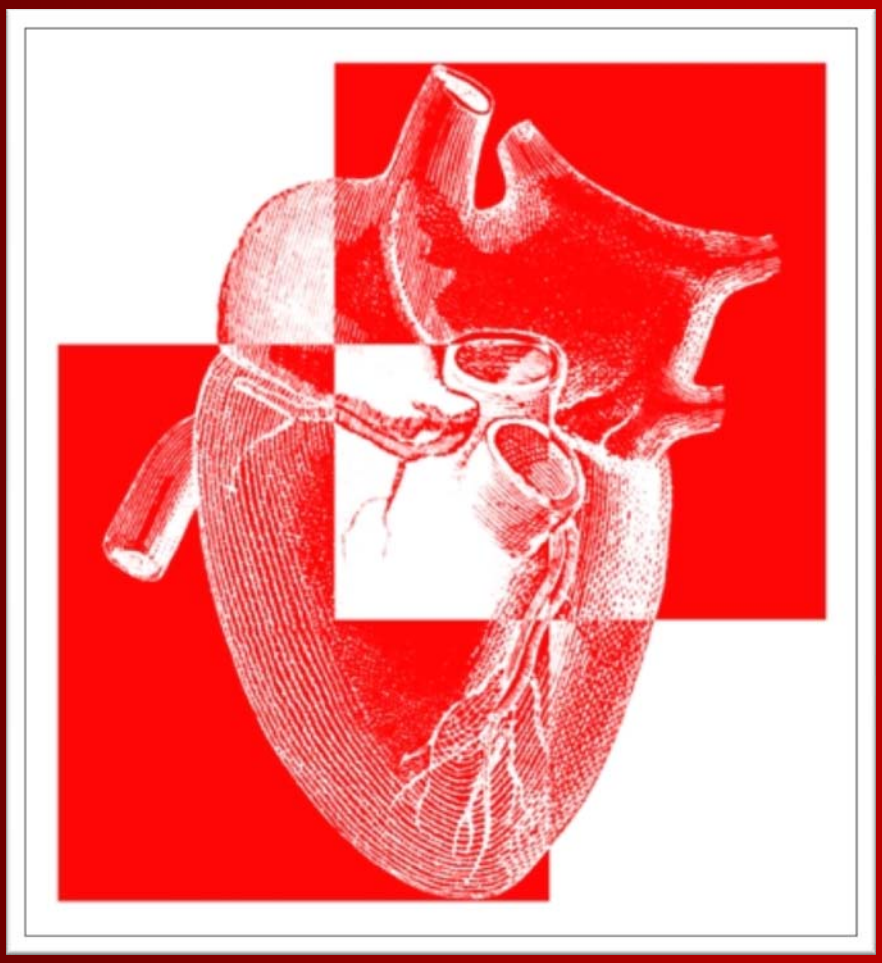
ASCTS Cardiac Surgery Database Project



Annual Report 2008 - 2009

VIC

Public Report

Australasian Society of Cardiac and Thoracic Surgeons *(ASCTS)*

Victorian Cardiac Surgery Database Project

Annual Public Report

2008 - 2009

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Foreword

Annual Victorian Report of the ASCTS Database 2008-2009

This report of the database covers the period from 1st July 2008 to 30th June 2009. Again, it presents a record and analysis of all cardiac surgical procedures performed in the participating Units.

As previously, an evaluation of the results of surgeons and Units revealed that the accustomed high standards of performance continue.

This data is presented in the format of the previous seven reports. Review of the last five years' data reveals some trends that are described in ensuing pages.

Further analysis of Unit and Surgeon performance in the form of Control Charts and CUSUM plots has been continued this year.

The second biennial review of the Dataset and Definitions is complete. The major changes were: more precise characterisation of pre-operative AMI; introduction of a section on anti-fibrinolytic use and a section to record prosthetic details. The web based communication system commenced in October 2008.

National Death Institute (NDI) data linkage, which is a part of our data verification program, has identified a number of probable deaths that were not previously reported to the Data Management Centre. However, this information has to be verified with the Units concerned before inclusion. Any necessary corrections will therefore be made in next year's Report.

In this and future Reports, intra-operative insertion of an LV electrode, when performed in conjunction with Coronary or Valve surgery, will no longer, by itself, qualify for analysis in the "Other" group. This correction will also be applied retrospectively. Therefore, the numbers of isolated Coronary Grafts and Valve procedures will increase slightly.

Once again, I would like to thank the members of the steering committee, their data managers and the staff of the Monash University, Department of Epidemiology and Preventive Medicine, for their perceptive and persisting contribution.

This database project is pleased to appreciatively acknowledge the Department of Health Services, for its encouragement, guidance and funding, which initiated and has assured the continuance of this important and pioneering project.

Gil Shardey
Chairman
Steering Committee

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Data Presentation

Reporting of data from the ASCTS registry occurs at the end of each financial year.

Therefore, data for the 2008-09 financial year includes all cases performed in participating units from 1st July 2008 to 30th June 2009.

Data from previous years (2005-08) includes all cases from participating units from 1st July 2005 to 30th June 2008.

The following points should be noted when generating web reports using ASCTS Online Database Program:

- Thirty day mortality includes those patients who died within 30 days of their first procedure date- in hospital or after discharge.

- Hospital mortality includes all patients who died before discharge from hospital. This includes those who died within or after 30 days.

Public Report

Introduction

The Australasian Society of Cardiac and Thoracic Surgeons (ASCTS), together with the Victorian Department of Human Services (VDHS) developed a program to collect data in reference to, and report on, cardiac (heart) surgery in Victorian hospitals.

This is the eighth report of the program. It describes the data from surgery performed between 1 July 2008 and 30 June 2009 at six specialist Cardiac Surgery Units within Victorian Public Hospitals. These include:

- Austin Hospital
- Geelong Hospital
- Monash Medical Centre – Clayton
- Royal Melbourne Hospital
- St Vincent's Hospital
- The Alfred Hospital

This report provides an overview of the patients who underwent surgery, the types of surgery performed, complications and other details relating to risk and the outcomes of surgery.

Who received cardiac surgery?

Two thousand six hundred and ninety two people underwent two thousand seven hundred and five cardiac surgical procedures in Victorian Public Hospitals over the 12 month period from July 2008 to June 2009. This is 64 more than the previous year. Overall, the demographic data in this period is similar to that of the previous years.

The risk of heart disease and surgical complications is influenced by a number of factors. These include age, underlying health conditions such as diabetes, elevated cholesterol levels and high blood pressure, lifestyle choices such as smoking and previous medical interventions such as a previous heart operation. *Table 1* outlines the proportion of patients with several of these risk factors.

Nearly three-quarters of the patients were aged 60 years and above (as shown in Figure 1. The average age was 66 years and approximately 70% the patients were male. In the group of patients who underwent cardiac surgery in 2008-09:

- one in seven were current smokers;
- approximately one in four had diabetes;
- three out of four had high blood pressure at a level requiring treatment;
- around one in five had previous heart intervention of whom more than two-thirds had a previous angioplasty and the remainder had some type of heart surgery;

- the proportion of elective patients being admitted to hospital on the day of their operation (rather than a day or two prior) has increased slightly.

Figure 1: Age Distribution of Patients having cardiac surgery in Victorian Public Hospitals during 2008 - 09

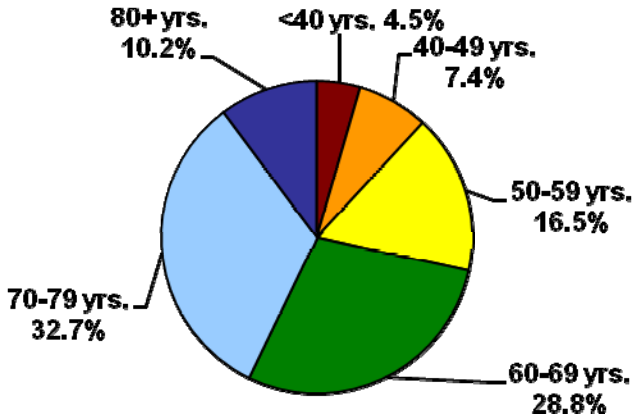


Table 1: Patient demographics' and risk factors

	2005-06	2006-07	2007-08	2008-09
Total number of Patients included	2778	2594	2629	2692
Total number of Procedures included	2794	2607	2642	2705
Risk Factors	**%**	**%**	**%**	**%**
Current Smoker	13	15	14	15
Diabetes	29	30	28	30
Hypertension (high blood pressure)	71	70	71	73
Cerebrovascular disease (e.g. stroke)	12	12	13	13
Peripheral Vascular Disease	13	12	9	10
Cardiac History				
Previous Cardiac Intervention	19	19	19	21
This included:				
Previous CABG	4	3	4	4
Previous Valve	2	3	3	3
Previous PTCA / Stent	11	11	11	13
Myocardial Infarction	43	43	42	41
This included:				
MI less than 21 days before surgery	19	19	20	20
Congestive Heart Failure	32	28	25	21
Admission				
Admitted on the Day of Surgery	53	54	46	49

What operations were performed?

The main operations were:

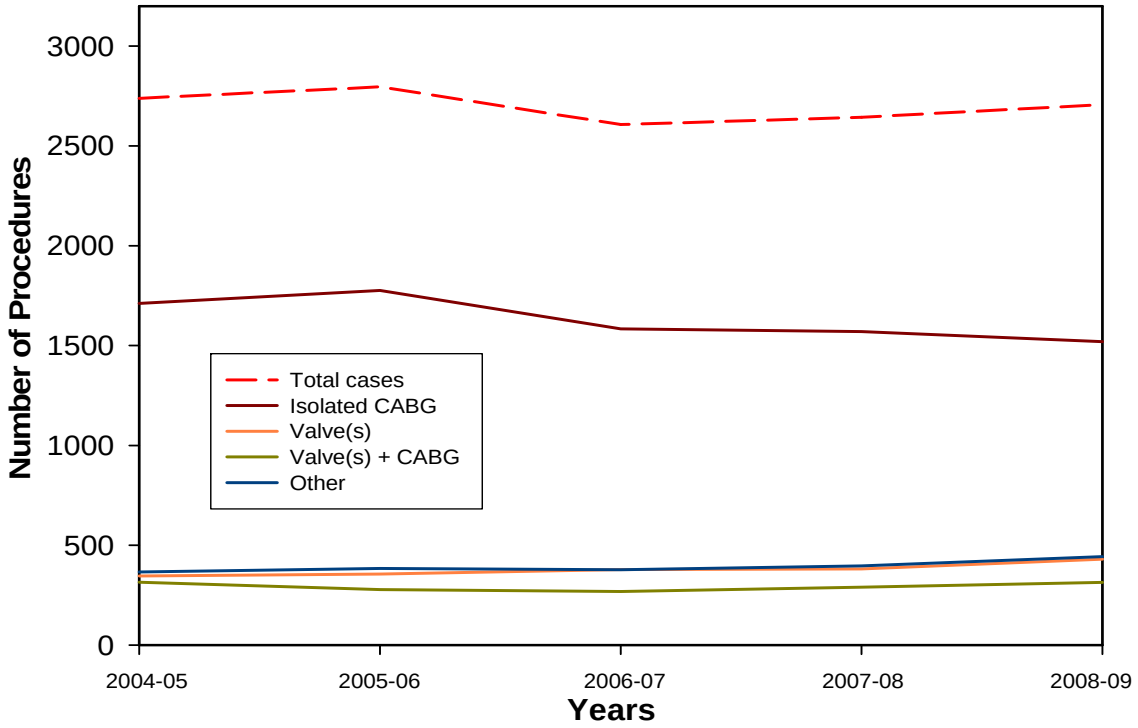
- Isolated Coronary Artery Bypass Graft Surgery (CABG) - 56% of procedures
- Isolated heart valve repair or replacement - 16%
- A combination of these two procedures - 12%

The remaining 16% were less common procedures.
Figure 2 shows the trends of cardiac operations over the past 5 years.

A coronary artery bypass graft is a surgical procedure where new channels are created around blocked or narrowed arteries to allow blood to reach the heart muscle again.

A heart valve operation is performed on a valve that is too narrow to allow sufficient blood to flow through the valve opening or on a valve that cannot close tightly enough to prevent blood from flowing in the wrong direction in the heart. When a valve cannot be repaired, it can be replaced with a substitute valve.

Figure 2: Total cardiac operations in the six Victorian hospitals 2004 – 09



How successful was surgery?

The data collected show that cardiac surgery in Victorian hospitals is very safe by world standards. One measure of success in the short term is the number of complications and deaths that occur. In both these areas, the Victorian outcomes were comparable or in some cases lower than those from the USA and the UK.

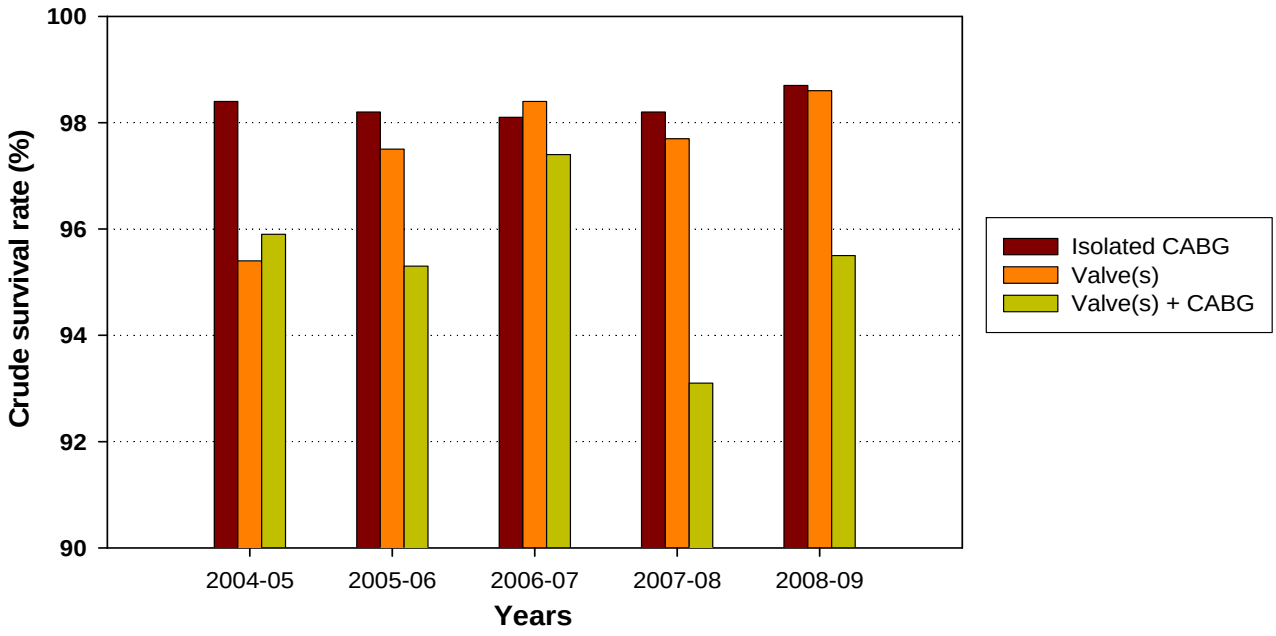
It is important to remember that individuals undergoing these operations have serious heart conditions and are generally in poor health. They are in great risk of complications following surgery compared to people in good health. Additionally, older age increases the risk of surgery.

Survival rates from cardiac surgery

The survival rate associated with cardiac surgery is calculated based on the number of deaths in hospital or within 30 days following surgery. Of the patients who had isolated CABG or isolated valve surgery this year, almost 99% (99 in 100 patients) survived, while 96% (96 in 100 patients) of patients who had a combination of valve and coronary operations survived after surgery.

This year, there is a slight improvement in the overall survival rate for isolated CABG and valve operations and a notable increase in patients who underwent a combination of valve and CABG operations. This information is presented in Figure 3.

Figure 3: Survival rate for different cardiac operations in the six Victorian Public Hospitals



Factors affecting the outcome of CABG

The remainder of this Report focuses on the risk factors and outcomes of patients undergoing isolated CABG procedures. This is the most common operation performed and detailed information is available from each hospital.

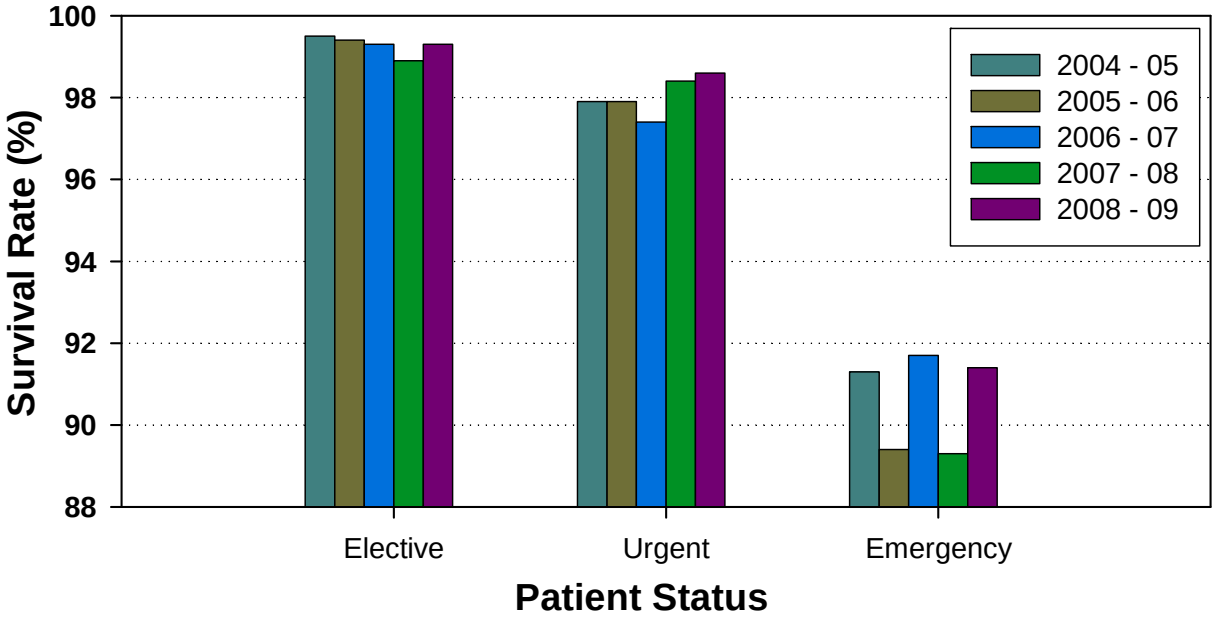
Clinical Urgency

Patients who undergo cardiac surgery present with varying degrees of clinical urgency. Ideally, a heart condition should be diagnosed at a time when surgery can be planned for at a convenient (or elective) time. However, this is not always the case and there is a proportion of patients who require almost immediate surgery from the time of clinic presentation. The urgency of cases presented to Victorian Public Hospitals for cardiac surgery in 2008-09 is described below.

- A little more than two thirds of the patients (63%) were classified as elective cases;
- One third of all cases were classified as urgent (needing surgery for clinical reasons during the presenting admission);
- Approximately 4% presented as an emergency (necessitating surgery on the same day);
- Only 3 cases or 0.2% total patients were classified as salvage procedures (patients being resuscitated en route to theatre);
- The overall survival rates for isolated CABG for the past five years for elective surgery have not changed dramatically.

Though the overall survival rate amongst patients who undergo cardiac surgery is high, it is observed that survival rates decrease with increasing clinical urgency. Patients' survival was highest in elective cases (over 99%). Survival is slightly less in urgent cases and even significantly less in emergency cases (91%). This trend is illustrated in Figure 4, using data from the past five years.

Figure 4: Survival rate for isolated CABG, in relation to the urgency of surgery

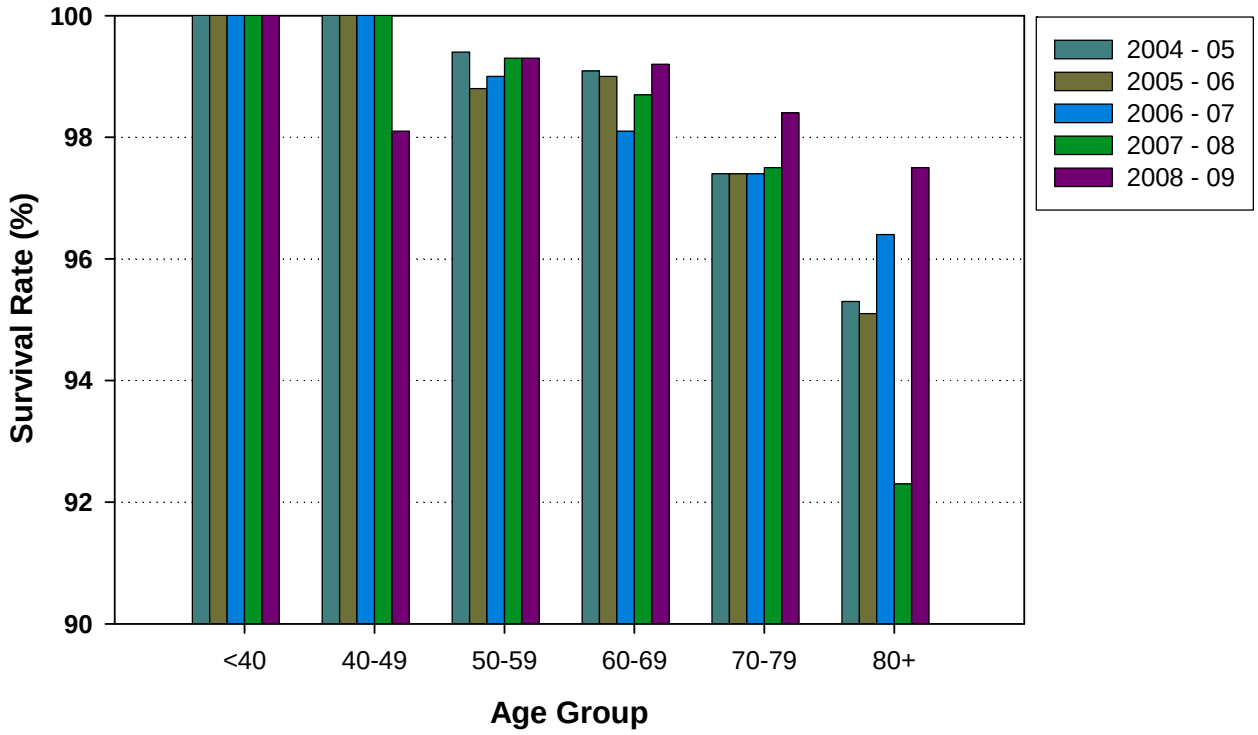


Age

Increasing age can also influence a patient' survival. Figure 5 shows survival rates for patients who had isolated CABG as an elective procedure (the most common level of urgency).

Over the past five years, survival rates within each age group fluctuate slightly. However, there is a general trend to decreasing survival with increasing age. Figure 5 illustrates this trend.

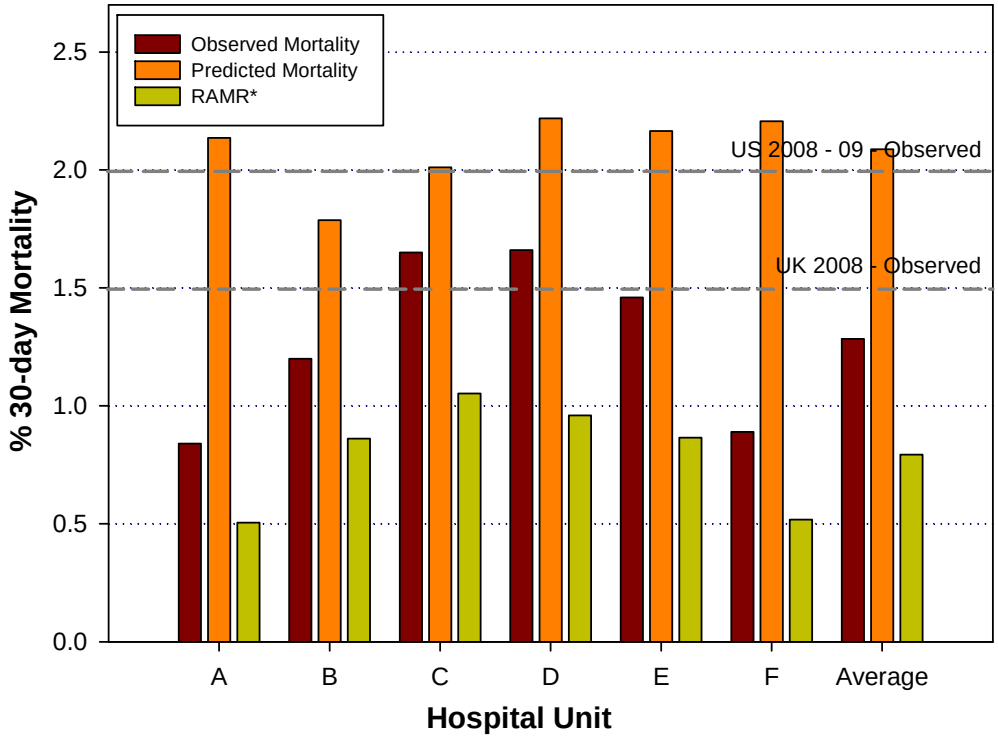
Figure 5: Survival rate for elective isolated CABG, in relation to patient age



Do outcomes differ at different hospitals?

For isolated CABG procedures, the observed mortality rates over the 30 days following surgery for all six Victorian Public Hospitals are below that of the USA Benchmark with two units above the UK average.

Figure 6A: Mortality rate within 30 days following Isolated CABG, for the six Victorian Public Hospital Cardiac Surgery Units during 2008 – 09



*Risk Adjusted Mortality Rate using the AusScore model
See Appendix A

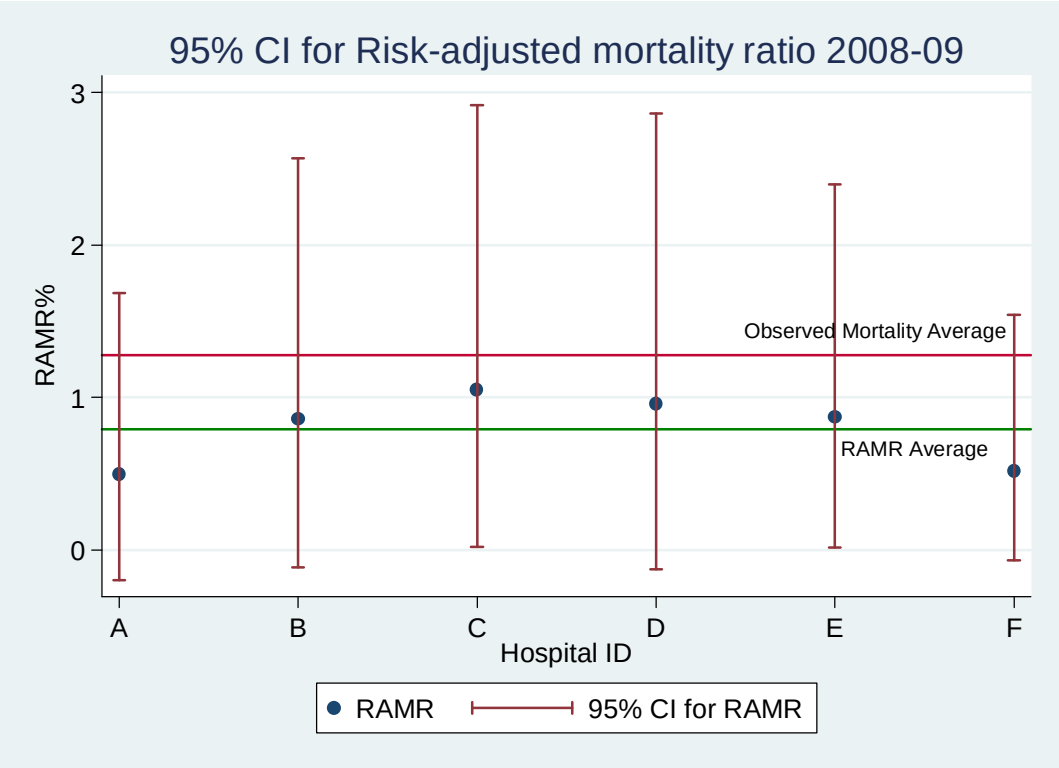
Figure 6A includes both "observed or actual" mortality and "predicted or risk-adjusted" mortality. The degree of risk associated with the operation varies widely for different patients who undergo cardiac surgery. Factors including age and urgency of surgery should be considered because the frequency of those characteristics will vary between hospitals. Risk adjustment provides a method of predicting mortality taking into account the characteristics of the patients in each Unit. It also provides a method of comparing mortality between hospitals.

A predicted mortality greater than the observed implies that the Unit's result is better than would be predicted on the basis of their patient group. This is the case for all Victorian Units this year.

The Risk-Adjusted Mortality Ratio (RAMR) compares the mortality rates for the units involved in this analysis. An RAMR significantly lower than the average means that the unit has performed better and one higher than average means that it has performed less well than average (see also Appendix A).

Figure 6B indicates that statistically, the performance of all six Victorian Public Hospitals is within acceptable limits and that there are no differences between them (at the 95% confidence limit level).

Figure 6B: 95% Confidence Intervals for Risk-Adjusted 30-day Mortality Ratio for all 6 Victorian Units during 2008- 09 financial years

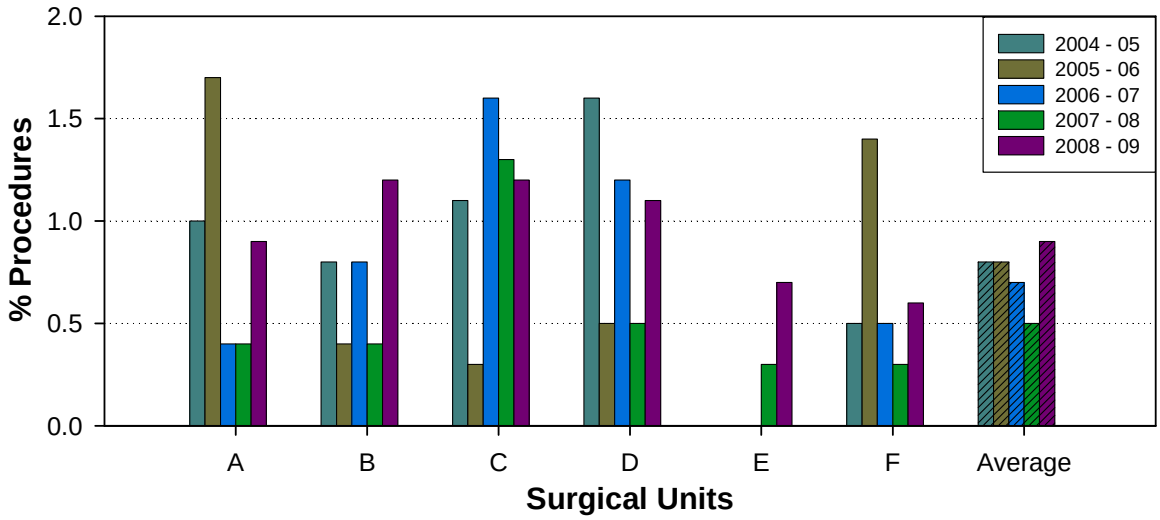


The analysis indicates that the performance of six Victorian Public Hospitals is not different (at the 95% confidence level) from the state average. See Appendix B for further explanation.

Complications of surgery

Deep sternal wound infection is a rare but serious complication of CABG surgery. In the past year, deep sternal wound infections were reported in just below 1% of patients who underwent cardiac surgery (14 cases reported before discharge and a further 7 cases after discharge but within 30 days of surgery). The rates are depicted in Figure 7 and Figure 8 respectively.

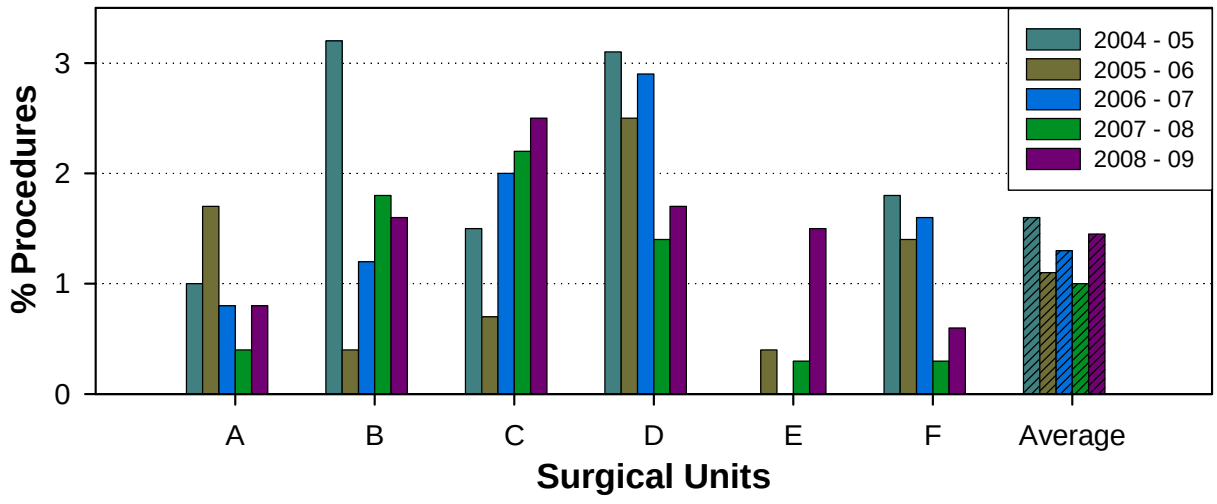
Figure 7: Deep Sternal Infections at hospital discharge following isolated CABG



*Missing bars represent no cases of Deep Sternal Infections

Number of cases	A	B	C	D	E	F	**Total**
2008- 2009	2	3	3	2	2	2	**14**

Figure 8: Deep Sternal Infections within 30 days following isolated CABG

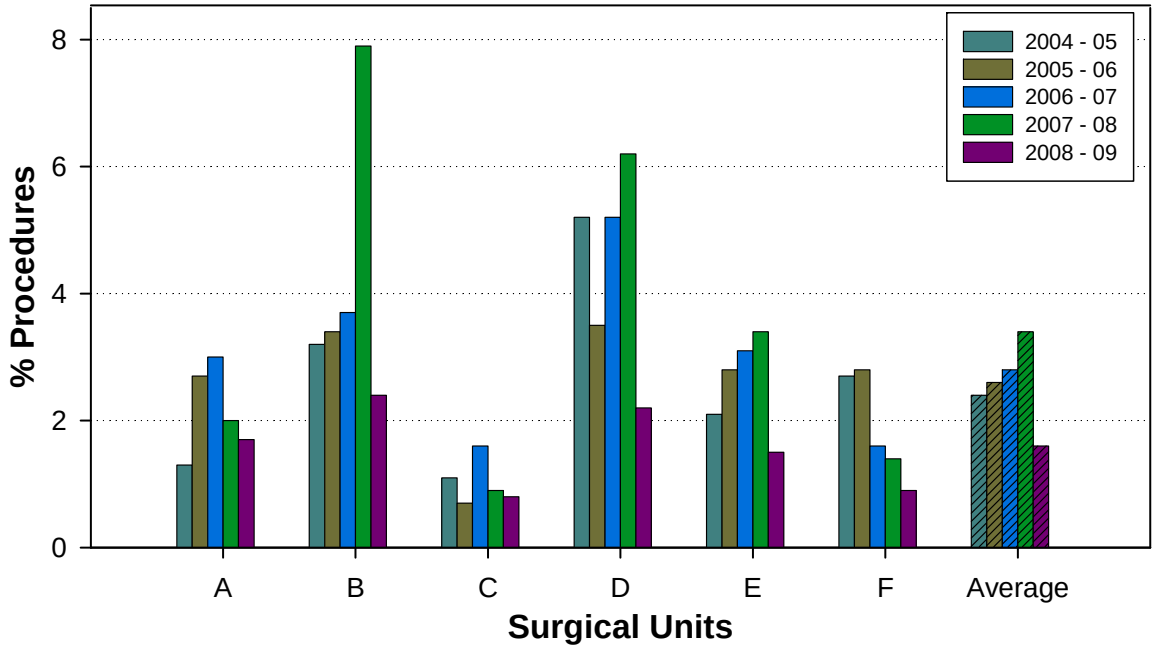


*Missing bars represent no cases of Deep Sternal Infections

Number of cases	A	B	C	D	E	F	**Total**
2008- 2009	2	4	6	3	4	2	**21**

Post-operative haemorrhage necessitating return to the operating theatre occurred in 23 out 1519, or 1.5% of patients having CABG. The incidence of post-operative haemorrhage over the past five financial years is shown in Figure 9.

Figure 9: Return to theatre for bleeding within 30 days following isolated CABG



Number of cases	A	B	C	D	E	F	**Total**
2008- 2009	4	6	2	4	4	3	**23**

Mechanical Ventilation and Length of Stay

Mechanical ventilation, (mechanical support and assistance of breathing) is temporarily required after cardiac surgery. In 2008-09, the median ventilation time following an isolated CABG procedure was 10 hours. The duration of ventilatory assistance is influenced by the extent and complexity of the cardiac surgery performed, the patient's age and the presence of factors such as obesity and pre-existing respiratory disease.

Following cardiac procedures, patients will usually spend a period of time in the Intensive Care Unit (ICU). In 2008-09, the median time spent in ICU following a CABG procedure was 24 hours. The time that a patient spends in ICU is also influenced by the patient's condition. The most common reasons for an extended stay in ICU is the need for extended or 'longer-than-usual' mechanical ventilation and for support of heart function.

Summary

Over the past five years, cardiac surgery in all of Victoria's Public Hospitals remains consistent and safe, or safer, than overseas hospitals. In spite of superficial appearances, there are no statistically significant differences for any of the outcomes between hospitals or from year to year.

In-House reporting module - report from all units combined

The ASCTS online web system contains an In-House reporting module that provides a report on case numbers and outcomes for the individual unit as required. The following pages display a copy of that report generated by the same software, but with combined data of all the units for the 2008-09 financial year.

PLEASE NOTE: Discrepancies between the Comprehensive Surgeons' Report and this Reporting Module are due to differences in filtering processes prior to analysis. In particular, the 25 deaths for isolated CABG in Table 1 recorded in this Module comprise all deaths reported to the Data Centre. Of those, 19 were in hospital (15 less and 4 more than 30 days after surgery) and 6 died after hospital discharge (4 within and 2 more than 30 says after surgery). To maintain consistency with the STS and UK databases, only the 19 in-hospital deaths were included in the Report analysis.

MONASH University
Medicine, Nursing and Health Sciences

Web Report for Surgeon or Cardiac unit by date range

Report By 6 VIC Units

Selected Date Range 01/07/2008 to 30/06/2009

Note: Incomplete data will affect the overall data pesented in this report.

Summary

Number of patients	2692	**Salvage**	9
Number of procedures	2705	**Redo**	219
Average Age	64.97	**Second procedure**	161
Male / Female	1924 / 768	**Total Mortality**	81
Elective	1834	**Hospital Mortality**	76
Urgent	749	**30-day Mortality**	65
Emergency	113	**Readmission**	303

Table 1 Surgery Type

	Total number of procedures		Total Mortality by procedure	
Surgery type (mutually exclusive)	**Number of procedures**	**% of total procedures**	**Number of patients**	**% of Surgery Type**
Isolated CABG	1519	56.16 %	25	1.65 %
Valve(s) only	430	15.90 %	10	2.33 %
Valve(s) + CABG	314	11.61 %	17	5.41 %
Other (COTH,NCOTH,AO)	442	16.34 %	29	6.56 %
All Procedures	2705	100.00 %	81	2.99 %

Age

	Number of procedures				Total Mortality (exclude double mort)			
Surgery type (mutually exclusive)	**Number of procedures**		**% of total procedures**		**Number of patients**		**% of Age Group**	
	Isolated CABG	**ALL**	**Isolated CABG**	**ALL**	**Isolated CABG**	**ALL**	**Isolated CABG**	**ALL**
<40 years	11	121	0.72 %	4.47 %	0	2	0.00 %	1.65 %
40 - 59 years	394	645	25.94 %	23.84 %	4	13	1.02 %	2.02 %
60 - 69 years	480	780	31.60 %	28.84 %	4	16	0.83 %	2.05 %
70 - 79 years	513	884	33.77 %	32.68 %	8	25	1.56 %	2.83 %
80 + years	121	275	7.97 %	10.17 %	3	9	2.48 %	3.27 %
All Procedures	1519	2705	100.00 %	100.00 %	19	65	1.25 %	2.40 %

Isolated Coronary artery surgery

Number of patients		1517	Total Radial Anastomoses		1139
Number of procedures		1519	Single Radials		798
Male / Female	1177.0	340	Double Radials		341
Stable/Unstable Angina	949 /	417	GEPA Anastomoses		1
Clinical Status: Elective		954	Graft Numbers:		
Urgent		504	6-graft		24
Emergency/Salvage		61	5-graft		141
Total CABG Mortality		25	4-graft		430
Offpump / Mort	103	1	3-graft		611
Onpump / Mort	1416	24	2-graft		257
Redo / Mort	51	1	1-graft		52
Total no. of arterial grafts		711	30-day Mortality		19
Mean no. of grafts		3.29	30-day Mortality by elective		7
LIMA		1226	30-day Mortality by urgent		7
RIMA		11	30-day Mortality by emerg/sal		5
BIMA		219			
Total IMA conduits		1455			
Total SVG Anastomoses		807			

Isolated Coronary artery surgery - Complications

Return to theatre	73	Pulmonary:	
Valve dysfunction	0	Prolonged Vent	148
Graft occlusion	0	Re-intubation	46
Reop Deep sternal inf	13	Pneumonia	98
Bleeding	23	Neurologic:	
Other cardiac	8	Stroke Permanent	7
Other non-cardiac	34	Stroke Transient	4
Deep Sternal Infections	21	Septicaemia	17
Renal failure	87	Anticoagulant complications	11
Haemofiltration	37	GIT complications	19
Peri-op AMI	12	Multi system failure	13
Peri-op Cardiogenic Shock	25	Inotrope use:	
New Cardiac Arrhythmia	487	> 4 hrs	577
Heartblock	5	low CO	364
Cardiac arrest	16	low SVR	221
Atrial Arrythmia	462		
Ventricular tachycardia	23		

Isolated Coronary artery surgery - Performance Indicators

Length of Stay (median)	9	**Ventilation hours (median)**	9
Post-procedure Length of Stay (median)	7	**30-Day Sternal Infection**	1.38 %
ICU hours (median)	24	**Reop for bleeding**	1.52 %
		30 Day Mortality	1.25 %
		Total Mortality	1.65 %

Isolated Valve(s) surgery

Number of patients	425	**30-day Mortality**	6
Number of procedures	430	**Total Mortality**	10
Male / Female	246 / 179		
Redo	41		

Isolated Valve Surg & Prosthesis

	Total number of procedures		Total Mortality by procedure		
Surgery type (mutually exclusive)	Number of procedures	% of total procedures	Number of patients	% of Surgery Type	Total number of prosthesis
Aortic Valve replacement (AVR) Only	243	56.28 %	4	1.65 %	Mechanical 67
					Bioprosthesis 172
					Homo/Allograft 1
					Autograft 0
Other Aortic Valve Procedure (Only)	13	3.02 %	1	7.69 %	
Mitral Valve Replacement (Only)	53	12.33 %	1	1.89 %	Mechanical 31
					Bioprosthesis 21
					Homo/Allograft 0
Mitral Valve Repair (Only)	52	12.09 %	1	1.92 %	Ring 52
Aortic and Mitral Valve Procedure (Only)	22	5.12 %	0	0.00 %	Mechanical 10
					Bioprosthesis 10
					Homo/Allograft 0
					Autograft 0
					Ring 6
Mitral and Tricuspid Valve Procedure (Only)	17	3.95 %	1	5.88 %	Mechanical 11
					Bioprosthesis 2
					Homo/Allograft 0
					Ring 17
Aortic, Mitral and Tricuspid Valve Procedure (Only)	5	1.16 %	1	20.00 %	Mechanical 4
					Bioprosthesis 2
					Homo/Allograft 0
					Autograft 0
					Ring 2
Other Valve Procedures	25	5.81 %	0	0.00 %	
Total	430	100.00 %	10	2.33 %	

Isolated Valve(s) surgery - Complications

Return to theatre	41	**Pulmonary:**	
Valve dysfunction	1	**Prolonged Vent**	46
Graft occlusion	0	**Re-intubation**	15
Reop Deep sternal inf	1	**Pneumonia**	25
Bleeding	19	**Neurologic:**	
Other cardiac	15	**Stroke Permanent**	2
Other non-cardiac	13	**Stroke Transient**	3
Deep Sternal Infections	1	**Septicaemia**	4
Renal failure	45	**Anticoagulant complications**	9
Haemofiltration	14	**GIT complications**	8
Peri-op AMI	3	**Multi system failure**	5
Peri-op Cardiogenic Shock	6	**Inotrope use:**	
New Cardiac Arrhythmia	122	**> 4 hrs**	172
Heartblock	14	**low CO**	113
Cardiac arrest	8	**low SVR**	62
Atrial Arrythmia	101		
Ventricular tachycardia	5		

Isolated Valve(s) - Performance Indicators

Length of Stay (median)	8	**Ventilation hours (median)**	9
Post-procedure Length of Stay (median)	8	**30-Day Sternal Infection**	0.24 %
ICU hours (median)	25	**Reop for bleeding**	4.47 %
		30 Day Mortality	1.41 %
		Total Mortality	2.35 %

Valve Surgery and CABG

	Total number of procedures		Total Mortality by procedure			
Surgery type (mutually exclusive)	Number of procedures	% of total procedures	Number of patients	% of Surgery Type	Total number of prostheses	
Aortic Valve replacement (AVR) + CABG	236	75.16 %	9	3.81 %	Mechanical	33
					Bioprosthesis	197
					Homo/Allograft	0
					Autograft	0
Other Aortic Valve Procedure + CABG	6	1.91 %	1	16.67 %		
Mitral Valve Replacement + CABG -	21	6.69 %	1	4.76 %	Mechanical	10
					Bioprosthesis	10
					Homo/Allograft	0
Mitral Valve Repair + CABG	34	10.83 %	5	14.71 %	Ring	31
Aortic and Mitral Valve Procedure + CABG	10	3.18 %	1	10.00 %	Mechanical	4
					Bioprosthesis	6
					Homo/Allograft	0
					Autograft	0
					Ring	0
Mitral and Tricuspid Valve Procedure + CABG -	3	0.96 %	0	0.00 %	Mechanical	0
					Bioprosthesis	1
					Homo/Allograft	0
					Ring	3
Aortic, Mitral and Tricuspid Valve Procedure + CABG -	3	0.96 %	0	0.00 %	Mechanical	0
					Bioprosthesis	3
					Homo/Allograft	0
					Autograft	0
					Ring	3
Other Valve Procedures + CABG	1	0.32 %	0	0.00 %		
Total	314	100.00 %	17	5.41 %		

CABG and Valve(s) Surgery

Number of patients		314		
Number of procedures		314	CABG and MVR	21
Male / Female	222 /	92	CABG and AVR and MVR	7
Redo		2	CABG and MV repair	34
CABG and AVR		236	30-day Mortality	14

CABG and Valve(s) Surgery - Complications

Return to theatre	35	Pulmonary:	
Valve dysfunction	0	Prolonged Vent	64
Graft occlusion	0	Re-intubation	22
Reop Deep sternal Inf	5	Pneumonia	29
Bleeding	17	Neurologic:	
Other cardiac	3	Stroke Permanent	8
Other non-cardiac	11	Stroke Transient	3
Deep sternal infection	7	Septicaemia	6
Renal failure	36	Anticoagulant complications	5
Haemofiltration	17	GIT complications	11
Peri-op AMI	3	Multi system failure	8
Peri-op Cardiogenic Shock	8	Inotrope use:	
New Cardiac Arrhythmia	158	> 4 hrs	178
Heartblock	11	low CO	130
Cardiac arrest	9	low SVR	69
Atrial Arrythmia	144		
Ventricular tachycardia	9		

CABG and Valve(s) Surgery - Performance Indicators

Length of Stay (median)	11	Ventilation hours (median)	13
Post-procedure Length of Stay (median)	9	30-Day Sternal Infection	2.23 %
ICU hours (median)	35.5	Reop for bleeding	5.41 %
		30 Day Mortality	4.46 %
		Total Mortality	5.41 %

Table 16 AVR Surgery and Aortic Procedures (+/-CABG)

	Total number of procedures		Total Mortality by procedure		
Surgery type (mutually exclusive)	Number of procedures	% of total procedures	Number of patients	% of Surgery Type	Procedure Types
AVR + Aortic Aneurysm (Only)	27	93.10 %	2	7.41 %	Arch % 0 Ascending 24 Thoracic/Abdominal % 0 Descending 0
AVR + Aortic Dissection (Only)	1	3.45 %	0	0.00 %	Ascending (%) 1 Descending (%) 0
AVR + Acute Traumatic Aortic Dissection (Only)	0	0.00 %	0	0.00 %	
AVR + CABG + Aortic Aneurysm (Only)	0	0.00 %	0	0.00 %	Arch % 0 Ascending 0 Thoracic/Abdominal % 0 Descending 0
AVR + CABG + Aortic Dissection (Only)	0	0.00 %	0	0.00 %	Ascending (%) 0 Descending (%) 0
AVR + CABG + Acute Traumatic Aortic Dissection (Only)	0	0.00 %	0	0.00 %	
Total	29	100.00 %	2	6.90 %	

Other surgery

Number of patients		439
Number of procedures		442
Male / Female	281.00	340

Table 3 Other surgery types

Surgery type (mutually exclusive)		Number of procedures	Total Mortality
Aortic Procedure		137	10
Aneurysm	- Asc	94	3
	- Arch	19	0
	- Desc	4	0
	- Thor/Abd	7	1
Dissection	- Asc - Acute	19	2
	- Asc - Chronic	5	0
	- Desc - Acute	7	2
	- Desc - Chronic	3	0
Acute Traumatic Aortic Transection		2	0
Carotid Endarterectomy		2	0
Lung Resection		8	0
Left Ventricular Aneurysm		14	1
Acquired VSD		7	1
Congenital ASD		31	2
Cardiac Trauma		5	1
LVOT Myectomy for HOCM		13	0
LV Rupture Repair		6	1
Pericardiectomy		8	1
Pulmonary Thrombo-endarterectomy		1	0
Left Ventricular Reconstruction		5	0
Pulmonary Embolectomy		4	2
Cardiac Tumour		13	0
Cardiac Transplant		23	2
Congenital Other		28	1
Permanent LV Epicardial Lead		34	3
Atrial Arrhythmia Surgery		82	5
Others		64	5

Other surgery - Complications

Return to theatre	61	Pulmonary:	
Valve dysfunction	0	Prolonged Vent	107
Graft occlusion	1	Re-intubation	26
Reop Deep sternal inf	0	Pneumonia	39
Bleeding	29	Neurologic:	
Other cardiac	23	Stroke Permanent	9
Other non-cardiac	20	Stroke Transient	1
Deep Sternal Infections	1	Septicaemia	14
Renal failure	52	Anticoagulant complications	14
Haemofiltration	30	GIT complications	14
Peri-op AMI	2	Multi system failure	17
Peri-op Cardiogenic Shock	28	Inotrope use:	
New Cardiac Arrhythmia	125	> 4 hrs	227
Heartblock	9	low CO	172
Cardiac arrest	18	low SVR	83
Atrial Arrythmia	97		
Ventricular tachycardia	15		

Other - Performance Indicators

Length of Stay (median)	9	Ventilation hours (median)	13
Post-procedure Length of Stay (median)	8	30-Day Sternal Infection	0.23 %
ICU hours (median)	42	Reop for bleeding	1.91 %
		30 Day Mortality	5.92 %
		Total Mortality	1.65 %

Appendix A

AUS-SCORE Risk Adjustment

The AUS-SCORE is the first validated model for risk-adjustment and risk prediction for 30-day mortality for isolated CABG surgery in Australia. The model has been developed on a large number of procedures using standardised data collection methodology and the subsequent validation of the model shows that it is a good fit for Australian data and correctly classified a large number of procedures. The Risk Adjusted Mortality takes into account a number of risk factors, selected as independent predictors of mortality, which includes age, ejection fraction estimate, NYHA class, cerebrovascular disease, urgency of procedures, previous CABG, hypercholesterolemia, peripheral vascular disease, cardiogenic shock, gender, smoking status and inotrope use. The ratio of the actual mortality to the expected mortality indicates the relative performance adjusted for the severity of illness or risk: a ratio of 1 indicates results as expected; less than 1 indicates results better than expected and greater than 1 indicates results worse than expected. This ratio is then multiplied by the Observed Average Mortality Rate to yield a Risk Adjusted Mortality Ratio (RAMR) which normalises the individual unit to the case mix.

The Risk Adjusted Mortality Ratio (RAMR) is calculated as follows:

$$\text{RAMR} = \left[\frac{\text{Observed Mortality Rate}}{\text{Predicted Mortality Rate}} \right] \text{X Average Observed Mortality Rate}$$

The Risk Adjusted Mortality Ratio is therefore, a predictor of mortality for a given patient set which takes into account the risks for those patients.

Appendix B

Analysis of 95% Confidence Intervals for Risk Adjusted Data used in this report.

An example of 95% Confidence Interval (CI) representation is shown in Figure 6B, describing the risk-adjusted mortality rate for 2007-2008 for each VIC unit for Isolated CABG. The red horizontal line represents the risk adjusted mortality ratio state average (%) and the green horizontal line represents the observed mortality rate state average (%). The black dot represents the Risk Adjusted Mortality Ratio (RAMR) for each unit with a vertical red line striking through, representing the 95% CI. There are upper and lower intervals (the vertical red line) for each unit which are above and below each black dot, respectively. To compare each unit's mortality rate (%) to the state average one would interpret the upper and lower intervals as follows: if the upper interval is below the state average than the hospital would be deemed to have performed better than the state average. Alternatively, if the lower interval is above the state average, than the hospital would be deemed to have performed poorer than the state average. If the interval includes the state average, there is no difference between the unit and the state performance.

Appendix C

CUSUM Test

The CUSUM analysis presented in this report indicates the performance of all units or individual units' 30d Risk Adjusted Mortality for Isolated CABG procedures. The CUSUM score represents the acceptable level of performance based on risk adjusted mortality. All cases are monitored for a given period of time and compared to the acceptable level of performance. The CUSUM charts indicate a rejection line (represented as the red line) where those units above this line have a non-acceptable level of performance and require further investigation. As a death occurs, the performance line (represented as the blue line) increases towards the rejection line. The continuous occurrence of mortality causes a cumulative increase towards the rejection line, however the occurrence of a non-death causes the performance line to move towards 0 which represents no deaths for a given period of time.