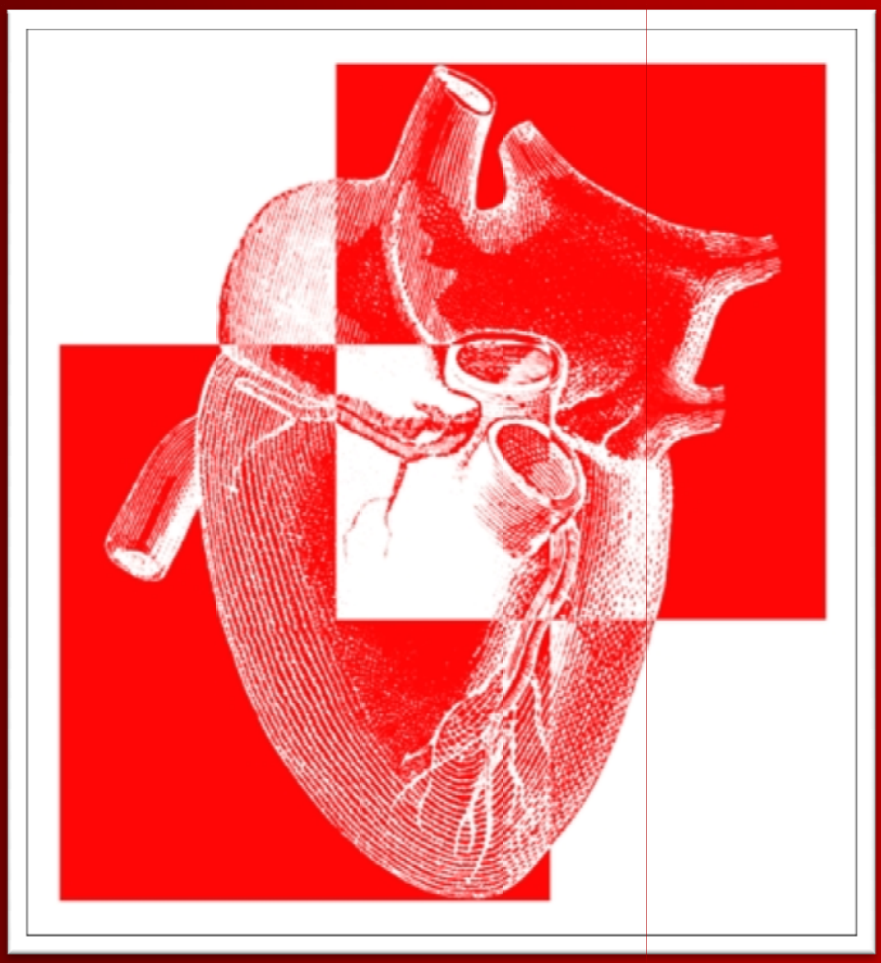
ASCTS Cardiac Surgery Database Project



Annual Report 2007-2008

VIC

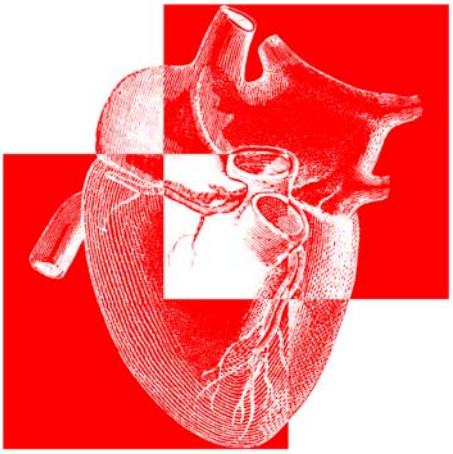
Public Report

Australasian Society of Cardiac and Thoracic Surgeons (ASCTS)

Victorian Cardiac Surgery Database Project

Annual Public Surgeons Report

2007-2008



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Foreword

Seventh Annual Victorian Report of the ASCTS Database 2007-2008

This report of the database covers the period from 1st July 2007 to 30th June 2008. 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 six 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 CUSUM plots has been added 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.

Once again, I would like to thank the members of the steering committee, their data managers and the staff of the 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 Victoria, for its encouragement, guidance and funding, which initiated and has assured the continuance of this important and pioneering project.

Gil Shardey
Chairman
Steering Committee

TABLE OF CONTENTS

List of Figures

List of Tables

Data Representation

All data represented in this report reflects the financial year of the dates stated for each figure and table, for example:

- Data represented as 2007-2008, includes all cases for the respective units during the period 1st July 2007 – 30th June 2008
- Data represented as 2004-2007, includes all cases for the respective units during the period 1st July 2004 – 30th June 2007

In the Web Report the following must be noted:

- 30 Day Mortality includes those patients who have died within 30 days of the procedure date in or out of hospital
- In hospital mortality includes all patients who have 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 seventh report of the program. It describes the data from surgery performed between 1 July 2007 and 30 June 2008 at the 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

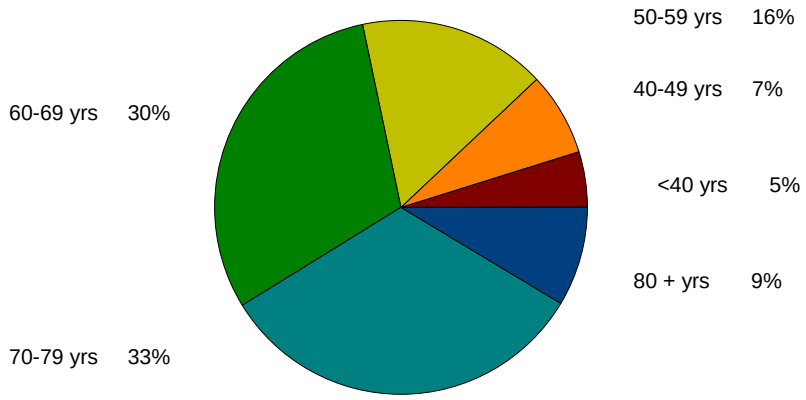
This report provides an overview of the patients who underwent surgery, the types of surgery performed, complications and other details relating to risk and the outcomes of surgery.

Who received cardiac surgery?

Two thousand six hundred and twenty nine people underwent two thousand six hundred and forty-two cardiac surgical procedures in Victorian Public Hospitals over the 12 month period from July 2007 to June 2008. This is thirty-five more than the previous year. Overall, the demographic data in this period is similar to that of the three previous years.

Approximately three-quarters of the patients were aged 60 years and above (as shown in Figure 1). The average age was 65 years and nearly three quarters of the patients were male.

Figure 1: Age Distribution of Patients having cardiac surgery in Victorian Public Hospitals during 2007 - 08



The risk of heart disease and surgical complications is influenced by a number of factors. Of the people undergoing cardiac surgery, one in seven were current smokers, one in four had diabetes, three out of every four had high blood pressure at a level requiring treatment, almost one in every five have had previous heart intervention and more than half of them have had a previous angioplasty.

Interestingly, the proportion of elective patients being admitted to hospital on the day of their operation (rather than a day or two prior) has decreased in the past year by 8%.

Table 1: Patient demographics' and risk factors

	2004-05	2005-06	2006-07	2007-08
Total number of Patients included	2723	2778	2594	2629
Total number of Procedures included	2736	2794	2607	2642
Risk Factors	%	%	%	%
Current Smoker	14	13	15	14
Diabetes	29	29	30	28
Hypertension (high blood pressure)	71	71	70	71
Cerebrovascular disease (e.g. stroke)	12	12	12	13
Peripheral Vascular Disease	12	13	12	9
Cardiac History				
Previous Cardiac Intervention	18	19	19	18
This included:				
Previous CABG	4	4	3	4
Previous Valve	2	2	3	3
Previous PTCA / Stent	9	11	11	11
Myocardial Infarction	44	43	43	42
This included:				
MI less than 21 days before surgery	19	19	19	20
Congestive Heart Failure	30	32	28	25
Admission				
Admitted on the Day of Surgery	48	53	54	46

What operations were done?

The main operations were:

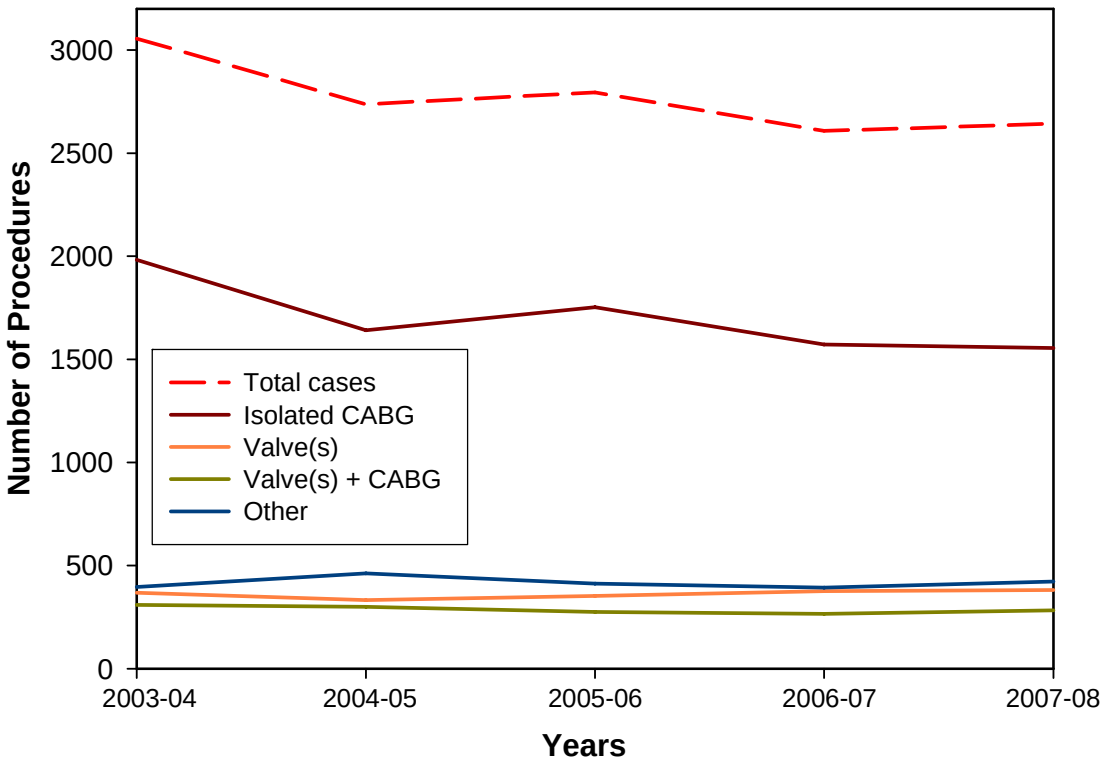
- Isolated Coronary Artery Bypass Graft Surgery (CABG) - 59% of procedures
- Isolated heart valve repair or replacement - 15%
- A combination of these two procedures - 11%

The remaining 15% were less common procedures. Figure 2 shows the trends of cardiac surgical 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 2003 - 08



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.

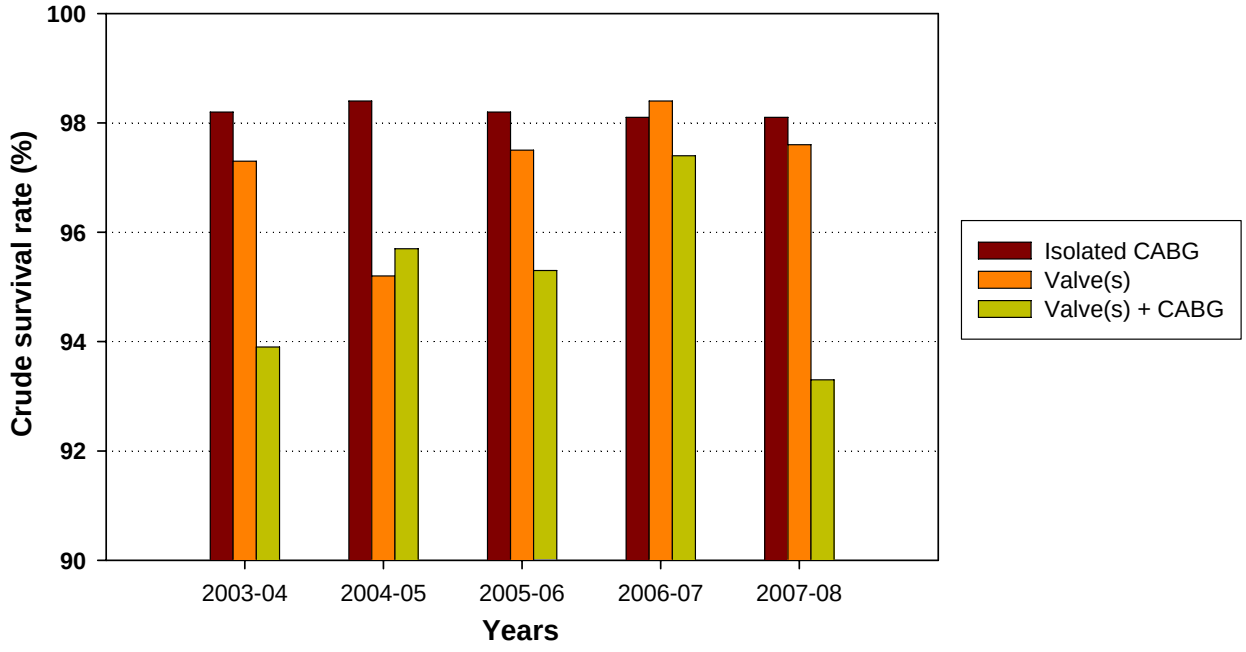
It is important to remember that individuals undergoing these operations have serious heart conditions and are generally in poor health. They are in great risk of complications following surgery compared to people in good health. Additionally, older age increases the risk of surgery.

Mortality rates from cardiac surgery

The mortality rates associated with cardiac surgery include deaths in hospital or within 30 days following surgery. Of the patients who had isolated CABG or isolated valve surgery in the past financial year, 98 of 100 survived. However of those who had a combination of valve and coronary operations, 93 of 100 survived after surgery.

The overall survival rate for isolated CABG has remained unchanged over the past five years. The survival rates for isolated valve surgery decreased slightly (approximately 1%) from 2006-07 to 2007-08. Notably, the survival for the combination of valve and CABG surgery was approximately 4% lower than the previous financial year. This information is presented in Figure 3.

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



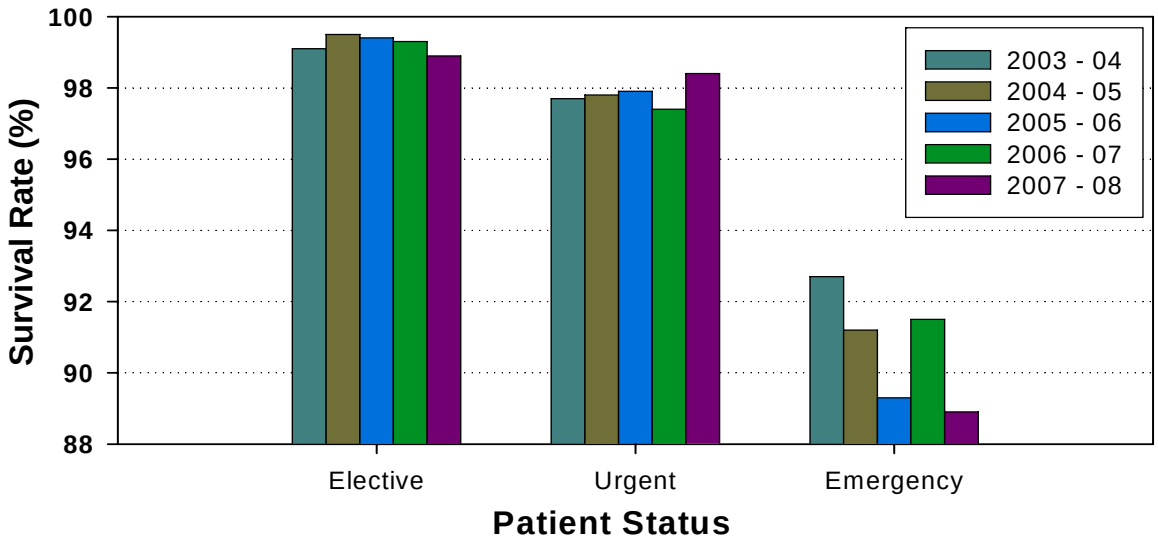
Factors affecting the outcome of CABG

The remainder of the report focuses on patients undergoing isolated CABG procedures. This is the most common operation performed, with very detailed information available from each hospital.

1. **Clinical Urgency.** As the urgency of the surgery increases so does the risk (Figure 4). In an ideal situation, the heart condition will be diagnosed with enough time for planned surgery. However, the reality is that patients present with varying degrees of urgency. Cases presenting to Victorian Public Hospitals for cardiac surgery in 2007-08 included:

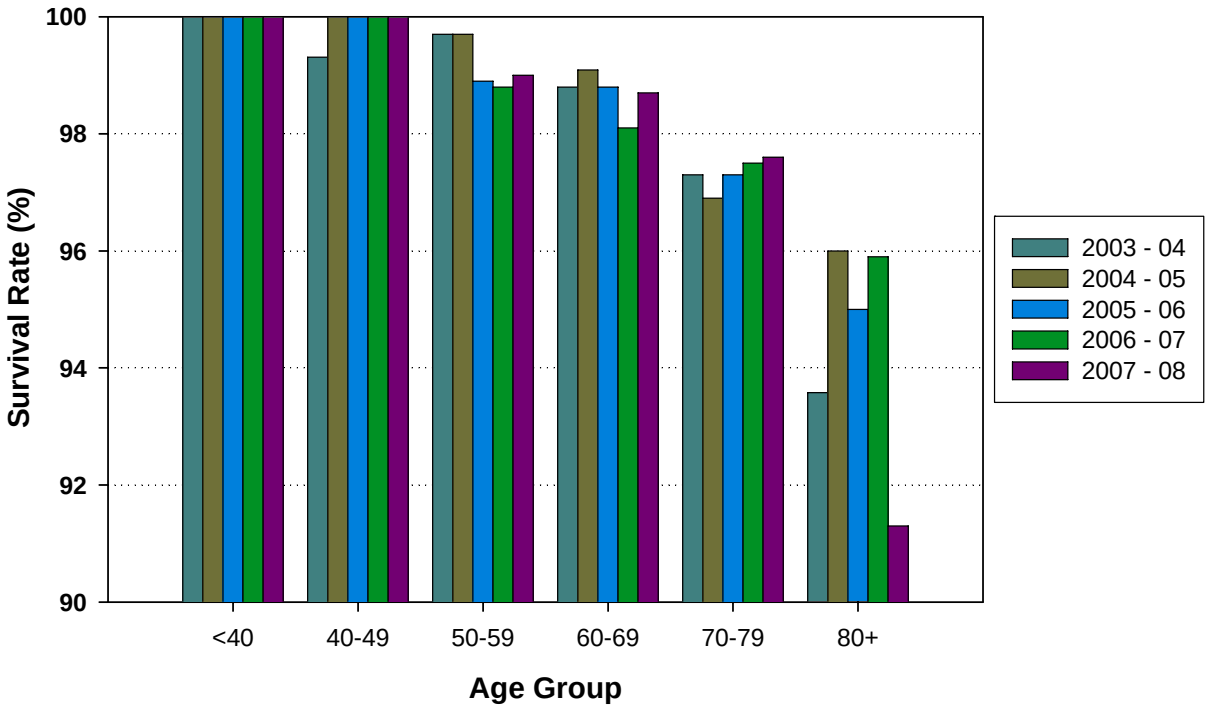
   - 47% presented as elective patients, the safest group, almost 10% fewer than in 2006-07;
   - 48% were urgent cases, slightly higher than last financial year and;
   - 5% presented as an emergency (necessitating surgery on the same day)
   - Only 2 cases or 0.1% total patients for 2007-08 year were 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. There was a marginal improvement in survival of Urgent cases by 1%. However, a reduction in survival by 2.6% of Emergency cases from the previous financial year was observed.

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



2. **Age.** An increase in age can dramatically influence a patient's survival. Figure 5 shows survival rates for people who had isolated CABG as an elective procedure. Over the past five years, the survival rates have not changed for those aged <40 to 79. However, there was a reduction of approximately 5% in survival rate in the over 80 year group from 2006-07 to 2007-08. Those seven patients had a high risk-profile. Five of the seven were urgent or emergency patients, four had unstable angina and six had extensive coronary disease.

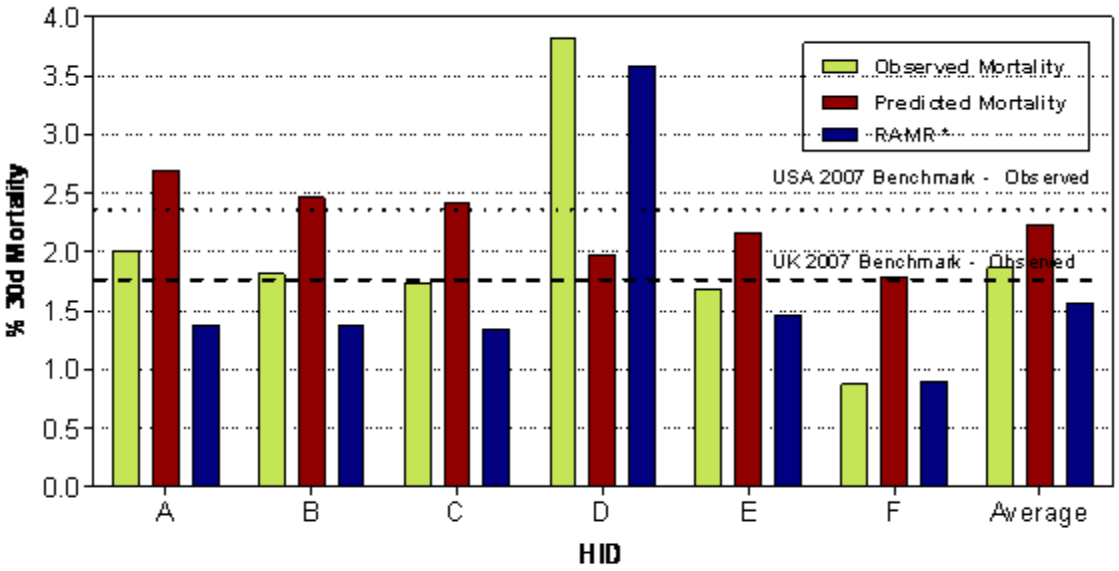
Figure 5: Survival rate for elective isolated CABG, in relation to patient age



Do outcomes differ at different hospitals?

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

Figure 6A: Mortality rate within 30 days following Isolated CABG, for the six Victorian Public Hospital Cardiac Surgery Units during 2007 - 08



Risk Ajusted Mortality Rate using the AUSCORE 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 such as age and urgency of surgery should be considered. Those patient characteristics will vary between hospitals. Therefore, Risk-Adjustment is a method for comparing mortality between hospitals.

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

Hospital D is singular in that its predicted mortality is lower than observed, suggesting that it’s observed mortality was greater than predicted. Furthermore, its RAMR is higher than the group average.

However Figure 6B indicates that statistically, its performance is within acceptable limits. Nonetheless that unit concerned has been reviewed.

Figure 6B: 95% Confidence Intervals for Risk-Adjusted 30-day Mortality Rate for all 6 Victorian Units during 2007- 08 financial years

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

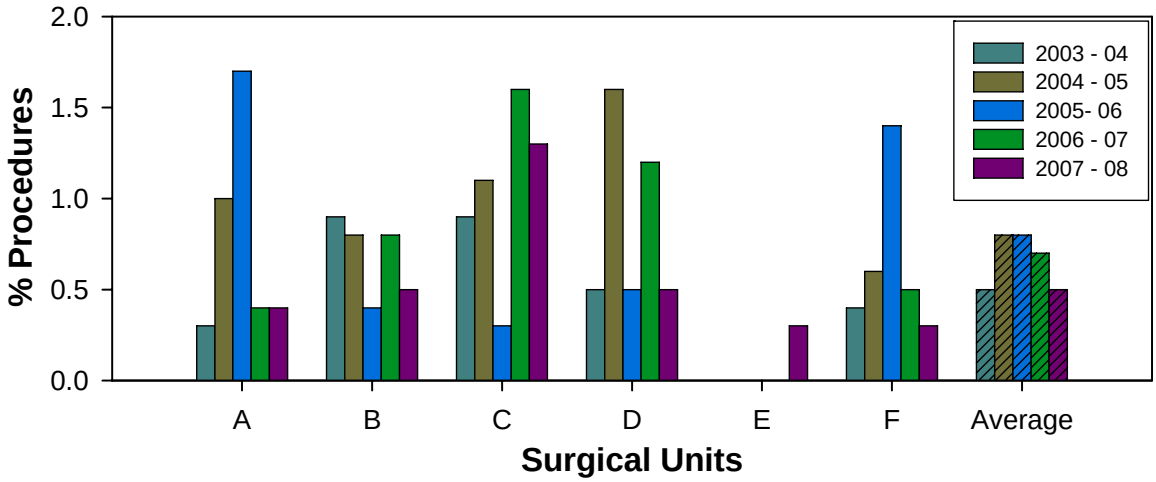
Complications of surgery

Deep sternal wound infection is a rare but serious complication of CABG surgery with the average occurrence for Victorian Cardiac Surgery Units being 1.0% for 2007-08 or a total of 15 patients (Figure 8). Over the past five years, about half of the deep sternal infections were diagnosed during admission for CABG surgery and half were re-admitted due to deep sternal infection (Figure 7 and 8).

Post-operative haemorrhage necessitating a return to the operating theatre occurred in 53 out of 1555 patients undergoing isolated CABG or 3.4% (Figure 9).

Unit E had a relatively low rate of deep sternal infections for the past five years and Unit C has a low rate of post-operative haemorrhage.

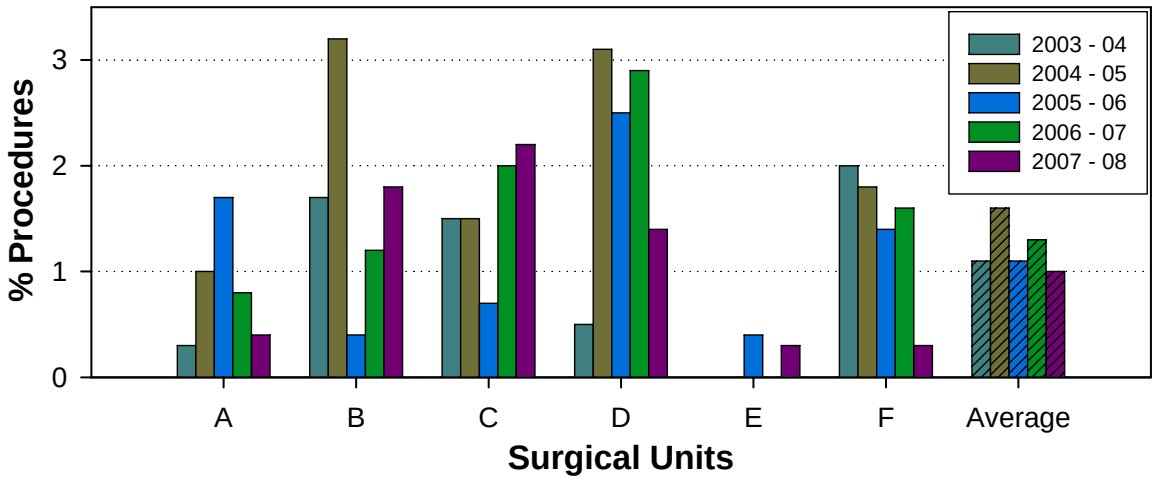
Figure 7: Deep Sternal Infections at hospital discharge following isolated CABG



	A	B	C	D	E	F	Average
Number of cases	1	1	3	1	1	1	8*

* 2007-2008 Total

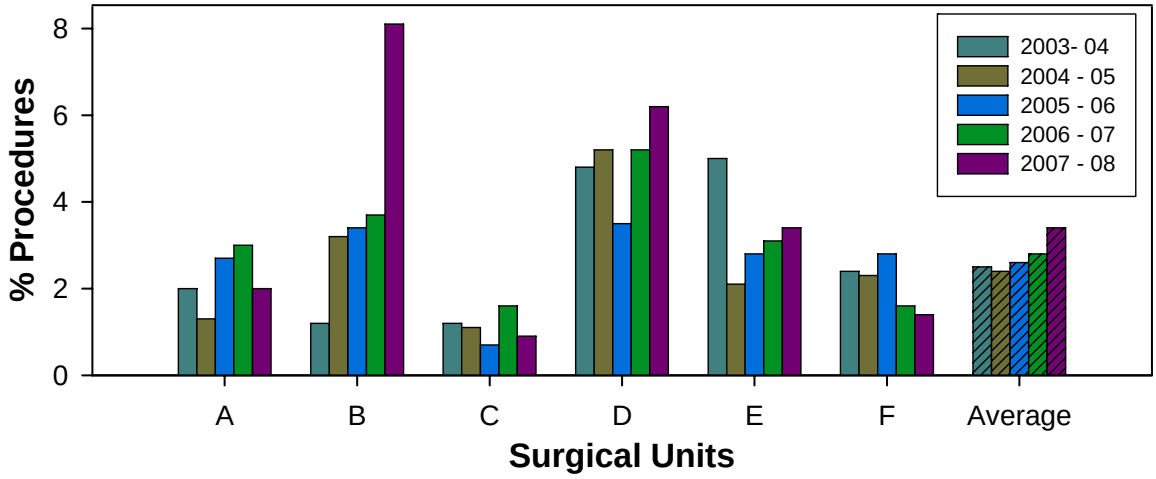
Figure 8: Deep Sternal Infections within 30 days following isolated CABG



	A	B	C	D	E	F	Average
Number of cases	1	4	5	3	1	1	15*

* 2007-2008 Total

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



	A	B	C	D	E	F	Average
Number of cases	5	18	2	13	10	5	53*

* 2007-2008 Total

Mechanical Ventilation and Length of Stay

Mechanical ventilation - equipment to support and assist breathing - is generally required following surgery. The median ventilation time following an isolated CABG procedure was 10 hours during 2007-08. The length of time a patient requires ventilation assistance depends on the extent and complexity of the cardiac surgery performed, the patient's age, the presence of obesity and of pre-existing respiratory disease.

Patients will usually spend a period of time in the Intensive Care Unit (ICU) following their procedure. The median ICU time following a CABG procedure was 25 hours during 2007-08. The length of time a patient spends in ICU is also dependent on the patient's condition. The most common reason for an extended period in ICU is the need for a longer-than-usual period of time on mechanical ventilation.

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 2007-08 financial year.

PLEASE NOTE: minor discrepancies between the report from the In-House reporting module and the Comprehensive Surgeon's Report are the result of differences in filtering processes prior to analysis whereby cases are excluded.

MONASH University
Medicine, Nursing and Health Sciences

Web Report for Surgeon or Cardiac unit by date range

Report By Cardiac Unit : [VIC]

Selected Date Range 01/07/2007 to 30/06/2008

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

Summary

Number of patients	2629	Salvage	8
Number of procedures	2646	Redo	205
Average Age	65.32	Second procedure	170
Male / Female	1925 / 704	Hospital Mortality	84
Elective	1386	30-day Mortality	76
Urgent	1085	Readmission	335
Emergency	167		

Table 1 Surgery Type

	Total number of procedures		Mortality (30 days post op) by procedure	
Surgery type (mutually exclusive)	Number of procedures	% of total procedures	Number of patients	% of Surgery Type
Isolated CABG	1556	58.81 %	29	1.86 %
Valve(s) only	383	14.47 %	9	2.35 %
Valve(s) + CABG	283	10.70 %	19	6.71 %
Other	424	16.02 %	19	4.48 %
All Procedures	2646	100.00 %	76	2.87 %

Note: There are an additional 4 procedures compared with the 2007-08 Annual Report due to additional entry of cases following data lock-down in October 2008.

Isolated Coronary artery surgery

Number of patients	1554	Total Radial Anastomoses	1188
Number of procedures	1556	Single Radials	836
Male / Female	1217 / 337	Double Radials	355
Stable/Unstable Angina	880 / 509	GEPA Anastomoses	0
Clinical Status: Elective	725	Graft Numbers:	
Urgent	748	6-graft	24
Emergency/Salvage	83	5-graft	154
Redo	40	4-graft	461
Offpump	42	3-graft	617
Total no. of arterial graft	1539	2-graft	254
Mean no. of arterial graft	3.34	1-graft	41
LIMA	1295	30 day Mortality	29
RIMA	13	30-day Mortality by elective	8
BIMA	184	30-day Mortality by urgent	12
Total IMA Anastomoses	1493	30-day Mortality by emerg/sal	9
Total SVG Anastomoses	848		

Isolated Coronary artery surgery - Complications

Return to theatre	94	Pulmonary:	
Valve dysfunction	0	Prolonged Vent	186
Graft occlusion	2	Re-intubation	50
Reop Deep sternal inf	6	Pneumonia	92
Bleeding	53	Neurologic:	
Other cardiac	11	Stroke Permanent	12
Other non-cardiac	28	Stroke Transient	7
Deep Sternal Infections	15	Septicaemia	9
Renal failure	82	Anticoagulant complications	4
Haemofiltration	24	GIT complications	13
Peri-op AMI	9	Multi system failure	13
Peri-op Cardiogenic Shock	0	Inotrope use:	
New Cardiac Arrhythmia	517	> 4 hrs	681
Heartblock	2	low CO	432
Cardiac arrest	24	low SVR	270
Atrial Arrythmia	488		
Ventricular tachycardia	26		

Isolated Coronary artery surgery - Performance Indicators

Length of Stay (median)	9	Ventilation hours (median)	10
Post-procedure Length of Stay (median)	6	30-Day Sternal Infection	0.97 %
ICU hours (median)	25	Reop for bleeding	3.41 %
		30 Day Mortality	1.87 %

Valve(s) Surgery alone

Number of patients	383	Mitral valve replacement	45
Number of procedures	383	Mechanical	29
Male / Female	225 / 158	Tissue	16
Redo	35	Mitral valve repair	44
Aortic valve replacement	225	Aortic & Mitral	22
Mechanical	63	Mitral & Tricuspid	11
Tissue	162	30-day Mortality	9

Valve(s) Surgery alone - Complications

Return to theatre	30	Pulmonary:	
Valve dysfunction	2	Prolonged Vent	52
Graft occlusion	0	Re-intubation	13
Reop Deep sternal inf	0	Pneumonia	17
Bleeding	9	Neurologic:	
Other cardiac	8	Stroke Permanent	3
Other non-cardiac	13	Stroke Transient	3
Deep Sternal Infections	1	Septicaemia	5
Renal failure	32	Anticoagulant complications	3
Haemofiltration	11	GIT complications	8
Peri-op AMI	1	Multi system failure	7
Peri-op Cardiogenic Shock	0	Inotrope use:	
New Cardiac Arrhythmia	140	> 4 hrs	148
Heartblock	10	low CO	87
Cardiac arrest	3	low SVR	61
Atrial Arrythmia	125		
Ventricular tachycardia	7		

Valve(s) Surgery alone - Performance Indicators

Length of Stay (median)	9	Ventilation hours (median)	10
Post-procedure Length of Stay (median)	7	30-Day Sternal Infection	0.26 %
ICU hours (median)	27	Reop for bleeding	2.35 %
		30 Day Mortality	2.35 %

CABG and Valve(s) Surgery

Number of patients		282		
Number of procedures		283	CABG and MVR	21
Male / Female	193 /	89	CABG and AVR and MVR	1
Redo		2	CABG and MV repair	35
CABG and AVR		214	30-day Mortality	19

CABG and Valve(s) Surgery - Complications

Return to theatre	35	Pulmonary:	
Valve dysfunction	1	Prolonged Vent	77
Graft occlusion	0	Re-intubation	21
Reop Deep sternal Inf	2	Pneumonia	34
Bleeding	16	Neurologic:	
Other cardiac	5	Stroke Permanent	5
Other non-cardiac	13	Stroke Transient	0
Deep sternal infection	4	Septicaemia	7
Renal failure	44	Anticoagulant complications	4
Haemofiltration	22	GIT complications	12
Peri-op AMI	1	Multi system failure	10
Peri-op Cardiogenic Shock	0	Inotrope use:	
New Cardiac Arrhythmia	109	> 4 hrs	174
Heartblock	2	low CO	133
Cardiac arrest	6	low SVR	54
Atrial Arrythmia	99		
Ventricular tachycardia	8		

CABG and Valve(s) Surgery - Performance Indicators

Length of Stay (median)	10	Ventilation hours (median)	14
Post-procedure Length of Stay (median)	8	30-Day Sternal Infection	1.42 %
ICU hours (median)	46	Reop for bleeding	5.67 %
		30 Day Mortality	6.74 %

Table 2 Type of Valve Prosthesis with or without CABG

	AVR	MVR	TVR	PVR
Mechanical	80	37	0	0
Bioprosthesis	358	29	2	1
Allograft	1	0	0	8
Autograft	5	0	0	0
Total	444	66	2	9

Mitral valve repair (ring/band)	79	Tricuspid valve repair (ring/band)	5

Table 3 Other surgery types

Surgery type (mutually exclusive)	Number of procedures	30-day Mortality
Aortic Procedure	119	8
Aneurysm - Asc Only	68	1
- Arch Only	1	1
- Desc	1	0
- Thor/Abd Only	4	0
Dissection - Asc - Acute	29	3
- Asc - Chronic	8	1
- Desc - Acute	1	1
- Desc - Chronic	1	0
Acute Traumatic Aortic Transection	0	0
Carotid Endarterectomy	1	0
Lung Resection	0	0
Left Ventricular Aneurysm	12	1
Acquired VSD	4	1
Congenital ASD	35	0
Cardiac Trauma	4	0
LVOT Myectomy for HOCM	15	0
LV Rupture Repair	2	0
Pericardiectomy	3	0
Pulmonary Thrombo-endarterectomy	0	0
Left Ventricular Reconstruction	1	0
Pulmonary Embolectomy	0	0
Cardiac Tumour	22	0
Cardiac Transplant	29	1
Congenital Other	18	1
Permanent LV Epicardial Lead	33	1
Atrial Arrhythmia Surgery	59	0
Others	60	4

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:

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

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.