

# **Cardiac surgery in Australia 1995**

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# **Cardiac surgery in Australia 1995**

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and  
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## Preface

This is the thirty-third national cardiac surgery report and presents information on all procedures performed in 1995. It is produced jointly by the Australian Institute of Health and Welfare and the National Heart Foundation of Australia. An advisory committee appointed by the Foundation oversees the cardiac surgery register and the Institute collates, analyses and reports the data through its National Centre for Monitoring Cardiovascular Disease. The project is financed by the Foundation and the Institute, through funds it receives for the National Centre from the Commonwealth Department of Health and Aged Care.

Under its Act, the *Australian Institute of Health and Welfare Act 1987*, the Institute is able to provide the legislative protection that is required to operate the cardiac surgery register and protect the data confidentiality interests of the participating units and their patients.

This report is intended primarily for workers in the field so it uses technical terms widely. However, to make the contents more accessible to other interested readers, a brief explanatory introduction and a glossary have been included.

Reports covering procedures done in 1996, 1997 and 1998 are in preparation and will be issued as soon as the data are made available by all participating units.

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Chairman  
Cardiac Surgery Advisory Committee

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## Summary

This report aims to provide details of cardiac surgery as performed in Australia in 1995. It covers patterns and trends in the use of cardiac surgery procedures for acquired and congenital conditions, and associated mortality.

The main findings of the report are:

- During 1995 there were an estimated 21,692 cardiac surgery procedures performed in Australia, with an average case load of 542 patients per unit.
- Cardiac surgery procedures increased by an estimated 3.6% compared with the previous year.
- The estimated national cardiac surgery rate was 1,200 per million population, with a 30-day mortality rate of 2.7%.
- There were 75 cardiac surgeons operating in 40 units throughout the country, compared with 37 units in 1994.
- There were 1,648 operations for congenital heart defects, with a 30-day mortality rate of 2.5%. There has been a slight decline in mortality from 1994. Septal defects were the main single reasons for congenital heart surgery.
- Among congenital defects, compared with the previous year, the number of operations for valve defects, atrial septal defects, coarctation of the aorta, persistent ductus arteriosus and ventricular septal defects increased, whereas those for Tetralogy of Fallot and for transposition of great vessels fell.
- Valvular heart defects accounted for an estimated 3,890 procedures, with a mortality rate of 3.7%. Thirty-nine procedures were reoperations for mechanical valve failures, 12 procedures were reoperations for allograft tissue valve failures and 136 procedures were reoperations for bioprosthetic tissue valve failures.
- Surgery was done most frequently for the aortic and mitral valves, and involved replacing the valve with a prosthesis in 58.3% of cases. Repairs were done in 17.9% of cases.
- There were an estimated 17,150 operations involving coronary artery bypass grafts, with a mortality rate of 2.3%. Seven per cent of coronary artery bypass graft procedures were reoperations.
- The average number of bypass grafts was three per patient. Saphenous vein and internal mammary artery grafts were the main types used in bypass graft operations, at 88.0% and 80.8% respectively.
- The age-standardised national average rate for coronary artery bypass graft surgery was 922 per million population. The rate varied across States, ranging from 674 per million population in Tasmania to 968 per million population in New South Wales.
- There were 100 heart transplants, 69 lung transplants and 13 combined heart–lung transplants done in 1995.

## Introduction

Heart disease is a major cause of morbidity and mortality, causing 30% of all deaths in Australia in 1997. The most common forms of heart disease affecting Australians are coronary heart disease, acquired valve disease, conduction defects, congestive heart failure and congenital heart defects. There is a wide range of treatments for heart disease, among which are cardiac surgery and electrophysiological treatments.

Coronary artery bypass grafting (CABG) was developed in the 1960s and is now a well-established procedure. Vessel grafts are used to construct new conduits from major arteries to points beyond obstructions in the coronary arteries to restore adequate blood supply to the heart muscle (myocardium). The procedure usually requires the chest to be opened and the circulation to be diverted from the heart and lungs to a cardiopulmonary bypass machine with a pump oxygenator. In most cases the graft material is obtained from the patient's saphenous vein in the leg or the internal mammary artery in the chest, or both. Less invasive techniques for performing the procedure are now being introduced. CABG is a treatment and not a cure for coronary artery disease, and there is a risk of recurrent disease. Reoperations are uncommon within the first five years but become more frequent later. Although coronary angioplasty has replaced some CABG procedures since it was introduced in the early 1980s, the techniques are regarded as complementary and the rate of CABG is still increasing.

Valve surgery involves repairing or replacing the mitral, aortic, tricuspid or pulmonary valves. It usually requires cardiopulmonary bypass. Valve disease may be age-related, a result of disease such as rheumatic fever, or congenital. Most valve procedures done in Australia consist of replacing the damaged valve with a mechanical prosthesis, a pig bioprosthesis or a human graft. Reconstruction of the damaged valve by suturing techniques is less common. Simpler valve procedures can be undertaken with catheter-based techniques.

Congenital conditions include abnormalities of the heart or heart valves, defects of the great vessels, such as the aorta and pulmonary artery, or combinations of defects. Most children with congenital defects are treated with open surgery, usually in infancy or early childhood.

Electrophysiology surgery involves removing sections of heart muscle tissue responsible for abnormal heart rhythms (arrhythmias) such as ventricular and supraventricular tachycardias, which can be serious or even life threatening.

Other cardiac procedures include operations on the aorta, surgery for cardiac tumours and trauma, transplants, and pericardiectomy.

The aim of this report is to provide details of cardiac surgery performed in Australia in 1995. The report covers patterns and trends in the use of cardiac surgery procedures for acquired and congenital conditions, and associated mortality.

This report is also available on the Internet at the Institute's web site:

<http://www.aihw.gov.au>

# Methods

This report summarises all cardiac surgery performed in 1995. Statistics from previous years are also included, as changes over time in the numbers, rates, and associated mortality of operations are of interest. Information about the rate of reoperations for coronary artery bypass grafts and valve surgery is also presented. Units operating in 1995 are listed in Appendix A. The list of units is reviewed each year and new units are invited to join the register and submit their data.

## Data collection and reporting

Generally, data collection forms are sent to all units at the beginning of each year for procedures done in the previous calendar year. Units are asked to complete the forms with aggregate results, not individual patient details, and submit them within eight weeks. Reports are provided by each unit under the condition that results will be presented in aggregate form only, and that results from individual units will not be released unless the head of the unit concerned agrees in writing.

Data are collected via a form presented here in Appendix B. This form is reviewed and updated by the Cardiac Surgery Advisory Committee each year to reflect changes in practice. Units' responses are reviewed, data are checked for consistency, any discrepancies are referred to the relevant unit, and data are then entered into a dedicated database at the Australian Institute of Health and Welfare. Results are analysed and the annual report compiled and reviewed by members of the Advisory Committee before its publication.

The 1995 data collection form included several changes from previous years. Information on non-conventional coronary artery bypass grafts was collected and reported, as well as additional detail on valve reoperations.

## Coverage

The register is believed to have almost full coverage of cardiac surgery procedures done in Australia to the end of 1994. However, for 1995 procedures, several units did not provide their data:

State	Number of units not participating in the register
Queensland	1
New South Wales	3

To provide a better national picture of cardiac surgery performed in 1995 despite the above limitation, where possible for this report, the data from the register have been complemented with information from the National Hospital Morbidity Database held by the Australian Institute of Health and Welfare. This database contains demographic, diagnostic, procedural and duration of stay information on episodes of care for patients admitted to hospital. The collection is based on data on hospitalisations compiled by State and Territory health authorities and supplied to the Australian Institute of Health and Welfare. A record is included for each separation, not for each patient, so patients who were hospitalised more than once in the year have more than one record in the database.

Data held in the National Hospital Morbidity Database was found to correspond well with those reported directly to the register by participating units.

Estimates for the total number of coronary artery bypass graft procedures nationally and for each State, as well as the age and sex of patients undergoing CABG, were obtained from this source. Records for separations with procedure codes for CABG (ICD-9-CM 36.1) as principal or additional procedure and with separation dates between 1 January and 31 December 1995 were included. For the vast majority of CABG procedures, the Cardiac Surgery Register supplied detailed information on associated mortality, number of anastomoses, type of graft used, concomitant procedures and reoperations.

The total number of operations for valvular heart defects nationally was estimated from National Hospital Morbidity Database records for separations with procedure codes for closed and open valve surgery (ICD-9-CM 35.0, 35.1 or 35.2) as principal or additional procedure and separation dates between 1 January and 31 December 1995. The Cardiac Surgery Register provided details on the type of valve operated on, type of surgical procedure performed, associated mortality and reoperations for most of these operations.

The Cardiac Surgery Register has full coverage of surgical procedures for congenital heart defects and transplants to 1995 so it was not necessary to access information from the National Hospital Morbidity Database.

For operations on the aorta and those for miscellaneous acquired heart conditions, the information presented in this report is incomplete. However, as there are relatively few such operations performed each year, the missing data would have only a small effect on overall surgery totals and mortality rates.

To allow a more accurate estimate of trends than that possible from information held in the Cardiac Surgery Register alone, where necessary figures for 1994 were revised using data from the National Hospital Morbidity Database and similar methods to those described above.

## **Definitions**

'Mortality' refers throughout the report to death within 30 days of the operation, or during the post-operative period in hospital.

The terms 'closed' and 'open' surgery are used in this report to indicate those operations performed without and with cardiopulmonary bypass support respectively. They do not allude to the use of catheter-based techniques.

Surgery rates are calculated as the number per million people in the Australian population. Death rates are given as percentages of those receiving the surgery.

The rates for bypass graft surgery have been calculated to include the Australian Capital Territory population with New South Wales, and the Northern Territory population with South Australia, since it is known from hospital morbidity data that those are the States where the vast majority of Australian Capital Territory and Northern Territory residents are treated. Standardised rates, which take account of differences in the age structure of the populations, have been included to provide a valid comparison of procedure rates across States.

## Cardiac surgery units and surgeons

In 1995 there were 75 cardiac surgeons operating in Australia as well as 21 overseas registrars, one service registrar and 26 trainees, eight of whom were from other countries. There were 40 hospitals at which cardiac surgery was performed but four units did not supply data for inclusion in this report.

## Total operations

An estimated total of 21,692 operations was performed in 1995. In 1995 there was an average case load of 542 patients per unit, with a range of 57 to 2,127.

For the 19,667 operations for which information is available in 1995, overall mortality was 2.7%. 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.

Compared with the previous year, there was an increase of 9.2% in the total number of closed and open operations in children under six months old. In patients aged over six months, there was also a rise in open and closed surgery of 1.0% overall.

Table 1 presents a summary of all operations, both open and closed, performed from 1986 to 1995, with associated mortality figures. The constant increase in the rate of operations performed and the variable decrease in mortality since 1953 are illustrated in Figure 1. This increase in rate has been entirely due to open heart surgery, closed heart surgery rates having remained fairly constant over the period. Mortality rates for open heart surgery fell markedly between the late 1950s and the 1980s, and have remained fairly constant since then.

**Table 1: Total heart operations and mortality rates (%), by age group, 1986–95**

Year	Closed operations						Open operations						Total operations					
	≤ 6 months		> 6 months		<i>Total</i>		≤ 6 months		> 6 months		<i>Total</i>		≤ 6 months		> 6 months		<i>Total</i>	
	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths	No.	Deaths
1986	239	4.6	340	2.4	579	3.3	163	12.3	10,331	3.2	10,494	3.3	402	7.7	10,671	3.1	11,073	3.3
1987	261	6.1	389	3.3	650	4.5	226	9.7	11,788	2.7	12,014	2.8	487	7.8	12,177	2.7	12,664	2.9
1988	240	5.4	322	3.7	562	4.4	236	11.9	12,355	3.0	12,591	3.2	476	8.6	12,677	3.0	13,153	3.2
1989	306	3.3	355	3.1	661	3.2	230	9.6	13,466	2.4	13,696	2.6	536	6.0	13,821	2.5	14,357	2.6
1990	249	3.6	287	2.1	536	2.8	277	7.9	14,313	2.6	14,590	2.7	526	5.9	14,600	2.6	15,126	2.7
1991	269	1.9	313	4.8	582	3.4	257	6.2	15,849	2.5	16,106	2.6	526	4.0	16,162	2.6	16,688	2.6
1992	249	7.2	300	3.0	549	4.9	291	6.2	16,260	2.7	16,551	2.8	540	6.7	16,560	2.7	17,100	2.9
1993	246	2.8	292	2.4	538	2.6	269	9.3	18,129	2.4	18,398	2.5	515	6.2	18,421	2.4	18,936	2.5
1994	291	2.4	388	5.2	679	4.0	253	9.5	20,001 <sup>(a)</sup>	2.7 <sup>(b)</sup>	20,254 <sup>(a)</sup>	2.8 <sup>(b)</sup>	544	5.7	20,389 <sup>(a)</sup>	2.8 <sup>(b)</sup>	20,933 <sup>(a)</sup>	2.8 <sup>(b)</sup>
1995	289	2.8	414	2.9	703	2.8	305	5.9	20,684 <sup>(a)</sup>	2.6 <sup>(b)</sup>	20,989 <sup>(a)</sup>	2.7 <sup>(b)</sup>	594	4.4	21,098 <sup>(a)</sup>	2.6 <sup>(b)</sup>	21,692 <sup>(a)</sup>	2.7 <sup>(b)</sup>

(a) Estimated numbers for all units in Australia.

(b) Based on the total number of procedures for which the information is available: 92% of procedures in 1994 and 90% of procedures in 1995.

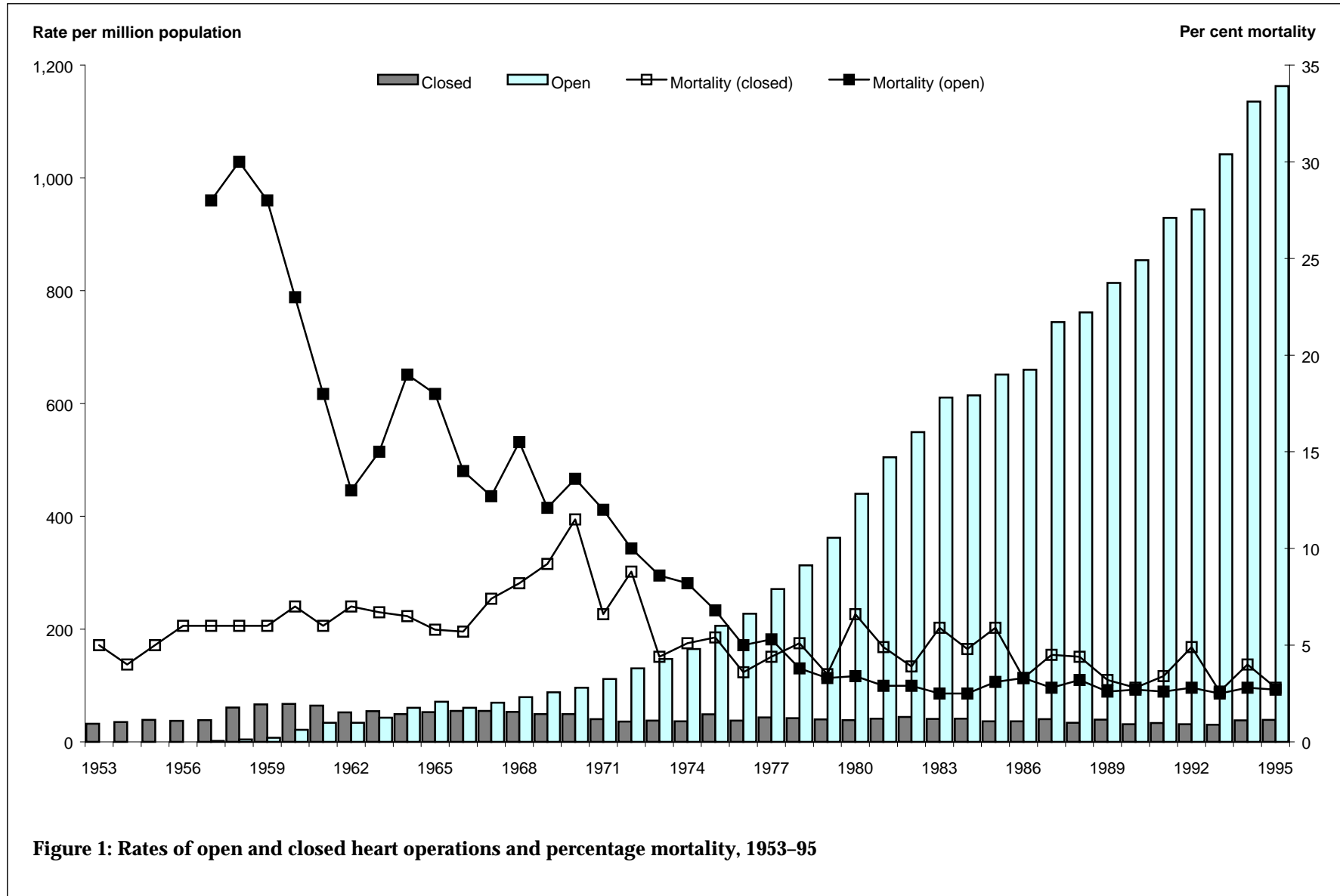


Table 2 summarises the distribution of operations for congenital and acquired defects in 1995. Operations for congenital conditions represent only 7.6% of the total and most are performed as open heart procedures.

**Table 2: Distribution of operations for congenital and acquired defects, 1995**

	Closed	Open	Total
	Per cent		
Congenital heart disease			
Under 1 month	24.0	0.6	1.3
1–6 months	17.1	0.9	1.4
Over 6 months	29.0	4.0	4.9
Acquired heart disease	29.9	94.5	92.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Table 3 is a more detailed summary of all operations performed in 1995 compared with figures for 1994. The total number of operations for congenital defects rose by 8.4% from 1,520 in 1994 to 1,648 in 1995. Mortality fell from 3.2% to 2.8% for open congenital operations, and fell from 3.6% to 1.8% for closed congenital operations. The estimated total number of operations for acquired heart disease rose from 19,413 in 1994 to 20,044 in 1995. Mortality was 2.7% for those 18,019 procedures for acquired conditions for which information is available.

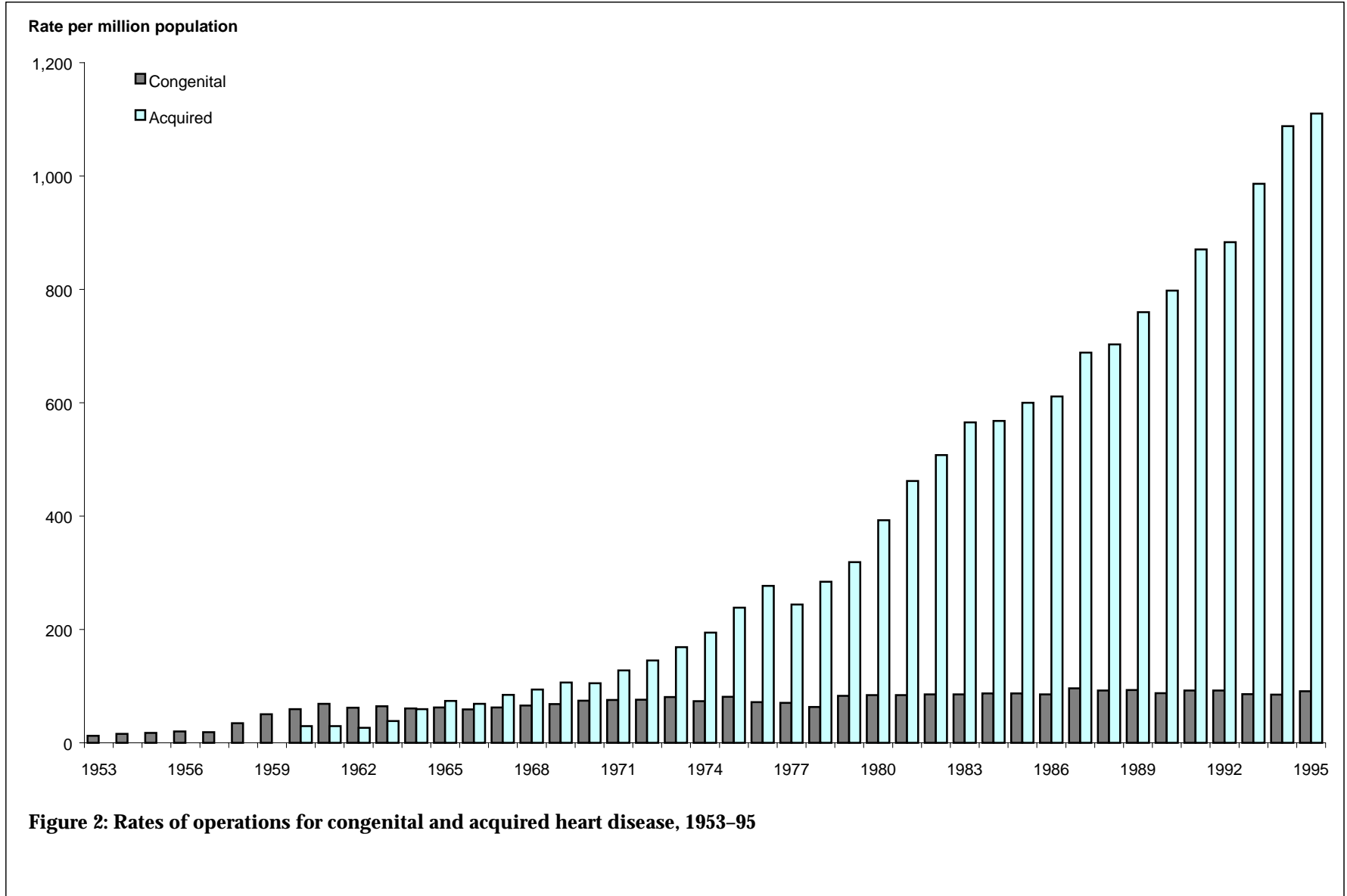
**Table 3: Total heart operations, 1994 and 1995**

	Closed operations		Open operations		Total operations	
	1994	1995	1994	1995	1994	1995
Congenital conditions	<b>Number (deaths)</b>					
Age Under 1 month	142 (3)	169 (5)	115 (18)	115 (11)	<b>257 (21)</b>	<b>284 (16)</b>
1–6 months	149 (4)	120 (3)	138 (6)	190 (7)	<b>287 (10)</b>	<b>310 (10)</b>
Over 6 months	207 (11)	204 (1)	769 (9)	850 (14)	<b>976 (20)</b>	<b>1,054 (15)</b>
<i>Subtotal</i>	<i>498 (18)</i>	<i>493 (9)</i>	<i>1,022 (33)</i>	<i>1,155 (32)</i>	<b><i>1,520 (51)</i></b>	<b><i>1,648 (41)</i></b>
Acquired conditions	181 (9)	210 (11)	19,232 (493) <sup>(a)</sup>	19,834 (473) <sup>(a)</sup>	<b>19,413 (502)<sup>(a)</sup></b>	<b>20,044 (484)<sup>(a)</sup></b>
<b>Total</b>	<b>679 (27)</b>	<b>703 (20)</b>	<b>20,254 (526)<sup>(a)</sup></b>	<b>20,989 (505)<sup>(a)</sup></b>	<b>20,933 (553)<sup>(a)</sup></b>	<b>21,692 (525)<sup>(a)</sup></b>

(a) Estimated number of operations for all units in Australia. Actual number of deaths is based on procedures for which the information is available: 92% of procedures in 1994 and 90% of procedures in 1995.

Figure 2 illustrates trends in the rates of congenital and acquired operations since 1953. It can be seen that rates of surgery for acquired heart disease have increased dramatically over the period, while those for congenital heart disease have increased only slightly.





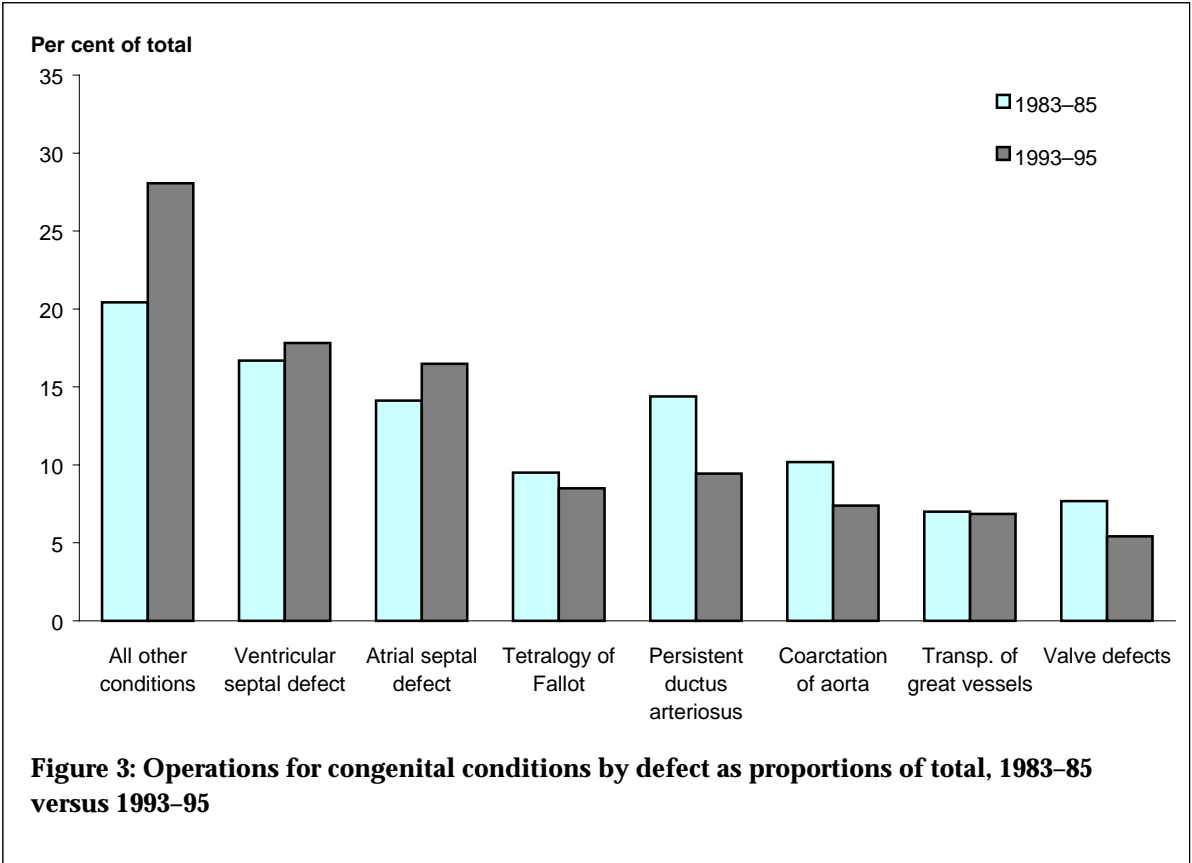
## Surgery for congenital heart defects

Table 4 presents figures for a number of major congenital heart conditions, from 1986 to 1995. There were 1,648 operations for congenital defects in 1995, with a mortality rate of 2.5%. Compared with 1994, there was an increase in the number of operations for valve defects (24.4% increase), persistent ductus arteriosus (22.0%), ventricular septal defect (17.7%), coarctation of the aorta (12.6%), atrial septal defects (11.6%) and other conditions (2.6%). Operations for Tetralogy of Fallot fell by 16.5% and transposition of great vessels fell by 1.9%.

**Table 4: Operations for congenital conditions by major heart defect, 1986–95**

<b>Congenital heart defect</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>
	<b>Number</b>									
Persistent ductus arteriosus	162	196	195	288	164	165	127	131	141	172
Valve defects	68	66	67	51	72	81	60	62	86	107
Coarctation of aorta	142	162	99	126	103	109	102	128	103	116
Atrial septal defect	201	209	266	232	245	249	265	228	258	288
Ventricular septal defect	209	257	234	218	231	252	254	270	260	306
Tetralogy of Fallot	116	169	156	140	116	144	169	154	133	111
Transposition of great vessels	91	104	123	98	108	108	93	107	108	106
Other conditions	367	386	385	472	455	496	549	438	431	442
<b>Total</b>	<b>1,356</b>	<b>1,549</b>	<b>1,525</b>	<b>1,565</b>	<b>1,494</b>	<b>1,604</b>	<b>1,619</b>	<b>1,518</b>	<b>1,520</b>	<b>1,648</b>

Figure 3 shows the proportion of total operations for congenital heart defects accounted for by a number of major conditions, in 1983–85 compared with 1993–95. Ventricular septal defect and atrial septal defect are the primary reasons for congenital heart surgery. In 1983–85 operations for persistent ductus arteriosus and coarctation of the aorta were more common than in 1993–95. The higher proportion in the group ‘all other conditions’ illustrates the increase in the scope and range of operations performed over the past decade. Table 5 gives detailed figures on closed and open operations, and associated deaths, for congenital heart conditions.



**Table 5: Closed and open heart operations for congenital defects, by age group, 1995**

Heart operation	Closed operations				Open operations				Overall total		
	≤ 1 month	1–6 months	≥ 6 months	Total	≤ 1 month	1–6 months	≥ 6 months	Total			
<b>Number (deaths)</b>											
Persistent ductus arteriosus	48 (0)	31 (0)	89 (0)	168 (0)	2 (1)	1 (0)	1 (0)	4 (1)	<b>172 (1)</b>		
Valve defect	2 (0)	—	—	2 (0)	11 (2)	15 (0)	79 (1)	105 (3)	<b>107 (3)</b>		
Coarctation of aorta	simple	37 (1)	19 (0)	36 (0)	92 (1)	—	—	1 (0)	1 (0)	<b>93 (1)</b>	
	complex	10 (0)	—	7 (0)	17 (0)	—	—	6 (1)	6 (1)	<b>23 (1)</b>	
Atrial septal defect	—	—	—	—	1 (0)	6 (0)	281 (0)	288 (0)	<b>288 (0)</b>		
Ventricular septal defect	uncomplicated	palliative	3 (0)	16 (2)	1 (0)	20 (2)	—	—	—	<b>20 (2)</b>	
		corrective	—	—	—	—	4 (0)	71 (1)	121 (1)	196 (2)	<b>196 (2)</b>
	with PS	palliative	—	—	—	—	—	—	—	—	
		corrective	—	—	—	—	—	4 (0)	31 (1)	35 (1)	<b>35 (1)</b>
	with pulmonary atresia	palliative	15 (1)	1 (0)	11 (0)	27 (1)	1 (0)	1 (0)	2 (0)	4 (0)	<b>31 (1)</b>
		corrective	—	—	—	—	1 (1)	—	23 (1)	24 (2)	<b>24 (2)</b>
Tetralogy of Fallot	simple	palliative	5 (0)	13 (0)	5 (0)	23 (0)	1 (0)	—	—	1 (0)	<b>24 (0)</b>
		corrective	—	—	—	—	1 (0)	4 (0)	58 (0)	63 (0)	<b>63 (0)</b>
	complex	palliative	—	2 (0)	4 (0)	6 (0)	—	2 (0)	1 (0)	3 (0)	<b>9 (0)</b>
		corrective	—	—	1(1)	1(1)	1(1)	—	13 (3)	14 (4)	<b>15 (5)</b>
acquired pulmonary atresia	palliative	—	—	—	—	—	—	—	—	—	
	corrective	—	—	—	—	—	—	—	—	—	
Transposition of great vessels		7 (0)	1 (0)	6 (0)	14 (0)	58 (0)	11 (1)	23 (0)	92 (1)	<b>106 (1)</b>	
Extra cardiac lesions	A-P window	—	—	—	—	2 (1)	—	—	2 (1)	<b>2 (1)</b>	
	interrupted aortic arch	11 (0)	1 (0)	2 (0)	14 (0)	2 (1)	4 (0)	—	6 (1)	<b>20 (1)</b>	
	vascular ring	—	3 (0)	10 (0)	13 (0)	—	1 (0)	—	1(0)	<b>14 (0)</b>	
Coronary artery defects		—	1 (0)	—	1(0)	—	1 (0)	3 (0)	4(0)	<b>5 (0)</b>	

(continued)

**Table 5 (continued): Closed and open heart operations for congenital defects, by age group, 1995**

Heart operation			Closed operations				Open operations				Overall total
			≤ 1 month	1–6 months	≥ 6 months	Total	≤ 1 month	1–6 months	≥ 6 months	Total	
<b>Number (deaths)</b>											
Right-sided lesions	Ebstein's anomaly	palliative	2 (0)	—	—	2 (0)	—	—	1 (0)	1 (0)	3 (0)
		corrective	—	—	—	—	—	—	2 (0)	2 (0)	2 (0)
	pulmonary atresia	palliative	15 (1)	4 (0)	4 (0)	23 (1)	3 (2)	1 (0)	4 (0)	8 (2)	31 (3)
		corrective	—	—	—	—	—	1 (0)	6 (0)	7 (0)	7 (0)
	tricuspid atresia	palliative	4 (1)	—	3(0)	7 (1)	2 (0)	4 (0)	13 (0)	19 (0)	26 (1)
		corrective	—	—	—	—	—	—	4 (1)	4 (1)	4 (1)
Left-sided lesions	cor triatrium	—	—	—	—	1 (0)	1 (0)	1 (0)	3 (0)	3 (0)	
	hypoplastic left heart syndrome	—	—	—	—	4 (1)	2 (2)	1 (0)	7 (3)	7 (3)	
	mitral atresia	—	—	—	—	—	—	1 (0)	1 (0)	1 (0)	
	sub-aortic stenosis	—	—	—	—	—	3 (0)	28 (0)	31 (0)	31 (0)	
	supra valvular stenosis	—	—	—	—	1 (0)	—	5 (1)	6 (1)	6 (1)	
Defects of partitioning	AV canal partial	—	1 (0)	—	1(0)	—	7 (0)	28 (0)	35 (0)	36 (0)	
	AV canal total	—	12 (0)	2 (0)	14 (0)	—	29 (2)	11 (0)	40 (2)	54 (2)	
	double outlet RV	—	9 (0)	4 (0)	13 (0)	1 (0)	2 (0)	16 (1)	19 (1)	32 (1)	
	truncus arteriosus	1 (0)	—	—	1(0)	4 (0)	5 (0)	4 (0)	13 (0)	14 (0)	
	other	4 (0)	4 (1)	—	8 (1)	1 (0)	2 (0)	36 (1)	39 (1)	47 (2)	
Other	asplenia syndrome	—	1 (0)	1 (0)	2 (0)	—	1 (0)	—	1 (0)	3 (0)	
	other	4 (1)	1 (0)	18 (0)	23 (1)	2 (1)	2 (1)	40 (1)	44 (3)	67 (4)	
	total anomalous venous return	1 (0)	—	—	1 (0)	11 (0)	9 (0)	6 (1)	26 (1)	27 (1)	
<b>Total</b>		<b>169 (5)</b>	<b>120 (3)</b>	<b>204 (1)</b>	<b>493 (9)</b>	<b>115 (11)</b>	<b>190 (7)</b>	<b>850 (14)</b>	<b>1,155 (32)</b>	<b>1,648 (41)</b>	

## **Surgery for valvular heart defects**

From the National Hospital Morbidity Database it is estimated that there were 3,890 operations for valvular heart defects in 1995. Details of 3,670 such operations are held in the Cardiac Surgery Register and they are shown in this section. Please note that the missing data refer only to acquired valve defects.

Table 6 presents information about valve surgery performed from 1986 to 1995, and Table 8 gives more detailed figures for 1995 alone. There has been an 88.0% increase in operations for valve defects between 1986 and 1995.

New in 1995, additional detail was collected about reoperations. Specifically, these were the type of tissue valve replaced (allograft or bioprosthetic) and the reason for valve replacement (degeneration, endocarditis, mechanical failure or paravalvular leak). In 1995 there were 39 reoperations for mechanical valve failures, with five deaths; 12 reoperations for allograft tissue valve failures, with one death; and 136 bioprosthetic tissue valve failures with seven deaths.

The reasons for reoperations for valve replacement are provided in Table 7. Degeneration was the most frequent cause of reoperations to tissue valves, accounting for 83.3% of all allograft replacements and 89.0% of bioprosthetic replacements. For mechanical valves, reoperations were performed for mechanical failure (38.5% cases), endocarditis (30.8%) and paravalvular leak (30.8%).

Figures 4 and 5 illustrate the trends in valve surgery over time. Most valve surgery is done on the aortic and mitral valves, with a marked increase in the number of procedures over the last decade. There has been a significant rise in the number of procedures involving replacing the damaged valve with a prosthesis, but other types of valve procedures have only increased modestly.

**Table 6: Operations for valve defects by type of valve and procedure, 1986–95**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
<b>Valve</b>	<b>Number</b>									
Mitral	843	928	932	987	963	1,075	1,188	1,346	1,391	1,336
Aortic	1,143	1,270	1,371	1,489	1,589	1,772	1,873	2,075	2,186	2,211
Tricuspid	51	46	46	67	62	51	73	106	83	79
Pulmonary	32	20	33	19	25	21	25	25	26	44
Not specified <sup>(a)</sup>	—	—	—	—	—	—	—	—	—	220
<b>Total</b>	<b>2,069</b>	<b>2,264</b>	<b>2,382</b>	<b>2,562</b>	<b>2,639</b>	<b>2,919</b>	<b>3,159</b>	<b>3,552</b>	<b>3,686</b>	<b>3,890</b>
<b>Type of surgery</b>										
Repair <sup>(b)</sup>	355	362	371	405	461	477	590	661	602	656
Replacement										
Prosthesis	1,182	1,370	1,378	1,523	1,534	1,778	1,861	2,136	2,355	2,141
Homograft	19	42	76	83	132	111	108	102	144	140
Heterograft	513	490	557	551	512	553	600	653	585	733
<i>Total replacement</i>	<i>1,714</i>	<i>1,902</i>	<i>2,012</i>	<i>2,157</i>	<i>2,178</i>	<i>2,442</i>	<i>2,569</i>	<i>2,891</i>	<i>3,084</i>	<i>3,014</i>
Not specified <sup>(a)</sup>	—	—	—	—	—	—	—	—	—	220
<b>Reoperations<sup>(c)</sup></b>										
Tissue valve										
Allograft	—	—	—	—	—	—	—	—	—	12
Bioprosthetic	—	—	—	—	—	—	—	—	—	136
Not specified	57	92	105	111	101	151	191	111	130	—
Mechanical valve	27	31	33	39	32	34	44	37	59	39

(a) Estimate from National Hospital Morbidity Database.

(b) Repair = valvotomy and reconstruction, as in Table 8.

(c) Not all units gave details on valve reoperations.

**Table 7: Reasons for reoperations<sup>(a)</sup> for valve replacement, 1995**

Reasons for reoperation	Tissue valves		Mechanical valves
	Allograft	Bioprosthetic	
<b>Number (deaths)</b>			
Degeneration	10 (1)	121 (5)	—
Endocarditis	2 (0)	5 (2)	12 (1)
Mechanical failure	—	—	15 (2)
Paravalvular leak	—	10 (0)	12 (2)
<b>Total</b>	<b>12 (1)</b>	<b>136 (7)</b>	<b>39 (5)</b>

(a) Not all units gave details on valve reoperations.

**Table 8: Operations for valve defects by type of valve and procedure, 1995**

Valve	Procedure	Congenital		Acquired			Overall total	
		Single	Single	Double	Triple	Total		
				<b>Number (deaths)</b>				
Mitral	Valvotomy	1 (0)	24 (0)	7 (0)	—	31 (0)	<b>32 (0)</b>	
	Reconstruction	with support ring	—	297 (8)	13 (1)	1 (1)	311 (10)	<b>311 (10)</b>
		without ring	—	138 (3)	18 (0)	1 (0)	157 (3)	<b>157 (3)</b>
		not specified	25 (0)	—	—	—	—	<b>25 (0)</b>
	Replacement	heterograft	1 (0)	78 (2)	9 (0)	2 (0)	89 (2)	<b>90 (2)</b>
		prosthesis	10 (0)	532 (27)	167 (6)	10 (1)	709 (34)	<b>719 (34)</b>
mitral homograft		—	1 (1)	1 (0)	—	2 (1)	<b>2 (1)</b>	
Aortic	Reconstruction	valvotomy	8 (1)	2 (1)	—	—	2 (1)	<b>10 (2)</b>
		decalcification	—	6 (0)	2 (0)	—	8 (0)	<b>8 (0)</b>
		for regurgitation	—	7 (0)	—	—	7 (0)	<b>7 (0)</b>
		other/unstated	9 (1)	2 (0)	3 (0)	—	5 (0)	<b>14 (1)</b>
	Replacement	homograft not specified	7 (1)	—	—	—	—	<b>7 (1)</b>
		classical homograft	—	68 (4)	3 (0)	—	71 (4)	<b>71 (4)</b>
		'mini root' homograft	—	20 (0)	1 (0)	—	21 (0)	<b>21 (0)</b>
		'mini root' heterograft	—	71 (4)	—	—	71 (4)	<b>71 (4)</b>
		stent-mounted heterograft	—	553 (21)	13 (1)	3 (0)	569 (22)	<b>569 (22)</b>
		pulmonary autograft	—	19 (0)	—	—	19 (0)	<b>19 (0)</b>
prosthesis	4 (0)	1,245 (51)	154 (4)	11 (2)	1,410 (57)	<b>1,414 (57)</b>		

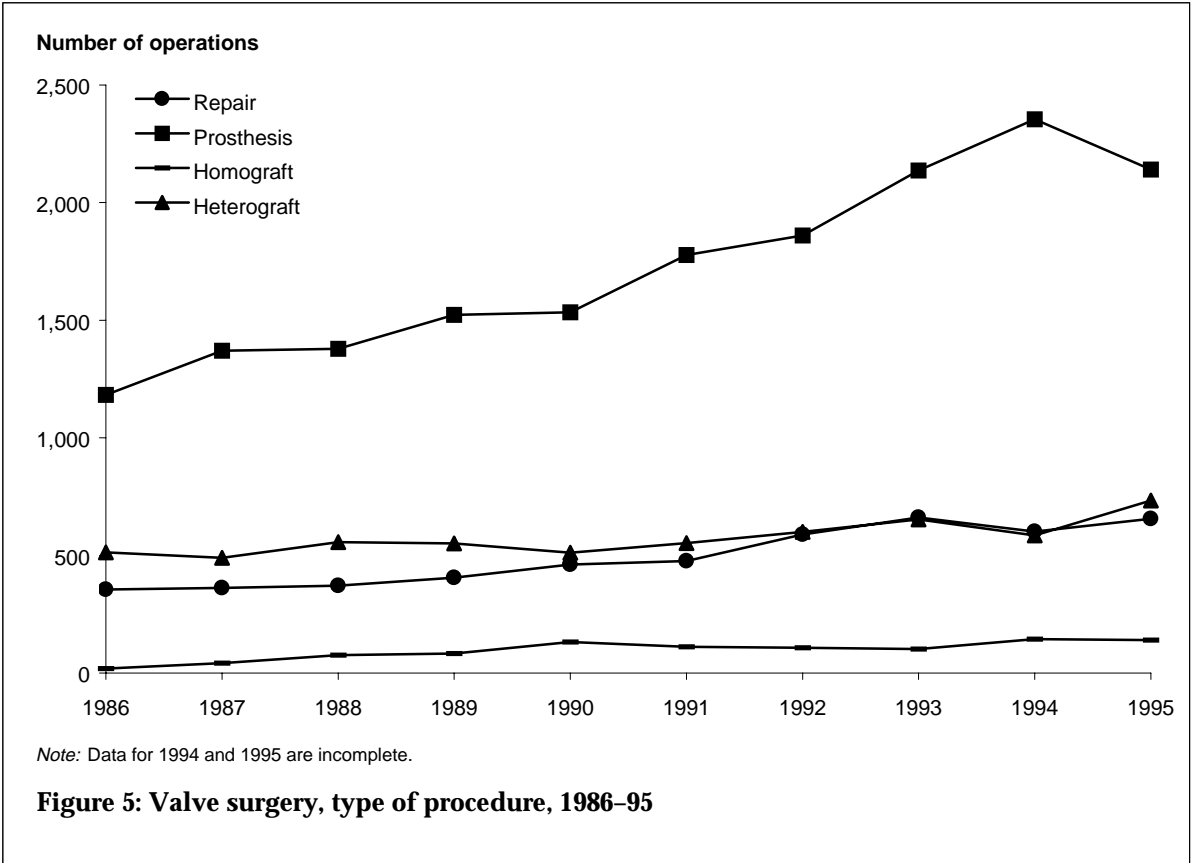
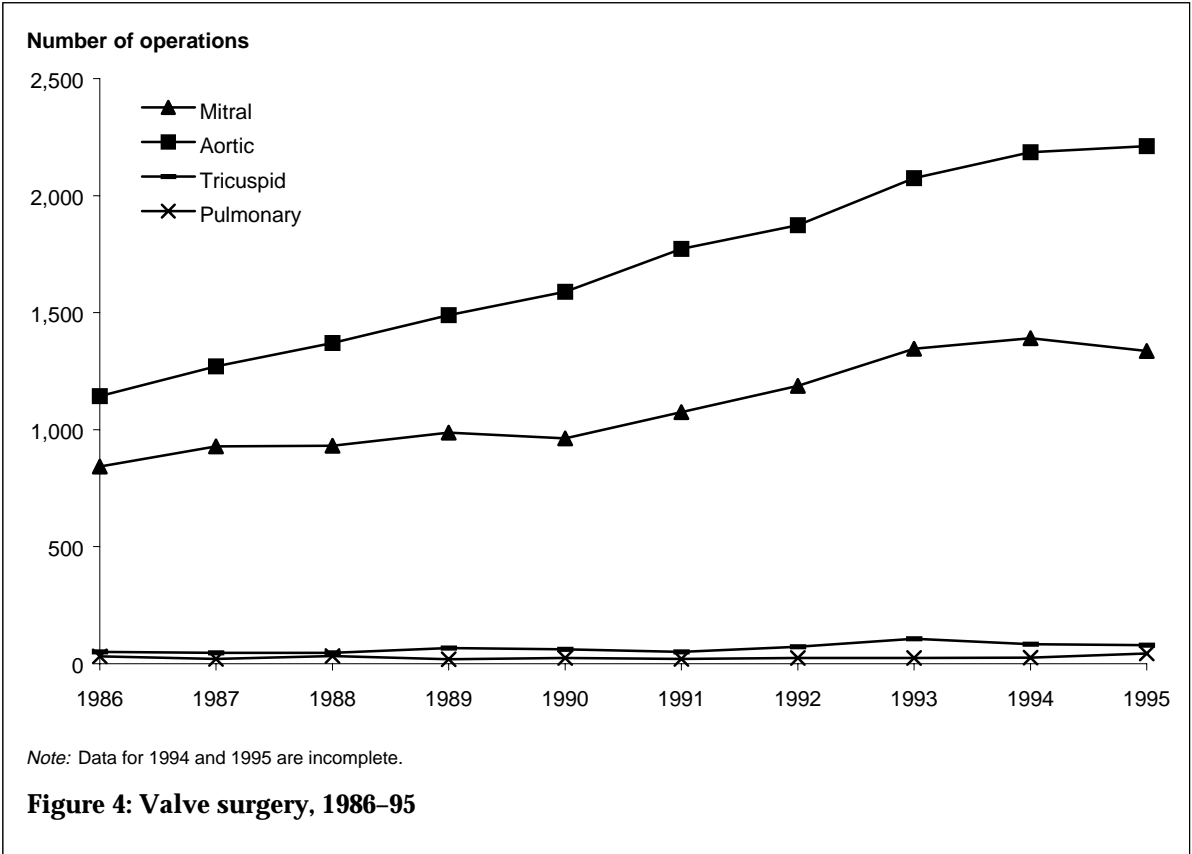
*(continued)*



**Table 8 (continued): Operations for valve defects by type of valve and procedure, 1995**

Valve	Procedure	Congenital		Acquired			Overall total	
		Single	Single	Double	Triple	Total		
				<b>Number (deaths)</b>				
Tricuspid	Reconstruction	with support ring	—	6 (0)	20 (1)	3 (1)	29 (2)	<b>29 (2)</b>
		without ring	—	7 (1)	24 (1)	9 (1)	40 (3)	<b>40 (3)</b>
		not specified	1 (0)	—	—	—	—	<b>1 (0)</b>
	Replacement	heterograft	—	1 (0)	—	1 (0)	2 (0)	<b>2 (0)</b>
		homograft	—	—	—	—	—	—
prosthesis		—	3 (0)	3 (0)	1 (0)	7 (0)	<b>7 (0)</b>	
Pulmonary	Valvotomy	17 (0)	—	—	—	—	<b>17 (0)</b>	
	Reconstruction	4 (0)	1 (0)	—	—	1 (0)	<b>5 (0)</b>	
	Replacement	homograft	20 (0)	—	—	—	—	<b>20 (0)</b>
		heterograft	—	1 (0)	—	—	1 (0)	<b>1 (0)</b>
		prosthesis	—	1 (0)	—	—	1 (0)	<b>1 (0)</b>
Not specified <sup>(a)</sup>	—	—	—	—	—	<b>220</b>		
<b>Total valves</b>		<b>107</b>	<b>3,083</b>	<b>438</b>	<b>42</b>	<b>3,563</b>	<b>3,890</b>	
<b>Total patients</b>		<b>107 (3)</b>	<b>3,083 (123)</b>	<b>219 (7)</b>	<b>14 (2)</b>	<b>3,316 (132)</b>	<b>3,423 (135)</b>	

(a) Estimate from National Hospital Morbidity Database.



## **Surgery for coronary artery disease**

From the National Hospital Morbidity Database it is estimated that 17,150 coronary artery bypass graft operations were performed in 1995. As discussed previously, four out of 40 units did not provide information for 1995 so the Cardiac Surgery Register contains details of only 15,125 bypass graft operations and they are presented in this section.

According to the Register, there were 15,156 operations for coronary artery disease in 1995: 15,125 with bypass grafts and 31 without. Mortality associated with bypass graft surgery was 2.3%. The average number of grafts per patient remained at 3.1. The results over the last seven years indicate that this average number of grafts has stabilised at just over three per patient.

In 1995, 7.2% of coronary artery bypass operations were reoperations. The mortality rate for these reoperations was 5.3%.

Detail on newer modalities for coronary artery bypass graft (CABG) was collected for the first time in 1995, however only two units could supply this information. These CABG modalities include procedures without cardiopulmonary bypass, CABG via thoracotomy and minimally invasive techniques. In 1995, two CABG operations were performed without cardiopulmonary bypass.

Tables 9 and 10 show numbers of operations with and without concomitant procedures, according to the number of distal anastomoses.

**Table 9: Coronary artery bypass graft operations (including operations with concomitant procedures), 1992–95**

	1992			1993			1994			1995			
	Number of distal anastomoses	Number of operations	% of total	Deaths	Number of operations	% of total	Deaths	Number of operations	% of total <sup>(a)</sup>	Deaths	Number of operations	% of total <sup>(a)</sup>	Deaths
1		1,247	9.6	38	1,471	10.0	37	1,252	8.4	55	1,191	7.9	40
2		2,831	21.9	69	3,242	22.1	59	3,292	22.0	78	3,352	22.2	79
3		4,279	33.1	82	4,794	32.7	93	4,998	33.5	101	5,180	34.2	110
4		3,153	24.4	64	3,526	24.1	60	3,792	25.4	101	3,825	25.3	82
5		1,140	8.8	29	1,298	8.9	23	1,322	8.8	30	1,279	8.5	26
6		237	1.8	5	259	1.8	7	248	1.7	6	256	1.7	4
7		46	0.3	0	46	0.3	2	32	0.2	4	39	0.3	3
8		2	0.0	0	1	0.0	0	4	0.0	0	2	0.0	0
9		—	—	—	1	0.0	1	1	0.0	0	1	0.0	0
<i>Subtotal</i>		<i>12,935</i>	<i>100.0</i>	<i>287</i>	<i>14,638</i>	<i>100.0</i>	<i>282</i>	<i>14,941</i>	<i>100.0</i>	<i>375</i>	<i>15,125</i>	<i>100.0</i>	<i>344</i>
Not specified <sup>(b)</sup>		—	—	—	—	—	—	1,524	—	n.a.	2,025	—	n.a.
<b>Total</b>		<b>12,935</b>	—	—	<b>14,638</b>	—	—	<b>16,465</b>	—	—	<b>17,150</b>	—	—
Average number of grafts per patient		3.1			3.1			3.1			3.1		
Overall mortality		2.2%			1.9%			2.5%			2.3%		
Reoperations		7.8%			7.7%			8.5%			7.2%		
Newer CABG modalities <sup>(c)</sup>		—			—			—			2		

(a) Calculated as a proportion of those procedures for which details are available.

(b) Estimated from National Hospital Morbidity Database.

(c) Newer CABG modalities include procedures without cardiopulmonary bypass, CABG via thoracotomy and minimally invasive techniques.

n.a. Details not available.

**Table 10: Operations for coronary artery disease, 1995**

Number of distal anastomoses	Concomitant procedures					Total
	None	Valve surgery	Excision of infarct or aneurysm	Ventricular septal defect	Other	
	<b>Number (deaths)</b>					
1	717 (13)	393 (17)	7 (0)	9 (4)	65 (6)	<b>1,191 (40)</b>
2	2,923 (47)	332 (25)	20 (0)	7 (2)	70 (5)	<b>3,352 (79)</b>
3	4,825 (89)	261 (12)	14 (0)	4 (2)	76 (7)	<b>5,180 (110)</b>
4	3,626 (62)	123 (8)	13 (0)	1 (1)	62 (11)	<b>3,825 (82)</b>
5	1,222 (20)	28 (3)	4 (0)	—	25 (3)	<b>1,279 (26)</b>
6	246 (3)	3 (0)	2 (0)	—	5 (1)	<b>256 (4)</b>
7	35 (1)	2 (1)	—	1 (1)	1 (0)	<b>39 (3)</b>
8	2 (0)	—	—	—	—	<b>2 (0)</b>
9	1 (0)	—	—	—	—	<b>1 (0)</b>
<i>Total with grafts</i>	<i>13,597 (235)</i>	<i>1,142 (66)</i>	<i>60 (0)</i>	<i>22 (10)</i>	<i>304 (33)</i>	<b><i>15,125 (344)</i></b>
Without grafts	—	—	7 (0)	20 (4)	4 (2)	<b>31 (6)</b>
<b>Overall total</b>	<b>13,597 (235)</b>	<b>1,142 (66)</b>	<b>67 (0)</b>	<b>42 (14)</b>	<b>308 (35)</b>	<b>15,156 (350)</b>
Reoperations	993 (50)	68 (6)	2 (0)	1 (0)	22 (2)	<b>1,086 (58)</b>
Newer CABG modalities <sup>(a)</sup>						<b>2</b>

(a) Newer CABG modalities include procedures without cardiopulmonary bypass, CABG via thoracotomy and minimally invasive techniques.

Note: This table shows details only of those procedures for which there is information available. It is estimated that there are an additional 2,025 coronary artery bypass graft operations not included in this table, making the estimated total of coronary artery operations with grafts 17,150.

Table 11 presents information on the types of graft used in these operations in 1995. Not all units could supply the information, so results have been calculated as percentages of bypass graft operations that involved the use of at least one of the types of graft. The table shows that nearly all (88.0%) bypass graft operations used at least one saphenous vein graft, with internal mammary artery graft the next major type at 80.8%. Other, more recently introduced types of graft were much less common.

**Table 11: Types of grafts used, 1995**

Type of graft	Number of patients having type of graft	Per cent of patients having type of graft
Saphenous vein	13,034	88.0
Internal mammary artery	11,971	80.8
Radial artery	554	3.7
Cephalic vein	82	0.6
Prosthetic or bioprosthetic	4	0.0
Gastro-epiploic artery	1	0.0

*Notes*

1. Not all units could supply this information, so results have been calculated as percentages of bypass graft operations which involved the use of at least one of the types of graft.
2. Each patient can have more than one type of graft.

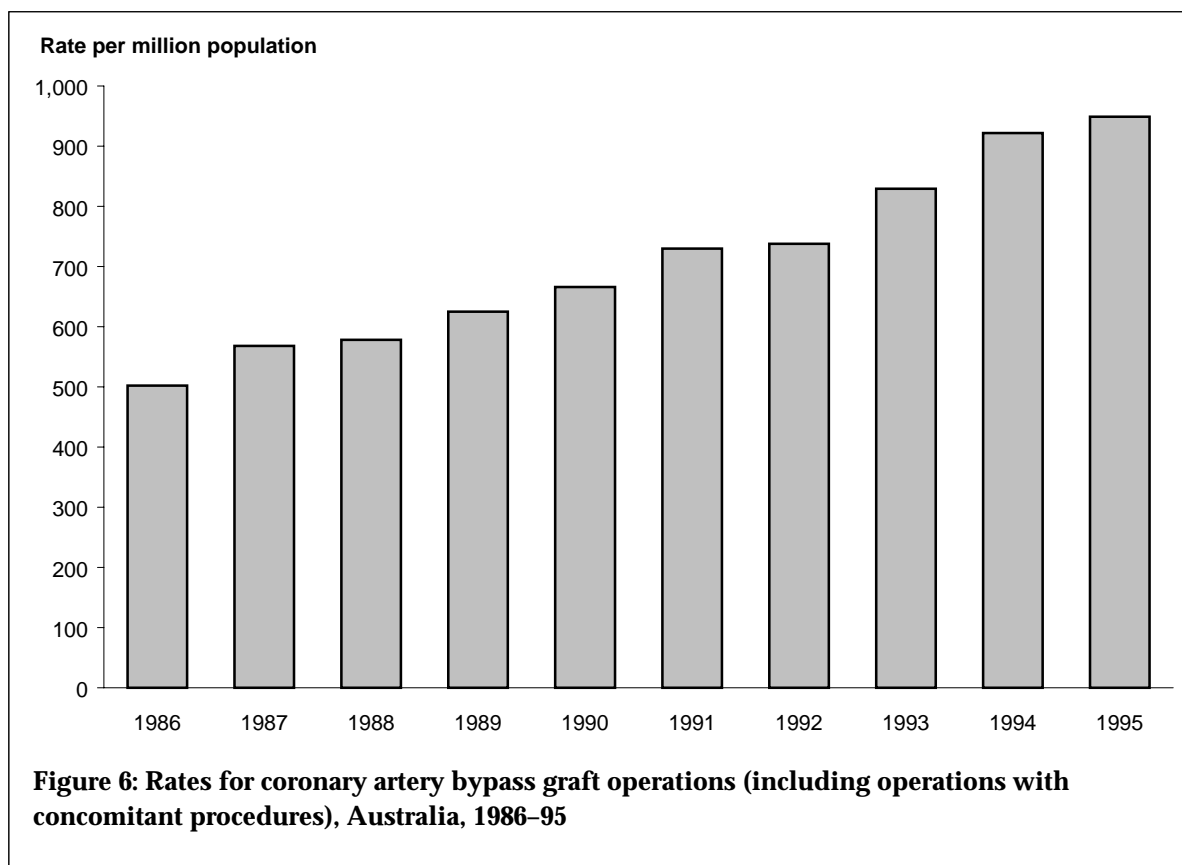
Between 1986 and 1995 there has been an 89% increase in the rate of bypass graft surgery in Australia (Table 12 and Figure 6). This marked rise is only partly explained by changes in the size and age structure of the population over that period.

**Table 12: Rates for coronary artery bypass graft operations (including operations with concomitant procedures), Australia, 1986–95**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Crude rate <sup>(a)</sup>	502	568	578	625	666	730	738	829	922 <sup>(b)</sup>	949 <sup>(b)</sup>

(a) The rate is defined as the number of operations per million population.

(b) Based on estimates from the National Hospital Morbidity Database to provide complete coverage of units nationally.



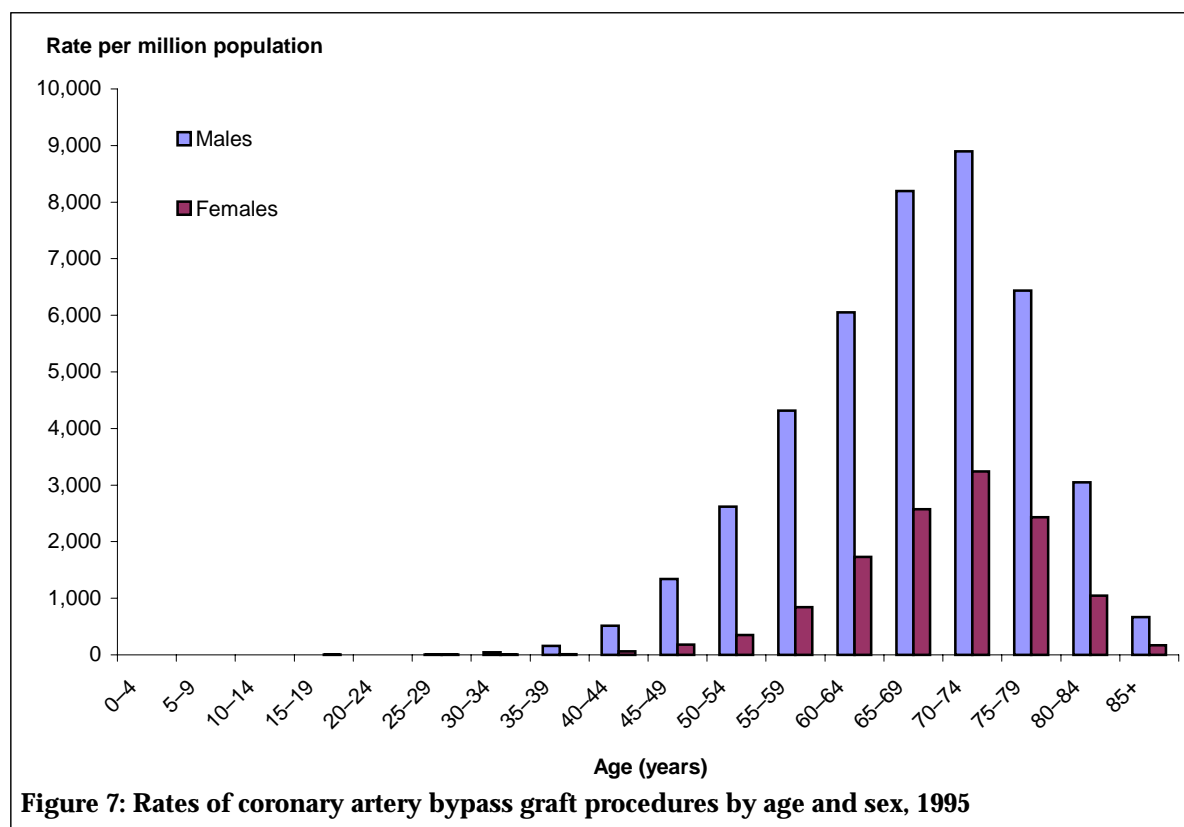
## Bypass graft surgery by age and sex

Coronary artery bypass graft surgery is done more frequently in males than females, at a ratio of 3.3:1. The difference in procedure rates between men and women is most marked in the age range 30–54 but is evident across all adult ages (Table 13). Procedure rates peak at ages 55–79 among males and 65–79 among females.

**Table 13: Coronary artery bypass graft procedures by age and sex, 1995**

Age	Males		Females		Ratio male: female
	Number	Age-specific rate per million	Number	Age-specific rate per million	
0-4	0	0.0	0	0.0	—
5-9	0	0.0	0	0.0	—
10-14	0	0.0	1	1.6	0.0
15-19	0	0.0	2	3.2	0.0
20-24	2	2.8	0	0.0	—
25-29	5	7.2	2	2.9	2.5
30-34	35	47.9	3	4.1	11.7
35-39	111	156.2	10	14.0	11.1
40-44	344	516.8	42	62.9	8.2
45-49	850	1,338.0	112	181.7	7.4
50-54	1,299	2,617.6	167	350.8	7.5
55-59	1,755	4,315.0	333	841.9	5.1
60-64	2,140	6,053.7	618	1,732.1	3.5
65-69	2,747	8,195.4	911	2,572.1	3.2
70-74	2,403	8,899.0	1,046	3,238.8	2.7
75-79	1,091	6,436.4	567	2,429.3	2.6
80-84	313	3,050.5	180	1,043.9	2.9
85+	38	669.4	23	171.2	3.9
<b>All ages</b>	<b>13,133</b>	<b>1,460.3</b>	<b>4,017</b>	<b>442.5</b>	<b>3.3</b>

Source: AIHW analysis of National Hospital Morbidity Database data.





## Regional rates for bypass graft surgery

The (age-standardised) national rate for coronary artery bypass graft surgery is 922 per million population. This rate varies across States, from 674 per million population in Tasmania to 968 per million population in New South Wales (including the Australian Capital Territory) (Table 14 and Figure 8). By comparison, the USA crude CABG rate in 1995 was 2,192 per million population.

**Table 14: Regional<sup>(a)</sup> rates for coronary artery bypass graft operations, 1995**

	NSW and ACT	Vic	Qld	WA	SA and NT	Tas	Australia
Crude rate	1,018.8	955.4	908.7	781.5	983.6	715.7	949.0
Standardised rate <sup>(b)</sup>	967.6	906.1	928.8	837.0	926.0	673.9	921.8

(a) Regional category refers to the location of the hospital where the procedure was performed.

(b) Age-standardised to the Australian 1991 population.

### Notes

1. The rate is defined as the number of operations per million population.
2. Rates have been calculated to include the Australian Capital Territory population with New South Wales and the Northern Territory population with South Australia since those are the States where the vast majority of Australian Capital Territory and Northern Territory residents are treated.
3. Based on estimates from the National Hospital Morbidity Database to provide complete coverage of units nationally.



## Transplants

Table 15 shows information on heart, lung and heart–lung transplants performed in 1995, compared with figures for 1993 and 1994. Overall, between 1994 and 1995 the number of lung transplants increased by 68.3% and heart transplants increased by 7.5%, while the number of combined heart–lung transplants decreased by 7.1%.

**Table 15: Transplantation—operations and mortality, 1993–95**

	1993	1994	1995
	<b>Number (deaths)</b>		
<b>Heart transplants</b>			
Cardiomyopathy	38 (4)	51 (0)	52 (4)
Ischaemia	37 (1)	33 (4)	41 (4)
Other/unstated	28 (0)	9 (4)	7 (1)
<b>Total</b>	<b>103 (5)</b>	<b>93 (8)</b>	<b>100 (9)</b>
<b>Heart–lung transplants</b>			
Congenital	7 (0)	9 (0)	11 (1)
Other	4 (0)	5 (0)	2 (0)
<b>Total</b>	<b>11 (0)</b>	<b>14 (0)</b>	<b>13 (1)</b>
<b>Lung transplants</b>			
Whole	29 (2)	41 (4)	69 (7)
Lobe	10 (2)	—	—
<b>Total</b>	<b>39 (4)</b>	<b>41 (4)</b>	<b>69 (7)</b>

## Operations on the aorta

Operations on the aorta during 1995 are presented in Table 16.

**Table 16: Operations on the aorta, 1995<sup>(a)</sup>**

	Acute (dissection)	Chronic (for aneurysm or dissection)	Total
Number (deaths)			
<b>Repair or replacement of ascending aorta</b>			
Aortic repair			
without valve resuspension	39 (6)	12 (0)	
with valve resuspension	22 (7)	18 (1)	
Composite graft replacing aortic valve and ascending aorta	22 (7)	67 (5)	
Homograft replacement of aortic valve and ascending aorta	2 (0)	47 (1)	
Separate aorta and valve replacement	1 (0)	6 (0)	
<b>Total</b>	<b>86 (20)</b>	<b>150 (7)</b>	<b>236 (27)</b>
	<b>For aneurysm</b>	<b>For dissection</b>	<b>Total</b>
Replacement of descending thoracic aorta	19 (1)	13 (7)	<b>32 (8)</b>
Replacement of aortic arch	17 (3)	9 (5)	<b>26 (8)</b>
<b>Total aortic operations</b>			<b>294 (43)</b>

(a) Four out of 40 units did not provide data in 1995.

# Operations for miscellaneous acquired heart conditions

Information on operations and mortality for other acquired heart conditions such as electrophysiological surgery, pulmonary embolectomies, pericardiectomies, cardiac tumours and cardiac trauma is presented in Table 17.

**Table 17: Operations for miscellaneous acquired heart conditions, 1995<sup>(a)</sup>**

Procedures		Number (deaths)
<b>Electrophysiological surgery for:</b>		
Supraventricular tachycardias	Wolff–Parkinson–White Syndrome	1 (0)
	AV junction	—
	Atrial fibrillation or flutter	1 (0)
	AV node ablation	—
Ventricular tachycardias	Recurrent ventricular tachycardia	1 (0)
	Aneurysmectomy	1 (0)
	Myocardial incision	6 (0)
	Automatic defibrillator	85 (0)
<b>Total electrophysiological surgery</b>		<b>95 (0)</b>
Cardiac tumour/cardiomyopathy	Myxoma	30 (0)
	Other cardiac tumour	9 (0)
	IHSS	6 (0)
<b>Total cardiac tumour/cardiomyopathy</b>		<b>45 (0)</b>
Cardiac trauma	Atrium	—
	Ventricle	5 (1)
	Valves	—
	Ascending aorta	1 (0)
	Descending aorta	10 (0)
	Other	2 (1)
<b>Total cardiac trauma</b>		<b>18 (2)</b>
<b>Pulmonary embolectomy</b>		<b>10 (4)</b>
Pericardiectomy for:	Tuberculosis	1 (0)
	Non-specific infections	4 (1)
	Uraemia	—
	Other	58 (0)
<b>Total pericardiectomy</b>		<b>63 (1)</b>
<b>Other conditions</b>		<b>37 (10)</b>

(a) Four out of forty units did not provide data in 1995.

# Glossary

**Acquired valve disease:** valve disease which is neither genetic nor present at birth.

**Anastomosis:** connection between blood vessels.

**Aortic valve:** valve between the left ventricle and the aorta.

**Arrhythmia:** any abnormality in the heartbeat, making it beat too fast, too slow or irregularly.

**Atresia:** absence or closure of a normal orifice.

**Atrial septal defect:** a hole in the wall (septum) between the upper two chambers of the heart (the atria).

**Cardiomyopathy:** a disease of heart muscle.

**Cardiopulmonary bypass:** diversion of the blood circulation from the heart and lungs and pumping of blood through a heart–lung machine to provide oxygen while the heart is stopped during surgery.

**Coarctation of aorta:** congenital narrowing of a short section of the aorta.

**Congenital heart defect:** heart disorder present at birth.

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

**Coronary artery disease:** any disease of the coronary arteries, particularly atherosclerosis, that reduces the flow of blood and hence the oxygen supply to the heart muscle.

**Ductus arteriosus:** special blood vessel in the foetus which allows blood to bypass the lungs.

**Ebstein's anomaly:** congenital malformation of the tricuspid valve of the heart.

**Fibrillation:** rapid, uncoordinated quivering of the muscle fibres of the heart instead of beating, so it cannot pump.

**Heterograft valve:** an animal valve used for transplantation.

**Homograft valve:** a human valve used for transplantation.

**Internal mammary artery:** an artery in the chest commonly used as a conduit during coronary artery bypass grafting.

**Ischaemic heart disease:** heart disease caused by inadequate flow of blood to the heart. Manifestations include angina and heart attack. Also known as coronary heart disease.

**Mitral valve:** valve between the left atrium and the left ventricle.

**Myocardial infarction:** death of part of the heart muscle deprived of an adequate blood supply by coronary artery blockage (heart attack).

**Myocardium:** the muscular wall of the heart.

**Newer CABG modalities:** alternative procedures to the standard techniques for coronary artery bypass grafting. They include operations done while the heart is beating (that is, without cardiopulmonary bypass) and minimally invasive techniques such as port-access coronary artery surgery. The latter involves making small cuts (ports) in the patient's chest through which surgical instruments are passed to do the coronary bypasses, rather than opening the chest.

**Patent ductus arteriosus (persistent ductus arteriosus):** a congenital heart defect in which the ductus arteriosus, which during foetal life allows the blood to bypass the lungs, fails to close at or soon after birth.

**Pulmonary valve:** valve between the right ventricle and the pulmonary artery.

**Saphenous vein:** a blood vessel in the leg; the most common vessel used as a supply of conduits for coronary artery bypass grafting.

**Separation:** refers to the 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 type of care.

**Stenosis:** narrowing, such as occurs inside a blood vessel or to the opening of a valve.

**Supraventricular tachycardia:** episodes of abnormally fast heart rate. This is caused by fast spontaneous impulses, arising in the upper chambers of the heart, that override the natural pacemaker.

**Tachycardia:** a rapid heart rate.

**Tetralogy of Fallot:** a common congenital heart disease comprising four defects: narrowing of the main artery to the lungs (pulmonary artery); a hole in the wall between the two lower chambers of the heart; defective positioning of the aorta; and thickening of the right ventricle of the heart.

**Tricuspid valve:** valve between the right atrium and the right ventricle.

**Truncus arteriosus:** a congenital defect where one artery replaces the aortic and pulmonary arteries.

**Valvotomy:** an operation that opens up a stenosed (unnaturally narrow) heart valve and allows it to function properly.

**Valvuloplasty:** procedure to repair an abnormal valve of the heart.

**Ventricular septal defect:** a hole in the wall (septum) between the lower two chambers of the heart (the ventricles).

## Appendix A: List of units operating in 1995

State	Unit
New South Wales	John Hunter Hospital
	Prince Henry Hospital
	The New Children's Hospital (Royal Alexandra Hospital for Children)
	Royal North Shore Hospital
	Royal Prince Alfred Hospital
	St George Hospital
	St Vincent's Private Hospital
	St Vincent's Public Hospital
	Strathfield Private Hospital
	Sydney Adventist Hospital
	Sydney's Children's Hospital (Prince of Wales Children's Hospital)
	The Hills Private Hospital
	Westmead Hospital
Queensland	Mater Misericordiae Hospital
	Prince Charles Hospital
	St Andrews War Memorial Hospital
	Townsville General Hospital
	The Wesley Hospital
	The John Flynn Hospital
South Australia	Ashford Community Hospital
	Flinders Medical Centre
	Royal Adelaide Hospital
	Wakefield Hospital
	Women's and Children's Hospital
Tasmania	Royal Hobart Hospital
Victoria	Cabrini Medical Centre
	Epworth Hospital
	Melbourne Private Hospital
	Monash Medical Centre
	Royal Children's Hospital
	Royal Melbourne Hospital
	St Vincent's Hospital
	St Vincent's Private Hospital
	The Alfred Hospital
	The Austin & Repatriation Medical Centre
	Warringal Private Hospital
Western Australia	Princess Margaret Hospital for Children
	Royal Perth Hospital
	Sir Charles Gairdner Hospital
	The Mount Hospital

# Appendix B: Data collection form

## AUSTRALIAN INSTITUTE OF HEALTH AND WELFARE

### CARDIAC SURGERY REGISTER

Annual report form for year ending December 1995

*To be completed by .....*

<b>CARDIAC SURGEONS</b>	Page 32
<b>MISCELLANEOUS PROCEDURES</b>	Page 33
<b>ACQUIRED DISEASE</b>	
Valve surgery - single	Page 34
Valve surgery - double	Page 35
Valve surgery - triple	Page 36
Valve surgery re-operations	Page 37
Surgery for coronary artery disease	Page 38
Great vessel surgery	Page 40
Other conditions	Page 41
<b>CONGENITAL DISEASE</b>	
Valve surgery	Page 43
Other common conditions	Page 44
Less common conditions	Page 46



**CARDIAC SURGERY REGISTER REPORT FORM  
FOR OPERATIONS PERFORMED IN 1995**

NAME OF UNIT: .....

UNIT NUMBER: .....

**CARDIAC SURGEONS IN YOUR UNIT**

	1995	
<b>SURGEONS</b>	<b>Names of surgeons</b>	<b>Head of department</b>
		<b>Surgeon responsible for this report</b>
<b>SURGEONS IN TRAINING IN AUSTRALIA*</b>	<b>Names of trainees</b>	<b>Status (i.e. R.A.C.S. approved trainee, service registrar, overseas registrar)</b>
<b>AUSTRALIANS TRAINING OVERSEAS</b>		

\* *Please indicate if a foreign national visiting Australia for training.*

## MISCELLANEOUS PROCEDURES

List here all procedures not readily fitting into any other section

Only enter here cases that do not fit into the specific categories used on subsequent pages. Please provide as much information as possible on these miscellaneous cases, such as the age of the patients, if the case involves a congenital defect, the number of grafts involved, if it includes coronary artery surgery, and the type of valve used if it is a valve case. If it is not obvious, please indicate whether cardiopulmonary bypass was used or not.

*for ACQUIRED DISEASE*

PROCEDURE	CLOSED		OPEN	
	No.	D.	No.	D.

*for CONGENITAL DEFECTS*

PROCEDURE	CLOSED		OPEN	
	No.	D.	No.	D.

**Please note:** Throughout the form, the column heading 'No.' refers to the total number of operations in the particular category, not only the survivors of the operation. The column heading 'D.' refers to the number of deaths resulting from this total number of operations.

## ACQUIRED DISEASE : VALVE SURGERY - SINGLE

<b>MITRAL</b> - Valvotomy	<b>CLOSED</b>	
	<b>No.</b>	<b>D.</b>

<b>SINGLE VALVE PROCEDURE</b>			<b>OPEN</b>			
			<b>Without coronary artery graft</b>		<b>With coronary artery graft</b>	
			<b>No.</b>	<b>D.</b>	<b>No.</b>	<b>D.</b>
<b>MITRAL</b>	Open mitral valvotomy					
	Reconstruction	<i>with support ring</i>				
		<i>without ring</i>				
	Replacement	<i>mitral homograft</i>				
		<i>heterograft</i>				
		<i>prosthesis</i>				
<b>AORTIC</b>	Valvotomy					
	Reconstruction	<i>decalcification</i>				
		<i>for regurgitation</i>				
		<i>other/unstated</i>				
	Replacement	<i>pulmonary autograft</i>				
		<i>classical homograft</i>				
		<i>"mini root" homograft</i>				
		<i>stent mounted heterograft</i>				
		<i>"mini root" heterograft</i>				
		<i>prosthesis</i>				
<b>TRICUSPID</b>	Reconstruction	<i>with support ring</i>				
		<i>without ring</i>				
	Replacement	<i>heterograft</i>				
		<i>prosthesis</i>				
<b>PULMONARY</b>	Reconstruction					
	Replacement*	<i>homograft</i>				
		<i>heterograft</i>				
		<i>prosthesis</i>				
<b>TOTAL NUMBER OF PATIENTS</b>						

\* In case of valve replacement using pulmonary autograft, please indicate the pulmonary replacement as an attached note. This will not be included as a double valve.

## ACQUIRED DISEASE : VALVE SURGERY - DOUBLE

DOUBLE VALVE PROCEDURE			OPEN			
			Without coronary artery graft		With coronary artery graft	
			No.	D.	No.	D.
<b>MITRAL</b>	Valvotomy					
	Reconstruction	<i>with support ring</i>				
		<i>without ring</i>				
	Replacement	<i>mitral homograft</i>				
		<i>heterograft prosthesis</i>				
<b>AORTIC</b>	Valvotomy					
	Reconstruction	<i>decalcification</i>				
		<i>for regurgitation</i>				
		<i>other/unstated</i>				
	Replacement	<i>pulmonary autograft</i>				
		<i>classical homograft</i>				
		<i>"mini root" homograft</i>				
		<i>stent mounted heterograft</i>				
		<i>"mini root" heterograft prosthesis</i>				
<b>TRICUSPID</b>	Reconstruction	<i>with support ring</i>				
		<i>without ring</i>				
	Replacement	<i>heterograft</i>				
		<i>prosthesis</i>				
<b>TOTAL NUMBER OF VALVES*</b>						
<b>TOTAL NUMBER OF PATIENTS</b>						

\* *By individual valves. As each patient has operations on two valves, the total number and total deaths must each add up to twice the number shown for total patients.*

### ACQUIRED DISEASE : VALVE SURGERY - TRIPLE

TRIPLE VALVE PROCEDURE			OPEN			
			Without coronary artery graft		With coronary artery graft	
			No.	D.	No.	D.
<b>MITRAL</b>	Valvotomy					
	Reconstruction	<i>with support ring</i>				
		<i>without ring</i>				
	Replacement	<i>mitral homograft</i>				
		<i>heterograft</i>				
		<i>prosthesis</i>				
<b>AORTIC</b>	Valvotomy					
	Reconstruction	<i>decalcification</i>				
		<i>for regurgitation</i>				
		<i>other/unstated</i>				
	Replacement	<i>pulmonary autograft</i>				
		<i>classical homograft</i>				
		<i>"mini root" homograft</i>				
		<i>"mini root" valve replacement</i>				
		<i>stent mounted heterograft</i>				
		<i>"mini root" heterograft</i>				
		<i>prosthesis</i>				
	<b>TRICUSPID</b>	Reconstruction	<i>with support ring</i>			
<i>without ring</i>						
Replacement		<i>heterograft</i>				
		<i>prosthesis</i>				
<b>TOTAL NUMBER OF VALVES*</b>						
<b>TOTAL NUMBER OF PATIENTS</b>						

\* By individual valves. As each patient has operations on three valves, the total number and total deaths must each add up to three times the number shown for total patients.

**ACQUIRED DISEASE : VALVE SURGERY RE-OPERATIONS**

Some of the valve patients reported on pages 3, 4 and 5 will be having their second valve replacement. Please indicate the number of <i>valves</i> (not patients) replaced for:			
		<b>No.</b>	<b>D.</b>
<b>MECHANICAL VALVES</b>	Mechanical failure		
	Endocarditis		
	Paravalvular leak		
<b>BIOPROSTHETIC VALVES</b>	Degeneration		
	Endocarditis		
	Paravalvular leak		
<b>ALLOGRAFT VALVES</b>	Degeneration		
	Endocarditis		
	Paravalvular leak		

## SURGERY FOR ACQUIRED CORONARY HEART DISEASE

<b>OPEN AND CLOSED - WITH GRAFTS</b>												
Number of distal anastomoses	No other procedure		With valve surgery		With myocardial resection or plication		With repair of VSD		With other procedures		Total	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												
<b>TOTAL</b>			**									
Re-operations for coronary artery disease*												

\* Please make sure that the re-operations are also included in the main part of the table.

\*\* Please check that this total is the same as the total number of patients reported on pages 3, 4 & 5 as having coronary artery grafts as well as valve surgery.

## SURGERY FOR ACQUIRED CORONARY HEART DISEASE (Cont)

### TYPE OF GRAFT

Please enter here how many of your patients had one of the following used as at least one of their grafts, so that we can calculate the use of each. Please report the number of *patients*, not grafts.

	No. of Patients
Saphenous vein	
Internal mammary artery	
Inferior epigastric artery	
Gastroepiploic artery	
Cephalic vein	
Radial artery	
Prosthetic or bio prosthetic	

### SURGERY FOR ACQUIRED CORONARY HEART DISEASE WITHOUT GRAFTS

Open	Myocardial resection or plication		Closure of VSD		Other		Total	
	No.	D.	No.	D.	No.	D.	No.	D.
Without Grafts								

### NON-CONVENTIONAL CABG

Some of the procedures already reported on pages 7 and 8 may have been done without CPB or using other non-conventional techniques. Please indicate here their number.

	No. procedures
Without CPB	
Minimally invasive techniques	
CABG via thoracotomy	



## ACQUIRED DISEASE : GREAT VESSEL SURGERY

REPAIR OR REPLACEMENT OF ASCENDING AORTA			OPEN			
			Without coronary artery graft		With coronary artery graft	
			No.	D.	No.	D.
Acute (dissection)	aortic repair	without valve resuspension				
	aortic repair	with valve resuspension				
	*composite graft replacing aortic valve and ascending aorta					
	*homograft replacement of aortic valve and ascending aorta					
	*separate aorta and valve replacement					
Chronic (for aneurysm or dissection)	aortic repair	without valve resuspension				
	aortic repair	with valve resuspension				
	*composite graft replacing aortic valve and ascending aorta					
	*homograft replacement of aortic valve and ascending aorta					
	*separate aorta and valve replacement					
<b>TOTAL</b>						

\* These cases should **not** be included under valve surgery.

REPLACEMENT OF AORTIC ARCH		OPEN			
		Without coronary artery graft		With coronary artery graft	
		No.	D.	No.	D.
for aneurysm					
for dissection					
<b>TOTAL</b>					

REPLACEMENT OF DESCENDING THORACIC AORTA		CLOSED		OPEN	
		No.	D.	No.	D.
for aneurysm					
for dissection					
<b>TOTAL</b>					

If hemi arch replacement is part of any of the above procedures, please indicate this in a footnote or attachment.

**ACQUIRED DISEASE : OTHER CONDITIONS**

<b>TRANSPLANTATION</b>		<b>NO.</b>	<b>DEATHS</b>
Cardiac	cardiomyopathy		
	ischaemia		
	other/unstated		
Heart-Lung	congenital		
	other/unstated		
Lung	whole		
	lobe		

		<b>OPEN</b>			
		<b>Without coronary artery graft</b>		<b>With coronary artery graft</b>	
		<b>No.</b>	<b>D.</b>	<b>No.</b>	<b>D.</b>
<b>ELECTROPHYSIOLOGICAL SURGERY</b>					
<b>SUPRAVENTRICULAR TACHYCARDIAS</b>	Wolff-Parkinson White Syndrome				
	AV-Junction				
	Atrial fibrillation or flutter				
	AV node ablation				
<b>VENTRICULAR TACHYCARDIAS</b>	Recurrent ventricular tachycardia				
	- aneurysmectomy				
	- myocardial incision				
<b>CARDIAC TUMOUR/ CARDIOMYOPATHY</b>	myxoma				
	other cardiac tumour				
	IHSS				
<b>TOTAL</b>					

		<b>CLOSED</b>		<b>OPEN</b>	
		<b>No.</b>	<b>D.</b>	<b>No.</b>	<b>D.</b>
<b>AUTOMATIC DEFIBRILLATOR</b>	Patches				
	Transvenous				

**ACQUIRED DISEASE : OTHER CONDITIONS (Cont)**

		CLOSED		OPEN without grafts	
		No.	D.	No.	D.
<b>CARDIAC TRAUMA</b>	atrium				
	ventricle				
	*valves				
	ascending aorta				
	descending aorta				
	other				
<b>PULMONARY EMBOLLECTOMY</b>					
<b>PERICARDIECTOMY FOR</b>	tuberculosis				
	non-specific infection				
	uraemia				
	other				
<b>OTHER CONDITIONS</b>	please list				
<b>TOTAL</b>					

\* These cases **should not be** included under valve surgery.

TOTAL PATIENTS : ACQUIRED DISEASE	OPEN				CLOSED	
	WITHOUT GRAFTS		WITH GRAFTS			
	No.	D.	No.	D.	No.	D.

### CONGENITAL DEFECTS : VALVE SURGERY

	CLOSED		
	No.	D.	Age
<b>MITRAL</b> - valvotomy			
<b>PULMONARY</b> - valvotomy			

SINGLE VALVE PROCEDURE	Under 1 Month		1-6 Months		Over 6 Months	
	No.	D.	No.	D.	No.	D.
<b>OPEN</b>						
<b>MITRAL</b> Valvotomy						
Reconstruction						
Replacement <i>heterograft</i>						
<i>prosthesis</i>						
<b>AORTIC</b> Valvotomy						
Reconstruction						
Replacement <i>homograft</i>						
<i>heterograft</i>						
<i>prosthesis</i>						
<b>TRICUSPID</b> Valvotomy						
Reconstruction						
Replacement <i>heterograft</i>						
<i>prosthesis</i>						
<b>PULMONARY</b> Valvotomy						
Reconstruction						
Replacement <i>homograft</i>						
<i>heterograft</i>						
<i>prosthesis</i>						
<b>TOTAL NUMBER OF PATIENTS</b>						

## CONGENITAL DEFECTS : OTHER COMMON CONDITIONS

	Under 1 Month				1-6 Months				Over 6 Months			
	Closed		Open		Closed		Open		Closed		Open	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
<b>Persistent ductus arteriosus</b>												
<b>Coarctation of aorta</b>												
Simple												
Complicated												
<b>Atrial septal defect</b>												
<b>Ventricular septal defect</b>												
Uncomplicated <i>palliative</i>												
<i>corrective</i>												
With PS <i>palliative</i>												
<i>corrective</i>												
With pulmonary atresia <i>palliative</i>												
<i>corrective</i>												
<b>Tetralogy of Fallot</b>												
Simple <i>palliative</i>												
<i>corrective</i>												
Complicated <i>palliative</i>												
<i>corrective</i>												
Acquired pulmonary atresia <i>palliative</i>												
<i>corrective</i>												
<b>TOTALS (this page)</b>												

**Please note:** Please be careful to put the cases in the correct columns, indicating whether they were done using the open or closed technique.

### CONGENITAL DEFECTS : OTHER COMMON CONDITIONS (Cont)

	Under 1 Month				1-6 Months				Over 6 Months			
	Closed		Open		Closed		Open		Closed		Open	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
<b>Transposition of great vessels</b>												
With intact ventricular septum												
<i>palliative</i>												
<i>corrective</i>												
With VSD												
<i>palliative</i>												
<i>corrective</i>												
With other significant anomaly												
<i>palliative</i>												
<i>corrective</i>												
With inversion of ventricles*												
<i>palliative</i>												
<i>corrective</i>												
Corrected transposition & other significant anomaly												
<i>palliative</i>												
<i>corrective</i>												
<b>TOTALS (this page)</b>												

\* Formerly 'corrected transposition with VSD'.

**Please note:** Please be careful to put the cases in the correct columns, indicating whether they were done using the open or closed technique.

## CONGENITAL DEFECTS : LESS COMMON CONDITIONS

	Under 1 Month				1-6 Months				Over 6 Months			
	Closed		Open		Closed		Open		Closed		Open	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
<b>EXTRA-CARDIAC LESIONS</b>  <div style="padding-left: 20px;">A-P window</div> <div style="padding-left: 20px;">Interrupted aortic arch</div> <div style="padding-left: 20px;">Vascular ring</div>												
<b>CORONARY ARTERY DEFECTS</b>												
<b>MISCELLANEOUS</b>  <div style="padding-left: 20px;">Total anomalous pulmonary venous return <i>palliative</i></div> <div style="padding-left: 40px;"><i>corrective</i></div> <div style="padding-left: 20px;">Asplenia syndrome <i>palliative</i></div> <div style="padding-left: 40px;"><i>corrective</i></div> <div style="padding-left: 20px;">Exploration only</div> <div style="padding-left: 20px;">Surgical procedures for other conditions (please specify)</div>												
<b>TOTALS (this page)</b>												

**Please note:** *Please be careful to put the cases in the correct columns, indicating whether they were done using the open or closed technique.*

**CONGENITAL DEFECTS : LESS COMMON CONDITIONS (Cont)**

	Under 1 Month				1-6 Months				Over 6 Months			
	Closed		Open		Closed		Open		Closed		Open	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
<b>RIGHT SIDED LESIONS</b>												
Ebstein's anomaly <i>palliative</i>												
<i>corrective</i>												
Tricuspid atresia <i>palliative</i>												
<i>corrective</i>												
Pulmonary atresia (with intact septum) <i>palliative</i>												
<i>corrective</i>												
<b>LEFT SIDED LESIONS</b>												
Cor triatrium <i>palliative</i>												
<i>corrective</i>												
Mitral atresia												
Hypoplastic left heart syndrome												
Sub-aortic stenosis												
Supra valvular stenosis												
<b>TOTALS (this page)</b>												

**Please note:** Please be careful to put the cases in the correct columns, indicating whether they were done using the open or closed technique.



**CONGENITAL DEFECTS : LESS COMMON CONDITIONS (Cont)**

	Under 1 Month				1-6 Months				Over 6 Months			
	Closed		Open		Closed		Open		Closed		Open	
	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.	No.	D.
<b>DEFECTS OF PARTITIONING</b>												
AV Canal - partial <i>palliative</i>												
<i>corrective</i>												
AV Canal - total <i>palliative</i>												
<i>corrective</i>												
Double outlet RV <i>palliative</i>												
<i>corrective</i>												
Truncus arteriosus <i>palliative</i>												
<i>corrective</i>												
Other (please specify)												
<b>TOTALS (this page)</b>												
<b>TOTAL PATIENTS : CONGENITAL DEFECTS (pages 12 to 17)</b>												

**Please note:** *Please be careful to put the cases in the correct columns, indicating whether they were done using the open or closed technique.*

## Related publications

Australian Institute of Health and Welfare (AIHW) 1998. Australian hospital statistics 1996–1997. AIHW Cat. No. HSE 5 (Health Services Series No. 11). Canberra: AIHW.

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Senes-Ferrari S 1999. Cardiac surgery in Australia 1994. AIHW Cat. No. CVD 6 (Cardiovascular Disease Series No. 9). Canberra: AIHW.

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Waters A-M, Armstrong T & Senes-Ferrari S 1998. Medical care of cardiovascular disease in Australia. AIHW Cat. No. CVD 4 (Cardiovascular Disease Series No. 7). Canberra: AIHW.