it is higher among the non-Indigenous population. Indigenous male rates were 2.3 times higher than that of Indigenous female rates. In contrast, non-Indigenous male rates were 3.6 times that of non-Indigenous female rates.

Coronary revascularisation in Australia

Figure 7: Rates of coronary artery bypass grafting among Indigenous and non-Indigenous Australians, 1995–98 and 1998–01



Note: Rates have been age-standardised to the 1991 Australian population.

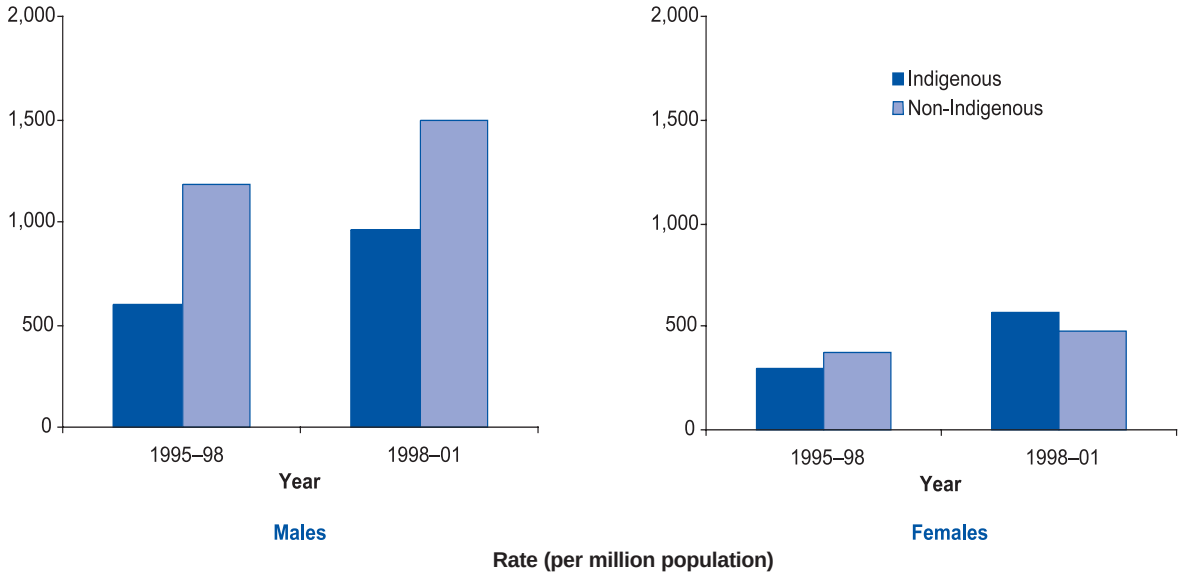
Source: AIHW National Hospital Morbidity Database.

Looking at the rates between different age groups, CABG rates were higher among middle-aged to older Indigenous Australians. For males, among the 55–64-year-olds there were 4,110 operations per million population and among the 65–74-year-olds there were 4,966 operations per million population; for females, among the 55–64-year-olds there were 1,845 operations per million population and among the 65–74-year-olds there were 2,007 operations per million population. When comparing age distributions for CABG operations between Indigenous Australians and non-Indigenous, Indigenous Australians underwent operations from an earlier age (35–44 years), whereas in non-Indigenous Australians operations began occurring from 45–54 years.

Between 1995–96 to 1997–98 and 1998–99 to 2000–01, CABG rates increased among both male and female Indigenous Australians—by 35% and 21%, respectively (Figure 7). However, among non-Indigenous Australians, CABG rates declined by 9% between both three-year periods for both sexes.

These analyses contrast with results observed internationally. Maori and Pacific peoples living in New Zealand underwent less CABG operations than other New Zealanders, at ratios unadjusted for need of 0.6 for men and 0.7 for women (Tukuitonga & Bindman 2002). In the United States, 'blacks' were more than a third less likely than 'whites' to undergo bypass surgery when adjusted for severity of disease and survival benefit due to revascularisation (Peterson et al. 1997).

Figure 8: Rates of percutaneous coronary intervention among Indigenous and non-Indigenous Australians, 1995–98 and 1998–01



Note: Rates have been age-standardised to the 1991 Australian population.

Source: AIHW National Hospital Morbidity Database.

PCI

During 1998–01, Indigenous males were less likely to receive PCI procedures compared with non-Indigenous males at a ratio of 0.6:1—964 per million population and 1,490 per million population, respectively. Among Indigenous females, the reverse was true, their PCI rates being 1.2 times that of non-Indigenous females—569 per million population and 477 per million population, respectively (Figure 8).

PCI rates peaked among middle-aged Indigenous men (3,176 operations per million population among 55–64-year-olds) and older Indigenous women (1,846 operations per million population aged 65–74 years). As with CABG, Indigenous Australians underwent PCI procedures from an earlier age (35–44 years) compared with non-Indigenous Australians (45–54 years).

The disparity in procedures performed between the sexes is found in both the Indigenous and non-Indigenous, although it is higher among the non-Indigenous. Male Indigenous rates were 1.7 times that of female Indigenous rates. In contrast, non-Indigenous male rates were 3.1 times those of non-Indigenous female rates.

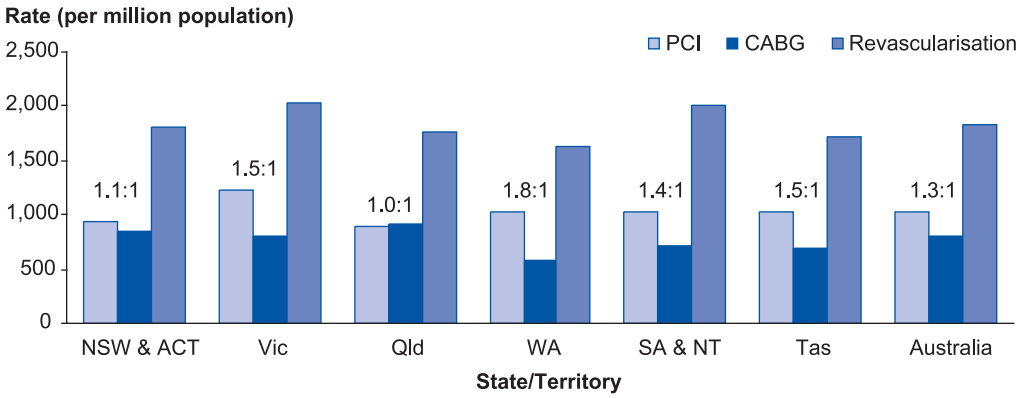
Between 1995–96 to 1997–98 and 1998–99 to 2000–01, PCI rates increased among both the male and female Indigenous populations—61% and 93%, respectively (Figure 8). In comparison, among the non-Indigenous population PCI rates increased by 27% for males and 28% for females between both three-year periods.

These analyses contrast with results observed internationally. Maori and Pacific peoples living in New Zealand underwent fewer PCI procedures than other New Zealanders by around one-third, unadjusted for risk (Tukuitonga & Bindman 2002). In the United States, 'blacks' were 13% less likely to undergo PCI than 'whites' when adjusted for disease severity and survival benefit (Peterson et al. 1997).

Regional variation

During 2000, there was considerable variation in coronary revascularisation procedures across states and territories, even after accounting for different age structures. In Victoria there were 25% more coronary revascularisation procedures (2,037 per million population) than Western Australia (1,624 per million population). PCI was more common in all states and territories except in Queensland where CABG was used slightly more frequently. The difference in procedure rates was most marked in Western Australia, where PCI was used more frequently than CABG at a ratio of 1.8 to 1 (Figure 9).

Figure 9: Coronary artery bypass grafting, percutaneous coronary intervention and revascularisation by region, 2000



Notes

1. Revascularisation = CABG + PCI.
2. Bolded figures above columns refer to ratio of PCI to CABG.
3. Age-standardised to the Australian population as at 30 June 1991.
4. Rates have been calculated to include the Australian Capital Territory (ACT) population with New South Wales (NSW), and the Northern Territory (NT) population with South Australia (SA). It is known from hospital morbidity data that the vast majority of NT residents are treated in SA and that nearly half of those treated in the ACT are NSW residents.

Source: AIHW National Hospital Morbidity Database.

In 2000, the national rate for CABG surgery was 809 per million population. This rate varied across states and territories, from 584 per million population in Western Australia to 908 per million population in Queensland (Table 1). The national rate for PCI was 1,022 per million population. This rate also varied across states and territories, from 887 per million population in Queensland to 1,224 per million population in Victoria (Table 1).

From these data it is not possible to determine the underlying reasons for differing patterns of revascularisation use across states and territories, although it is expected that these would reflect different clinical indications and decisions.

Table 1: Coronary artery bypass grafting and percutaneous coronary intervention rates by region, 2000

Procedure		NSW & ACT	Vic	Qld	WA	SA & NT	Tas	Australia
		Rate (per million population)						
CABG	Crude rate	940	906	950	584	814	809	884
	Age-standardised rate	846	809	908	584	724	691	809
PCI	Crude rate	1,054	1,370	944	1,065	1,155	1,203	1,125
	Age-standardised rate	948	1,224	887	1,037	1,023	1,020	1,022
Revascularisation	Crude rate	2,007	2,286	1,882	1,654	2,304	2,015	2,019
	Age-standardised rate	1,804	2,037	1,767	1,624	2,015	1,713	1,836

Notes

1. Revascularisation = CABG + PCI.
2. Age-standardised to the Australian population as at 30 June 1991.
3. Rates have been calculated to include the Australian Capital Territory (ACT) population with New South Wales (NSW), and the Northern Territory (NT) population with South Australia (SA). It is known from hospital morbidity data that the vast majority of NT residents are treated in SA and that nearly half of those treated in the ACT are NSW residents.

Source: AIHW National Hospital Morbidity Database.

International comparisons

Rates of coronary revascularisation procedures vary throughout the world and generally reflect the rates of coronary artery disease within each country (Moise 2003).

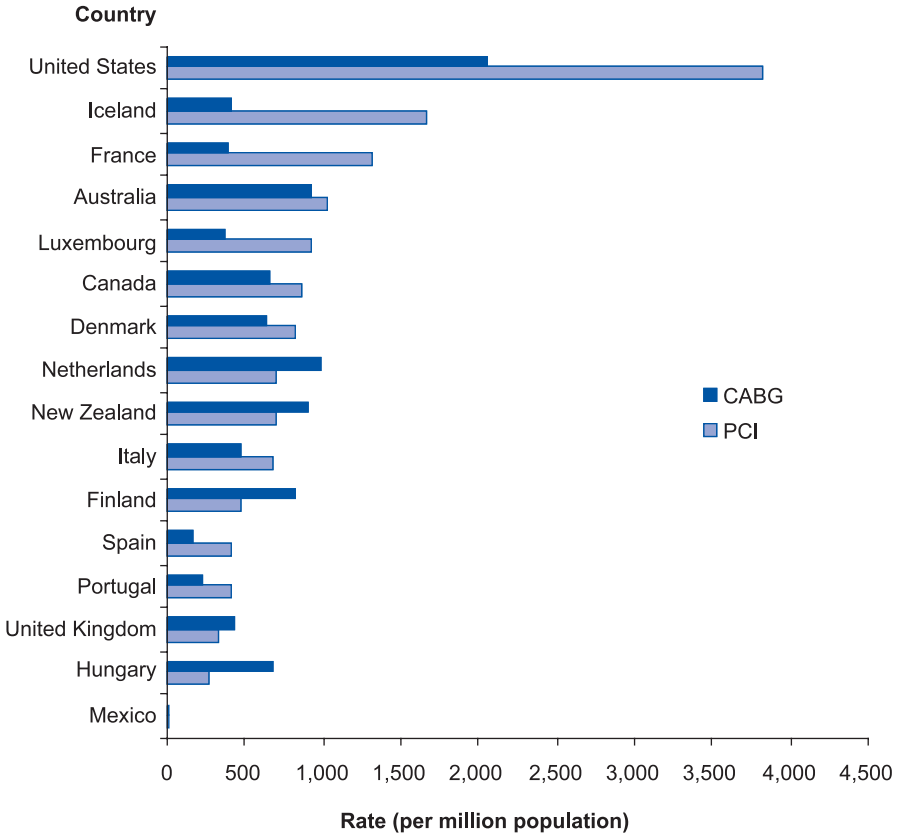
Figure 10 presents crude rates of procedures compiled by the OECD for the latest available year, 1999, for countries with available data. The United States had the highest rates of PCI and CABG of the countries shown—their age-standardised procedure rates were 2 to 3 times those of Australia. For both PCI and CABG, Australia was at the higher end of the countries compared, at rates 1,027 and 915 per million population respectively. Australia also follows the international pattern of higher PCI than CABG rates (OECD 2003).

Coronary revascularisation in Australia

A detailed international study by the OECD (based on 1998 data for 18 countries) showed that for patients aged 40–90 years being treated for an AMI in hospital, Australia has one of the highest levels of PCI use per head of population, exceeded only by the United States, Germany and Belgium. For CABG surgery, the United States had the highest rates and Australia ranked second (Moise 2003).

The study reported that the higher revascularisation rates of the United States were due to a combination of high per capita income and the early adoption and diffusion of health technologies. The high levels of utilisation observed for the United States, Germany and Australia were not unusual given the high levels of coronary heart disease and its risk factors observed in those countries. The study also concluded that a strong link exists between health care system supply-side incentives and the level and diffusion of invasive revascularisation procedures.

Figure 10: International comparison of revascularisation procedures, 1999



Note: Crude rates calculated by OECD.

Source: OECD Health Data 2003.

Data sources

National Hospital Morbidity Database, held at the AIHW, contains demographic, diagnostic, procedural and duration of stay information on episodes of care for patients admitted to hospital. The data items are supplied to the AIHW by the state and territory health authorities. The database provides information on the number of hospitalisations (separations) for a particular condition or procedure. Although it is possible to count the number of patients individually, it is not possible to attribute multiple hospital episodes to the same individual. Records for separations with relevant procedure codes using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) as principal or additional procedure and with separation dates between 1 January and 31 December 2000 were included. Methods used to count procedures using the ICD-10-AM codes are described elsewhere AIHW: Davies & Senes 2003 and AIHW: Davies & Senes 2002. Data are collected and usually reported by financial year; however, information on the database also enables compilation by calendar year, which has been undertaken in parts of this report to extend the trend information available from the procedure registers from 1981. Approximately 5.7% of separations from private hospitals were not reported to the National Hospital Morbidity Database in 2000–01 so the rates presented are likely to be an underestimate of the actual rates (AIHW 2002).

The ICD-10-AM codes used in this report:

Procedure	ICD-10-AM code
Coronary artery bypass grafting	Blocks [672–679] 38497, 38500, 38503, 90201
Percutaneous transluminal coronary angioplasty	Block [670] 35304-00, 35305-00
Coronary stenting	Block [671] 35310

National Cardiac Surgery Register, a joint project between the National Heart Foundation of Australia and the AIHW. This database contains information on the number of a range of heart surgery procedures and associated deaths (but without risk adjustment). The data are collected by calendar year and supplied on a voluntary basis annually to the AIHW by cardiac surgery units around Australia.

National Coronary Angioplasty Register, a joint project between the National Heart Foundation of Australia and the AIHW. This database contains information on coronary angioplasty procedures, indications, associated complications, lesion location, success rates and adjunctive techniques such as stenting. The data are collected by calendar year and supplied on a voluntary basis annually to the AIHW by cardiac catheterisation units around Australia.

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Abbreviations and definitions

Acute myocardial infarction—Life threatening emergency that occurs when a vessel supplying blood to the heart muscle is suddenly blocked completely by a blood clot.

Coronary artery disease—Any disease of the coronary arteries; particularly atherosclerosis, which reduces the flow of blood and hence the oxygen supply to the heart muscle.

Coronary artery bypass grafting (CABG)—Grafting of blood vessel(s) to bypass obstructions in coronary arteries and improve the supply of blood to the heart.

Coronary stenting—Use of a metal mesh tube that is expanded within an artery at a point of narrowing and left there to hold the artery open.

Percutaneous—Via the skin. Used here to refer to techniques such as PCI or PTCA where a catheter is first inserted into an artery via the skin.

Percutaneous coronary intervention (PCI)—A term used to encompass all forms of percutaneous revascularisation, including balloon angioplasty, stenting etc.

Percutaneous transluminal coronary angioplasty (PTCA)—A method of treating localised coronary artery narrowing, using a special catheter with a balloon that can be inflated to dilate the narrowed vessel. It is a subset of the more general category, percutaneous coronary intervention.

Restenosis—Repeated narrowing. See *stenosis*.

Revascularisation—Restoration or improvement of blood flow to the heart muscle by bypassing or removing obstructions in coronary arteries, as occurs with CABG or PCI.

Separation—Refers to an episode of care in hospital. It also means the process by which an admitted patient completes an episode of care by being discharged, dying, transferring to another hospital or changing the type of care.

Stenosis—Narrowing, such as occurs inside a blood vessel or to the opening of a valve.

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Appendix tables

Table A1: Coronary artery bypass grafting by age and sex, 2000

	Males			Females			
Age (years)	Number	Per cent	Rate[a]	Number	Per cent	Rate[a]	Rate ratio male:female
0–4	1	0.0	1.5	1	0.0	1.6	0.9
5–9	0	0.0	0.0	0	0.0	0.0	—
10–14	1	0.0	1.5	0	0.0	0.0	—
15–19	1	0.0	1.5	0	0.0	0.0	—
20–24	0	0.0	0.0	1	0.0	1.6	—
25–29	5	0.0	6.9	0	0.0	0.0	—
30–34	15	0.1	21.1	2	0.0	2.8	7.6
35–39	92	0.7	122.7	20	0.5	26.3	4.7
40–44	301	2.3	417.2	46	1.1	62.7	6.6
45–49	624	4.8	930.6	109	2.6	160.8	5.8
50–54	1,278	9.8	2,011.0	186	4.5	297.8	6.8
55–59	1,625	12.5	3,315.5	320	7.7	669.4	5.0
60–64	2,026	15.6	5,062.4	463	11.2	1,157.9	4.4
65–69	2,150	16.6	6,459.7	698	16.9	2,016.2	3.2
70–74	2,412	18.6	7,999.1	971	23.5	2,907.2	2.8
75–79	1,726	13.3	7,838.1	913	22.1	3,161.3	2.5
80–84	603	4.6	5,054.2	329	8.0	1,722.5	2.9
85+	126	1.0	1,649.6	72	1.7	414.2	4.0
Total	**12,986**	**100.0**	**1,362.0**	**4,131**	**100.0**	**426.3**	**3.2**
ASR[b]			**1,301.0**			**371.6**	**3.5**

— nil.

(a) Rate (per million population).

(b) Rate (per million population) age-standardised to the Australian population as at 30 June 1991.

Source: AIHW National Hospital Morbidity Database.

Table A2: Percutaneous coronary intervention procedures by age and sex, 2000

	Males			Females			
Age (years)	Number	Per cent	Rate[a]	Number	Per cent	Rate[a]	Rate ratio male:female
0–4	5	0.0	7.6	1	0.0	1.6	4.8
5–9	1	0.0	1.4	2	0.0	3.0	0.5
10–14	2	0.0	2.9	2	0.0	3.1	1.0
15–19	0	0.0	0.0	1	0.0	1.5	—
20–24	2	0.0	3.1	2	0.0	3.1	1.0
25–29	17	0.1	23.5	0	0.0	0.0	—
30–34	66	0.4	93.2	18	0.3	25.1	3.7
35–39	295	1.8	394.2	38	0.7	50.2	7.8
40–44	712	4.4	989.1	95	1.7	130.3	7.6
45–49	1,298	8.0	1,945.7	226	4.0	335.2	5.8
50–54	2,115	13.1	3,333.6	416	7.4	667.6	5.0
55–59	2,380	14.7	4,855.2	517	9.2	1,091.9	4.4
60–64	2,480	15.4	6,187.6	709	12.6	1,786.6	3.5
65–69	2,289	14.2	6,893.9	928	16.5	2,689.2	2.6
70–74	2,150	13.3	7,176.5	1,153	20.5	3,455.8	2.1
75–79	1,568	9.7	7,140.6	941	16.7	3,270.3	2.2
80–84	616	3.8	5,177.8	438	7.8	2,305.3	2.2
85+	160	1.0	2,064.0	141	2.5	805.0	2.6
Total	**16,156**	**100.0**	**1,699.7**	**5,628**	**100.0**	**583.3**	**2.9**
ASR[b]			**1,594.6**			**510.7**	**3.1**

— nil.

(a) Rate (per million population).

(b) Rate (per million population) age-standardised to the Australian population as at 30 June 1991.

Source: AIHW National Hospital Morbidity Database.

Table A3: Coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI) and total revascularisation procedures in Australia, 1981–2000

	CABG		PCI		Revascularisation	
Year	Number of procedures	Rate (per million population)	Number of procedures	Rate (per million population)	Number of procedures	Rate (per million population)
1981	4,987	334	45	3	5,032	337
1982	5,720	377	151	10	5,871	387
1983	6,565	427	348	23	6,913	449
1984	6,641	426	737	47	7,378	474
1985	7,240	459	1,244	79	8,484	537
1986	7,351	459	1,840	115	9,191	574
1987	8,445	519	2,383	147	10,828	666
1988	8,786	531	3,153	191	11,939	722
1989	10,531	626	4,219	251	14,750	877
1990	11,381	667	4,904	287	16,285	954
1991	12,649	732	5,726	331	18,375	1,063
1992	12,935	739	6,748	386	19,683	1,125
1993	14,638	829	8,334	472	22,972	1,300
1994	16,465	922	9,732	545	26,197	1,467
1995	17,150	949	11,348	628	28,498	1,577
1996	17,759	970	13,853	757	31,612	1,726
1997	17,377	938	15,918	859	33,295	1,798
1998	17,451	932	18,094	969	35,545	1,900
1999	17,321	906	19,444	1,021	36,765	1,943
2000	17,117	884	21,784	1,125	38,901	2,019

Notes

1. CABG refers to ICD-9-CM code 36.1. ICD-10-AM has been used for data pertaining to the second half of 1998. The ICD-10-AM codes used were 38497, 38500, 38503 and 90201.
2. PCI refers to ICD-9-CM codes 36.01, 36.05, 36.06 and 36.07. ICD-10-AM has been used for data pertaining to the second half of 1998. The ICD-10-AM codes used were 35304-00, 35305-00 and 35310.
3. For the years 1981–88 CABG data represent operations involving CABG and no concomitant procedures. For the years 1989–97 these data represent operations involving CABG with or without concomitant procedures.
4. Rate (per million population) relates to crude rates. These rates do not take into account the different age structure of these populations over time.

Sources

1. AIHW–NHF National Cardiac Surgery Register and Coronary Angioplasty Register.
2. AIHW National Hospital Morbidity Database.

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