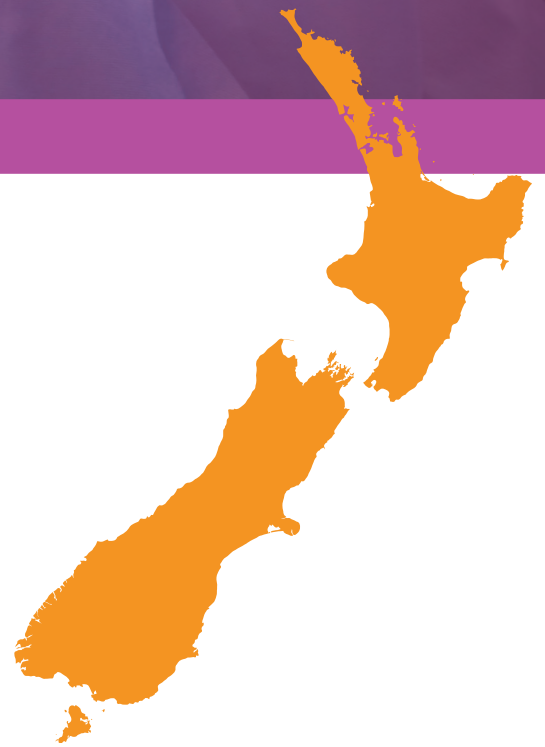


2018

ANNUAL REPORT



Cardiac surgery in New Zealand public hospitals



Suggested citation: The New Zealand National Cardiac Surgery Clinical Network. Cardiac Surgery in New Zealand Public Hospitals. 2018 Annual Report; Report Number 4.





Introduction

In 2015 New Zealand surgeons produced the first comprehensive publicly available report of national cardiac surgical outcomes. Now in the fourth year of reporting, we are very proud to present the overall results of 2,625 open-heart procedures performed in New Zealand. This report not only represents the hard work and commitment to patient care of NZ cardiac surgeons but also highlights the work of each health care professional who cares for the patient from initial presentation to their recovery following surgery. The outcomes presented in this report are a considerable achievement for the profession and confirm our collective commitment to delivering high-quality cardiac surgical care to the NZ population. They also reinforce that cardiac surgery in NZ is performed to the highest standard and comparable to the best outcomes reported internationally.

There is an ongoing need in surgery to be transparent in the analysis and reporting of clinical outcomes, improve safety standards and reinforce the trust between clinician and patient. Collecting, analysing and reporting high quality data helps to drive quality improvement and enables the patient to understand more about the risks associated with surgery. This in turn will allow patients to make more informed decisions about their treatment within a New Zealand specific context. For the individual patient the enclosed report clearly shows the risk of different procedures and the expected risk for patients depending on their risk profile.

Surgeons across the country have willingly worked hard and committed time and effort in analysing the data over the past four years. Through continuous evaluation of the database we have ensured the data are an accurate reflection of clinical workload and outcomes and is representative of national performance. Collection and analysis of surgical outcomes is a reflective exercise and in reporting these outcomes we believe it will inspire surgeons and the broader surgical team to continually strive to improve care by questioning and refining current practice.

I am so pleased to see that over only a few years the fourth report has evolved and come a long way from the first. As the infrastructure and governance of the database matures and as the data collected grows, we can look forward to greater insight into cardiac surgical practice in NZ. Further analysis will reveal essential learning points that will help to improve and propel cardiac surgery performance and safety in our country.

Adam El Gamel

Chair New Zealand Cardiac Surgery Clinical Network

Foreword



Introductions

This is the fourth national annual report of cardiac surgical services in New Zealand (NZ). It describes the demographics, risk factors and outcomes for 2,625 patients undergoing cardiac surgery during the 2018 calendar year. It is a collaborative project undertaken by all 5 hospitals performing publicly funded cardiac surgery in NZ. The report has been collated by the registry governance group in conjunction with the NZ Cardiac Surgery Clinical Network (NCSCN). The registry captures 100% of patients having publicly funded surgery in NZ and is contributed to by all vocationally registered cardiothoracic surgeons in NZ.

As with any newly established registry the initial few years of data collection focus on ensuring data quality, streamlining process for data collection, interrogation of the dataset for completeness and quality and ensuring appropriate governance structures and reporting practice are in place. Our registry by international standards is still in its infancy and over the last 5 years the NCSCN has worked on unifying IT structures, data collection practices and completeness of the dataset so that the quality of data has continued to improve. This is evidenced by over 99% of patients in the 2018 report having all mandatory data fields completed. As the registry continues to evolve and we look to develop more sophisticated reporting tools we have established a data governance group that works in conjunction with the NCSCN and is charged with the day to day running of the programme.

The annual report presented here whilst showing a snapshot of all patients having cardiac surgery focuses outcome reporting on the two largest groups of patients having surgery those being isolated CABG and isolated AVR. When combined, these two cohorts represent approximately 60% of the cases in the annual report. These are the two operations used for reporting purposes in comparable international cardiac surgical registries as these two procedures are performed in the highest volume and frequency and therefore are the most appropriate procedures for benchmarking outcomes. Throughout the report we will be comparing results to previous NZ reports and will also reference benchmark outcomes to those published by Australian and New Zealand Society of Cardiac and Thoracic Surgeon (ANZSCTS). ANZSCTS report outcomes for public and privately funded cardiac surgery performed in 37 cardiac surgical units in Australia and is the most appropriate registry for comparing and benchmarking NZ outcomes to. Within this report the observed mortality, morbidity for patients and the key performance indicators for cardiac surgical procedures performed in NZ is comparable to that reported by ANZSCTS and other international cardiac surgical registries.

Sean Galvin

**Chair, New Zealand Cardiac Surgery Registry Governance Group
on behalf of the New Zealand Cardiac Surgery Clinical Network**



Acknowledgement

The authors of this report would like to acknowledge all those who contributed to the collection and review of data and the production of this report. Along with those named below we are grateful to all the doctors and nurses who helped with the collection of data, the database managers who curate the registry at a local level at each of the DHBs and to the staff of the Ministry of Health and Robin Kinsman & Peter Walton from Dendrite Clinical Systems who helped with production of this report.

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- **Dominic Parry** Cardiothoracic Surgeon, Southern DHB.
- **Harsh Singh** Cardiothoracic Surgeon, Canterbury DHB.
- **Sean Galvin** Cardiothoracic Surgeon, Capital and Coast DHB.
- **Adam El Gamel** Cardiothoracic Surgeon, Waikato DHB.
- **David Haydock** Cardiothoracic Surgeon, Auckland DHB.
- **Alastair M'George** Intensivist, Auckland DHB.
- **Kevin Murray** Consumer Representative.
- **Jenna Turton-Lane** Database Manager Representative.
- **Gerry Devlin** Cardiologist, Chair National Cardiac Clinical Network.
- **Nik Straugheir** Ministry of Health.
- **Susan Wells** Network Coordinator
- **Charlotte Allin** NZ Project Manager, Dendrite Clinical Systems



All images of cardiac surgery provided by Louise Goossens.

Introduction

The New Zealand Cardiac Surgery Registry collects demographic, clinical and outcome data on all patients having publicly funded cardiac surgery in NZ. The registry aims firstly to improve quality of care for cardiac patients by allowing appropriate comparison of clinical performance with National and International standards, and secondly to provide useful data on changing trends within the specialty.

All data is collected using Dendrite Clinical Systems' cardiac database software and using pre-agreed data definitions that are in keeping with other comparable registries. The minimum mandatory dataset for collection is included in Appendix 1. All vocationally registered cardiothoracic surgeons in NZ from the five public hospitals performing cardiac surgery contribute data to the registry and are made up of:

1. Dunedin Public Hospital / Southern DHB.
2. Christchurch Public Hospital / Canterbury DHB.
3. Wellington Regional Hospital / Capital and Coast DHB.
4. Waikato Hospital / Waikato DHB.
5. Auckland City Hospital / Auckland DHB.

The 2018 report presents an overview of patients having cardiac surgery in public hospitals in New Zealand between 1 January and 31 December 2018. The first part of the report gives an overview of all patients having surgery and then we discuss the two index procedures chosen for in depth analysis, isolated CABG and isolated AVR. These two procedures account for 60.5% of all patients having cardiac surgery in NZ (47.1% isolated CABG and 13.4% isolated AVR). It is important when choosing a procedure for detailed analysis that it is performed with sufficient frequency that the outcomes seen are representative of true outcomes and not just due to the statistical variance that is seen when reporting on low volume less frequently performed procedures. For the purpose of reporting in most international registries CABG is chosen as the procedure for benchmarking, reporting and comparing surgical outcomes. CABG in particular is a procedure performed by all cardiac surgeons and surgical units in NZ to a large enough volume that it allows detailed analysis of outcomes.

The 2018 report is broken up into the following areas of reporting.

- **Section 1:** Overview and key messages from the 2018 report.
- **Section 2:** Isolated CABG with detailed patient characteristics and outcomes.
- **Section 3:** Isolated AVR with detailed patient characteristics and outcomes

In 2018 we have begun to tease out some of the more important patient characteristics and the impact they may have on post-operative outcomes. In particular we have started to look at the effects of age, sex, ethnicity, obesity, smoking and diabetes on intervention rates and post-operative outcomes.

Obesity, smoking status and diabetes in particular are major risk factors for post-operative complications. In general the risk of complications such as infection, stroke, renal failure and prolonged length of hospital stay are all influenced and their incidence increased by these risk factors. We hope that in 2019 and beyond we will be able to further dive into these areas to look at trends in treatment and complications and also to highlight areas for focusing quality improvement.

Benchmarking outcomes

For the purpose of comparing and benchmarking the New Zealand outcomes we have compared results to the ANZSCTS public report from 2018¹. The ANZSCTS database currently collects information on approximately 14,000 patients having cardiac surgery *per year* in 41 participating centres. The ANZSCTS database has prospectively collected clinical information and outcome data on a total of 145,000 patients since its inception. The 2018 report includes data on 62, 839 patients collected between 2014 and 2018.

Key performance indicators

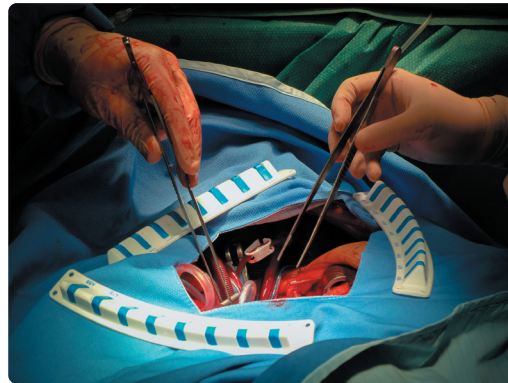
Key performance indicators (KPIs) for reporting have been chosen as they represent the adverse outcomes that significantly effect patient recovery and quality of life. These KPIs are also reported in keeping with the practices of other international registries such as ANZSCTS. For the purpose of the NZ report the specific KPIs selected for the report include:



- Mortality in hospital and 30-day mortality.
- Permanent stroke.
- New onset atrial fibrillation.
- Deep sternal wound infection.
- Return to theatre for bleeding.
- Readmission rates at 30 days post-operatively.

Expected mortality rates

EuroSCORE II (ESII) is referenced throughout the annual report². ESII is an international risk model used to assess risk in patients undergoing cardiac surgery. It was developed in 2010 by analysing risk factors and outcomes in 22,381 patients having cardiac surgery at 154 European Hospitals. This risk tool is presently used as a surrogate estimate of risk in NZ however as a historically developed modelling tool developed in Europe it has been noted to be poorly calibrated in both an Australian and NZ cohort of patients^{3,5}. Specifically, in ANZ the ES II model seems to be less accurate at an individual level in more complex patients and in particular in those having anything other than isolated CABG or valve surgery. In this report for the purpose of examining isolated CABG and isolated AVR it is a tool that we have used to risk stratify groups of patients and to compare our performance against expected outcomes. Whilst it is referenced as an overall indication of risk it does not have the degree of accuracy in a NZ cohort to confidently guide complex risk analysis at an individual patient level. Work is underway within ANZSCTS and the NCSCN to validate the ESII within our registry patients and to recalibrate the model to better guide risk analysis at a local NZ level.

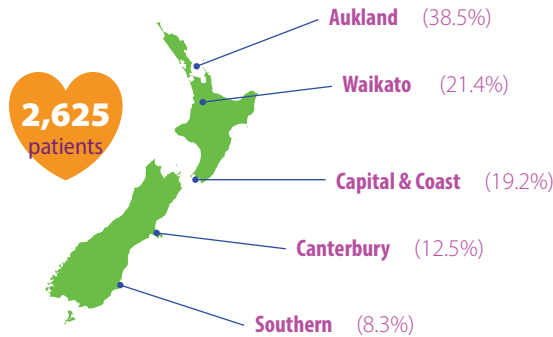


1. Mr Gilbert Shardey, Dr Jenni Williams-Spence, Dr Lavinia Tran, Mr Noah Solman, Ms Jenna McLaren, Mrs Nicole Marrow, Ms Angela Brennan, Professor Rob Baker, Mr Andrew Newcomb and Professor Christopher Reid on behalf of the ANZSCTS Database. The Australian and New Zealand Society of Cardiac and Thoracic Surgeons Cardiac Surgery Database Program National Annual Report 2018. Monash University, DEPM, August 2019. Report No 12.
2. Samer AM et al. EuroSCORE II. *European Journal of Cardio-Thoracic Surgery*. 2012; **41(4)**: 734–745.
3. Singh N et al. Assessment of the EuroSCORE II in a New Zealand Tertiary Centre. *Heart, Lung and Circulation*. In Press 2018
4. Galvin S et al. Report to New Zealand Cardiac Surgical Network November 2018. 2018
5. Billah B, Reid CM, Shardey GC & Smith JA. A preoperative risk prediction model for 30- day mortality following cardiac surgery in an Australian cohort. *European Journal of Cardiothoracic Surgery*. 2010; **37**: 1086-1092.

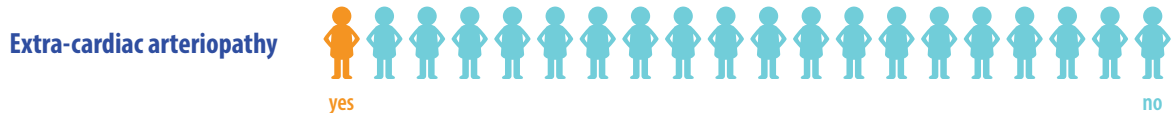
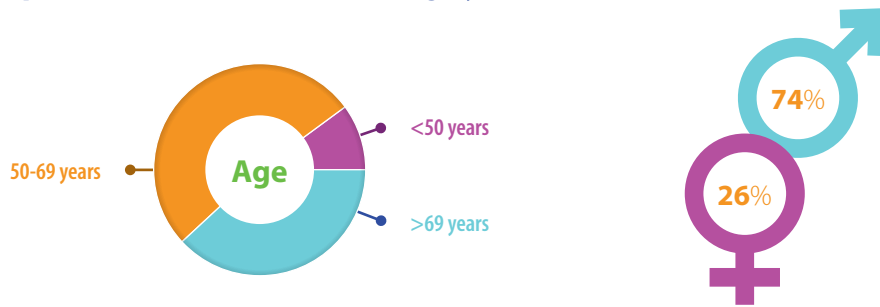
Summary infographics

Number of adult cardiac surgery operations in New Zealand in 2018

Infographics

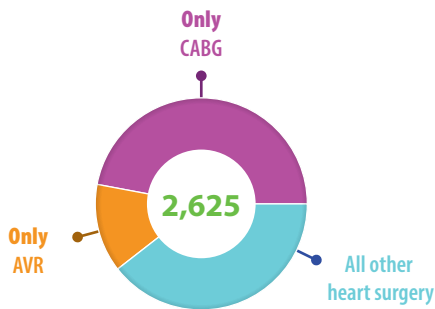


Our patients' characteristics before surgery





The kind of cardiac surgery performed



Pre-operative mortality risk assessment

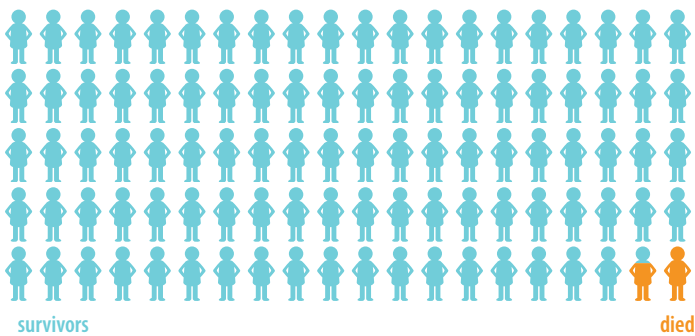


Outcomes after common kinds of cardiac surgery

Mortality in-hospital after surgery

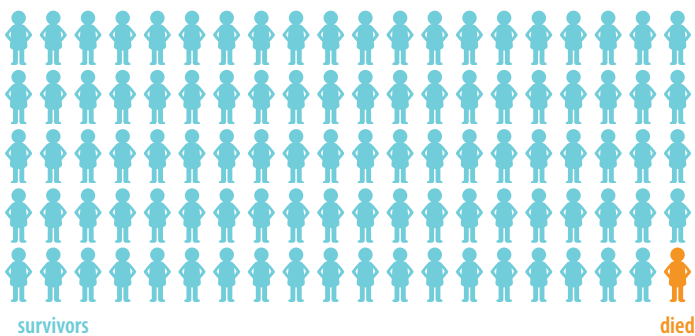
Isolated CABG

1.7% observed mortality rate



Isolated AVR

0.9% observed mortality rate



Ventilation



Isolated CABG **7 hours**
Isolated AVR **6 hours**

ICU



Isolated CABG **24 hours**
Isolated AVR **24 hours**

Hospital stay after surgery



Isolated CABG **6 days**
Isolated AVR **6 days**

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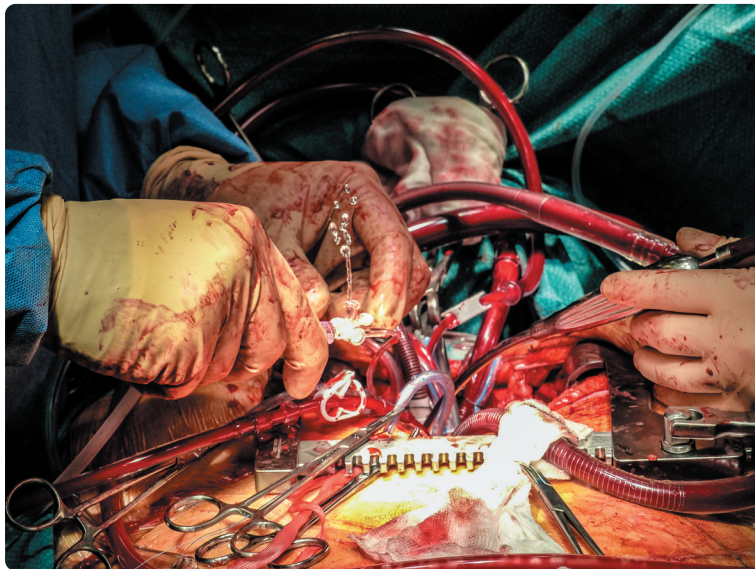
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Overview of the people who had cardiac surgery

The first part of this report focuses on the risk factors of all patients presenting for cardiac surgery regardless of operation performed. It gives an overview of the total workload for cardiac surgical services in New Zealand including the types of operation performed and patient age, ethnicity, risk profile and comorbidity. The breakdown of types of procedure performed is specified in Table 06.

Key messages

In the 12-month period 1 January to 31 December 2018 a total of 2,625 cardiac surgical procedures were performed across the five publicly-funded cardiac surgery centres (Table 01). This compares to 2,764 procedures in 2015, 2,807 procedures in 2016 and 2,727 procedures in 2017. During 2018 a decrease in the volumes of surgery performed was observed and likely reflects the impact of industrial action and increasing pressures on ICU availability on the ability to provide cardiac surgical services nationally.

The majority of patients having cardiac surgery are male (Table 01, males 74.3%). Men tend to be over represented at a younger age. Whilst more males have surgery in each age bracket there is a greater proportion of females having surgery over the age of 70 years (Fig. 01). Maori and Pacific Islanders represent 11% and 9.3% of patients having cardiac surgery. Maori are likely under-represented in patients having cardiac surgery. It is estimated that Maori represent approximately 16% of the general NZ population in 2018¹. Pacific peoples make up 8% of the NZ population.

There is a high percentage of patients with additional cardiovascular risk factors including current smoking (9.9%), diabetes (22.2%) and hypertension (71.3%); see Table 03.

Approximately 1/3 of patients have had a previous myocardial infarction with 21% having had it in the 30-days prior to their cardiac surgery (Table 03).

A high proportion (16%) of patients have had a previous cardiac intervention with the majority of those having had previous coronary stents or angioplasty (8.5%); see Table 03.

Obesity, a major cardiovascular risk factor is endemic in this group of patients with the majority being classified as either overweight or obese. (Table 04). This is most striking in Maori and Pacific Islanders where only 14.6% of patients are classified as being in a healthy BMI group and 47.8% being classified as obese.

Diabetes which is also a major risk factor for cardiovascular disease is present in 22.2% of all patients having surgery. Again it is significantly over represented in the Maori and Pacific Island patients with 32.9% being diabetic compared to 16.6% of NZ European patients.

1. Ministry of Health. 2019. Wai 2575 Māori Health Trends Report. Wellington: Ministry of Health. Stats NZ accessed 18 Nov 2019. http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE8277&_ga=2.194126059.756707666.1573077459-495924111.1572910309#

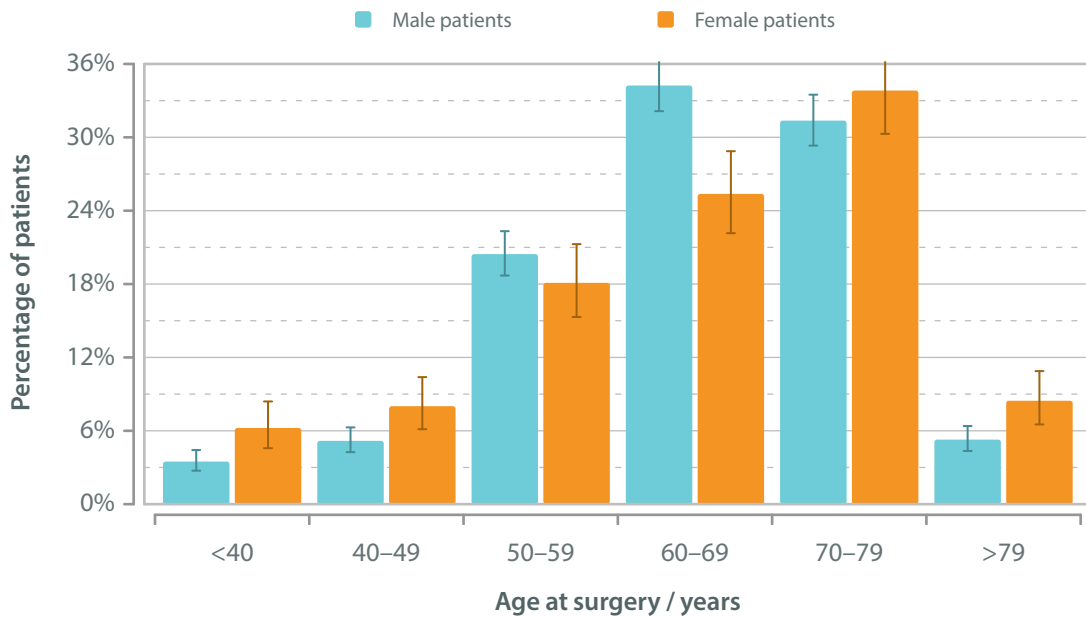
Age and gender

Database overview

Table 01 All cardiac surgery patients in 2018: age and gender

Age at surgery / years	Gender		
	Male	Female	All
<40	68 (3.5%)	42 (6.2%)	110 (4.2%)
40–49	101 (5.2%)	54 (8.0%)	155 (5.9%)
50–59	399 (20.5%)	122 (18.1%)	521 (19.8%)
60–69	668 (34.2%)	171 (25.4%)	839 (32.0%)
70–79	612 (31.4%)	228 (33.8%)	840 (32.0%)
>79	103 (5.3%)	57 (8.5%)	160 (6.1%)
Unspecified	0	0	0
All	1,951	674	2,625

Fig.01 All cardiac surgery patients: Age and gender; calendar year 2018 (n=2,625)





Ethnicity

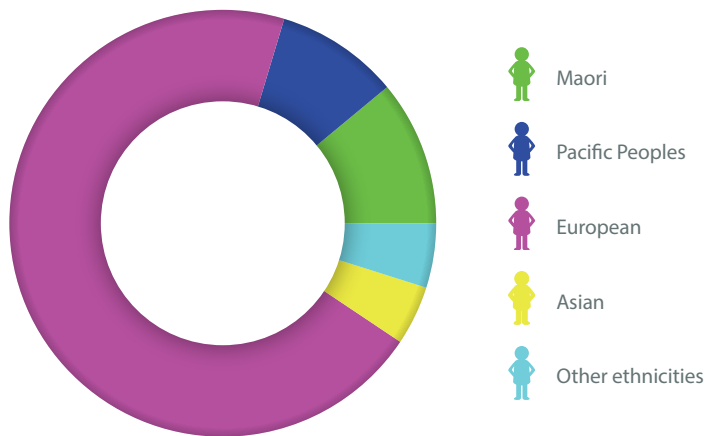
Table 02 All cardiac surgery patients in 2018: ethnicity

	Count	Percentage
Maori	289	11.0%
Pacific Peoples	245	9.3%
European	1,844	70.3%
Asian	118	4.5%
Other ethnicity	128	4.9%
Unspecified	1	
All	2,625	

Database overview

Fig. 02

**All cardiac surgery patients: Ethnicity;
calendar year 2018 (n=2,624)**



Risk factors

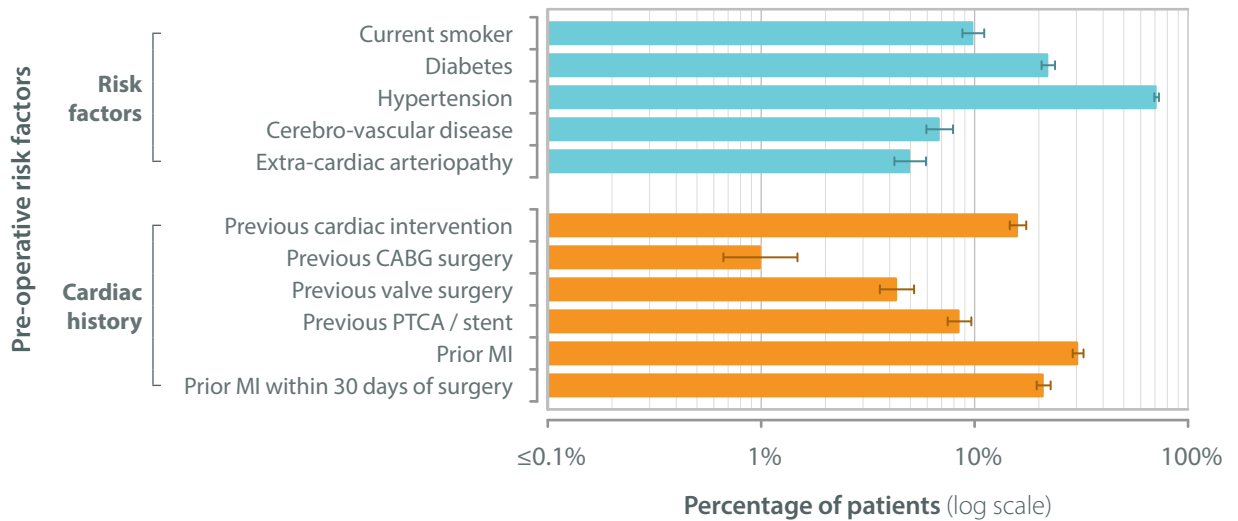
Table 03 All cardiac surgery patients in 2018: pre-operative risk factors

	No	Yes	Unspecified	Percentage with the risk factor	
Risk factors	Current smoker	2,356	258	11	9.9%
	Diabetes	2,041	581	3	22.2%
	Hypertension	751	1,869	5	71.3%
	Cerebro-vascular disease	2,441	180	4	6.9%
	Extra-cardiac arteriopathy	2,491	131	3	5.0%
Cardiac history	Previous cardiac intervention	2,203	419	3	16.0%
	Previous CABG surgery	2,583	26	16	1.0%
	Previous valve surgery	2,496	113	16	4.3%
	Previous PTCA / stent	2,399	223	3	8.5%
	Prior MI	1,821	802	2	30.6%
	Prior MI within 30 days of surgery	2,047	547	31	21.1%

Database overview

Fig. 03

All cardiac surgery patients: Risk factors; calendar year 2018



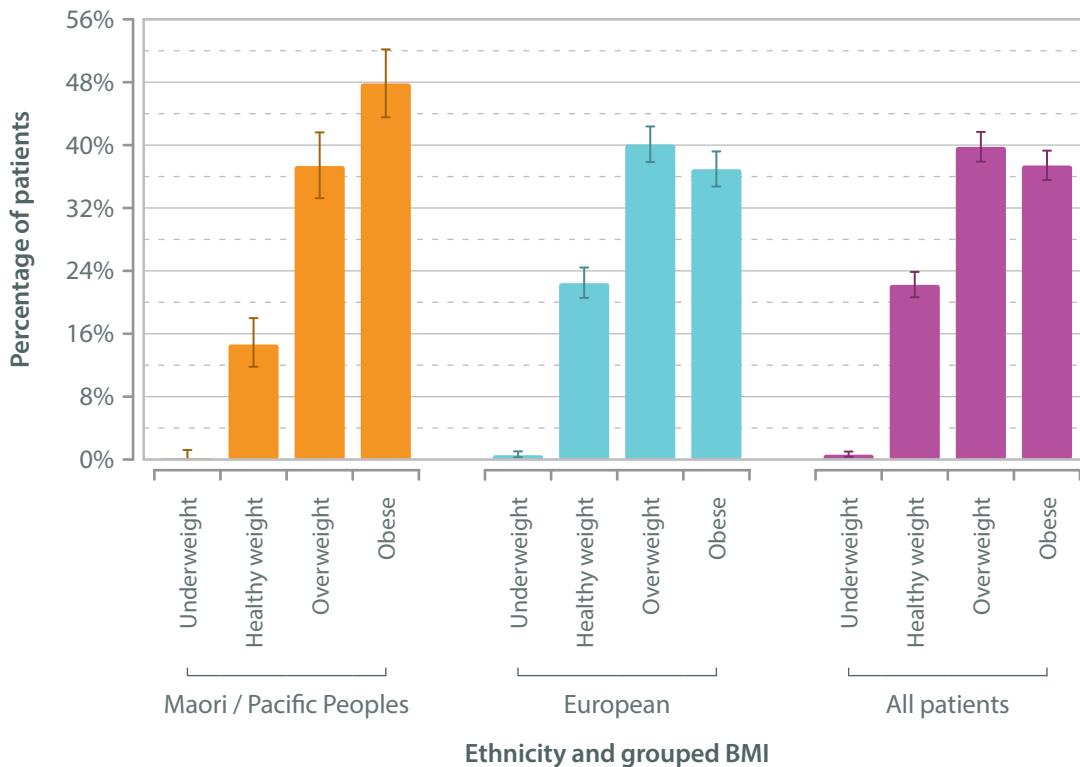


Body mass index

Table 04 All cardiac surgery patients in 2018: BMI and ethnicity

BMI group ²	Ethnicity		
	Maori / Pacific Peoples	European	All patients
Underweight	1 (0.2%)	10 (0.5%)	16 (0.6%)
Healthy weight	78 (14.6%)	413 (22.4%)	582 (22.2%)
Overweight	199 (37.3%)	738 (40.1%)	1,042 (39.8%)
Obese	255 (47.8%)	680 (36.9%)	980 (37.4%)
Unspecified	1	3	5
All	534	1,844	2,625

Fig. 04 All cardiac surgery patients: Body mass index; calendar year 2018



- The BMI categories are defined as following (in units of kg m⁻²):
Maori / Pacific Peoples: under-weight <18.5; normal weight 18.5–25.9; overweight 26.0–31.9; obese >31.9
All other ethnic groups: under-weight <18.5; normal weight 18.5–24.9; overweight 25.0–29.9; obese >29.9

Diabetes

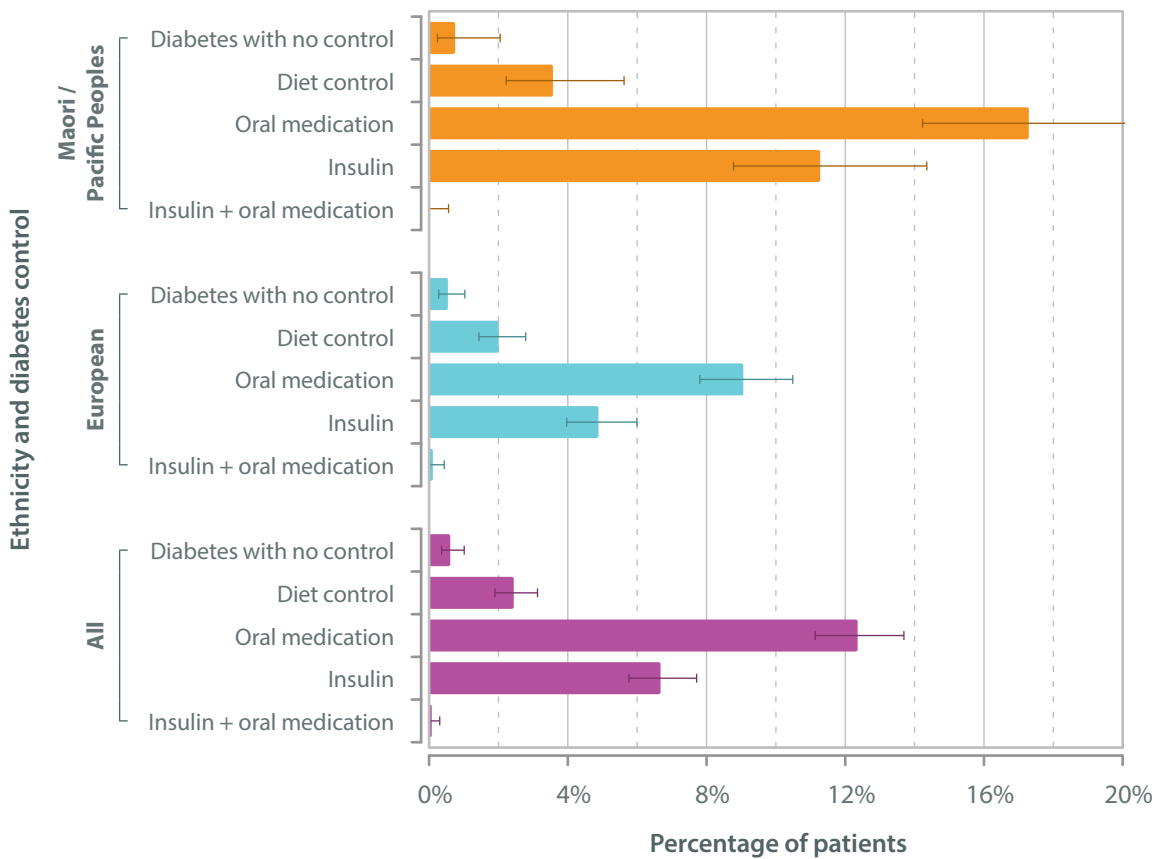
Database overview

Table 05 All cardiac surgery patients in 2018: diabetes and ethnicity

	Ethnicity		
	Maori / Pacific Peoples	European	All
No diabetes	357 (67.1%)	1,537 (83.4%)	2,041 (77.8%)
Diabetes	175 (32.9%)	306 (16.6%)	581 (22.2%)
Diabetes with no control	4 (0.8%)	10 (0.5%)	16 (0.6%)
Diet control	19 (3.6%)	37 (2.0%)	64 (2.4%)
Oral medication	92 (17.3%)	167 (9.1%)	324 (12.4%)
Insulin	60 (11.3%)	90 (4.9%)	175 (6.7%)
Insulin + oral medication	0 (0.0%)	2 (0.1%)	2 (0.1%)
Unspecified	2	1	3
All	534	1,844	2,625

Fig. 05

All cardiac surgery patients: Diabetes control; calendar year 2018





Procedures

Table 06 Procedures performed in 2018

	Count	Percentage
CABG alone	1,235	47.1%
CABG & valve	285	10.9%
CABG, valve & other	54	2.1%
CABG & other	33	1.3%
Valve alone	620	23.6%
Valve & other	234	8.9%
Other	162	6.2%
Unspecified	2	
All	2,625	

Top-level
procedure
grouping

Database overview



Isolated Coronary Artery Bypass Grafting

Coronary artery disease is the leading cause of mortality in Maori and non-Maori New Zealanders. Coronary artery bypass grafting (CABG) is a highly effective operation that improves the blood supply of the heart in people with severe coronary artery disease. Typically these patients have been assessed by a cardiologist and are not suitable candidates for percutaneous coronary intervention (stents) or other forms of treatment. The aim of the procedure is to reduce symptoms, improve quality of life, minimise the risk of a heart attack and prolong life.

The operation is the most commonly performed operation by adult cardiac surgeons. In the year 2018 a total of 1,229 patients underwent a publicly-funded isolated CABG which was 47.9% of the total volume of cardiac surgery. (Table 06). The volumes of the procedure is consistent over the past four years audited.

Information is also collected on the risk factors for coronary artery disease. These risk factors include diabetes, dyslipidaemia, high blood pressure, smoking and obesity (Table 08, Fig. 07) or a combination of them. Some people unfortunately have a genetic predisposition. Other risk factors can enhance early progression of the disease in those with a familial predisposition. They also impact on outcome in terms of complications and early recovery from heart surgery.

Key points from the 2018 report for patients undergoing CABG

The majority of patients having surgery are over the age of 60 and 34.6% of patients are over the age of 70 (Table 07, Fig. 06).

The majority of patients having CABG are males (table 7, figure 8, 82.5% males *versus* 17.5% females). This ratio is consistent with that reported by ANZSCTS with 81.9% of patients in the ANZSCTS 2018 report being male. Our data is also consistent with the finding that women present at an older age for CABG.

As expected a significant proportion of patients having CABG have risk factors including 12.1% being active smokers, 31.2% are diabetics, 79.9% are hypertensive and 39.9% of patients had a myocardial infarction in the 30 days prior to surgery (Table 08, Fig. 06).

The predicted mortality for this cohort of patients undergoing CABG using EuroSCORE II variables was 1.8%, where known.

Actual observed unadjusted mortality rates for patients undergoing first time isolated CABG remains low at 1.7% in 2018. This is comparable to previous NZ national reports with annual observed mortality of 1.5% in 2016 and 2.2% in 2017. It also is comparable to the ANZSCTS reported mortality of 1.14% and the unadjusted STS CABG mortality rate in 2018 of 2.25%.

The majority (76%) of patients having CABG were classified as low risk (ESII predicted mortality of <2%). In this group of patients the observed mortality was 0.6% compared to a predicted mortality of 1.1%. Most of the mortality occurred in higher risk patients and those who underwent urgent, emergency or salvage surgery.

Rates of deep sternal wound infection (DSWI) remain very low in New Zealand. In 2018 the incidence of DSWI was 0.4% which is lower than that seen in other international registries. ANZSCTS in 2017 reported a incidence of DSWI of 1.06% following isolated CABG. It is likely that the coordinated national effort to minimise surgical site infections (SSI) through the HQSC cardiac surgical SSI programme has contributed somewhat to this very low rate of deep sternal infections.

Ventilation times, length of ICU and post-operative length-of-stay are all within international published figures (Table 11).

Other KPIs (Table 12) are comparable to internationally reported outcomes and previous NZ Annual reports including:

- 0.8% permanent stroke *versus* ANZSCTS 0.92%.
- 3.3% return to theatre for bleeding *versus* ANZSCTS 2.51%.
- 22.6% new onset atrial arrhythmia.
- 11.4% 30-day readmission rates *versus* ANZSCTS 9.58%

Pre-operative patient characteristics

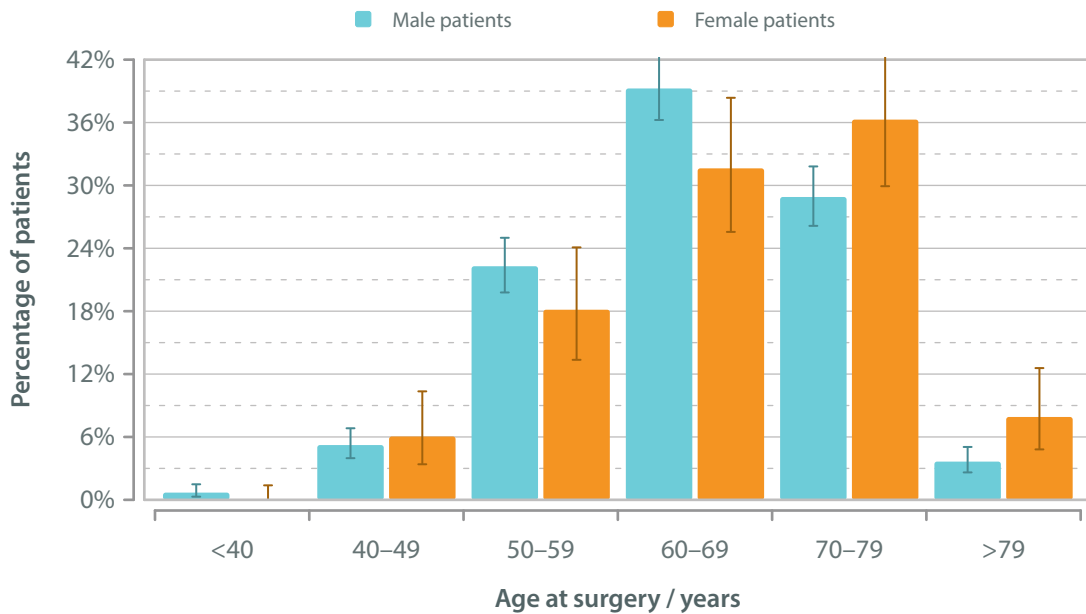
Age and gender

Isolated CABG

Table 07 First-time isolated CABG in 2018: age and gender

Age at surgery / years	Gender		
	Male	Female	All
<40	7 (0.7%)	0 (0.0%)	7 (0.6%)
40–49	53 (5.2%)	13 (6.0%)	66 (5.4%)
50–59	226 (22.3%)	39 (18.1%)	265 (21.6%)
60–69	398 (39.3%)	68 (31.6%)	466 (37.9%)
70–79	293 (28.9%)	78 (36.3%)	371 (30.2%)
>79	37 (3.6%)	17 (7.9%)	54 (4.4%)
Unspecified	0	0	0
All	1,014	215	1,229

Fig. 06 **First-time isolated CABG: Age and gender; calendar year 2018 (n=1,229)**





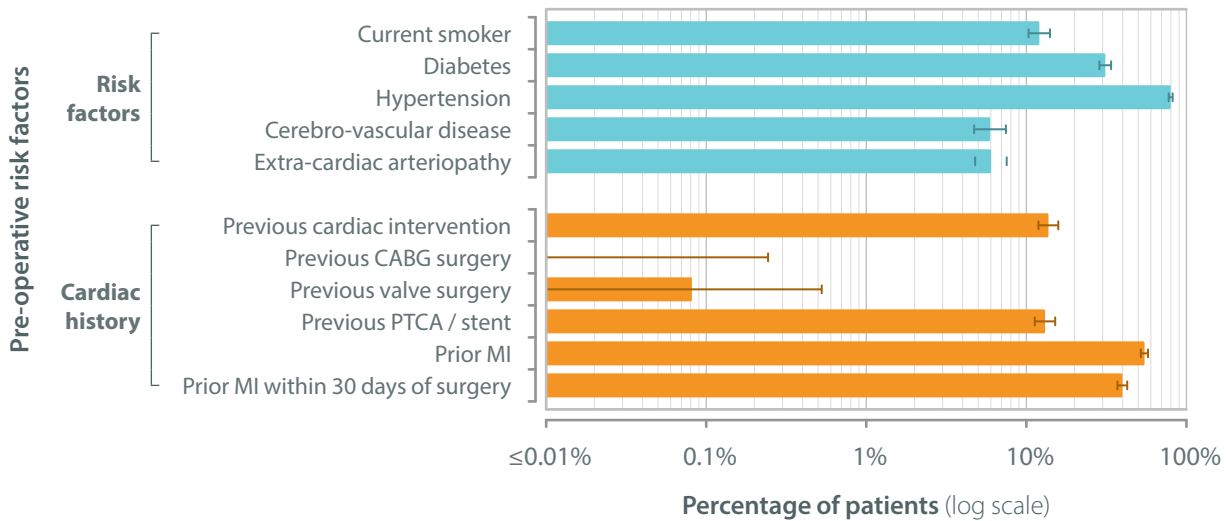
Risk factors and cardiac history

Table 08 First-time isolated CABG in 2018: pre-operative risk factors & cardiac history

	No	Yes	Unspecified	Percentage with the risk factor	
Risk factors	Current smoker	1,079	148	2	12.1%
	Diabetes	846	383	0	31.2%
	Hypertension	247	980	2	79.9%
	Cerebro-vascular disease	1,155	73	1	5.9%
	Extra-cardiac arteriopathy	1,155	74	0	6.0%
Cardiac history	Previous cardiac intervention	1,060	169	0	13.8%
	Previous CABG surgery	1,229	0	0	0.0%
	Previous valve surgery	1,228	1	0	0.1%
	Previous PTCA / stent	1,068	161	0	13.1%
	Prior MI	556	673	0	54.8%
	Prior MI within 30 days of surgery	726	481	22	39.9%

Fig. 07

All cardiac surgery patients: Risk factors & cardiac history; calendar year 2018



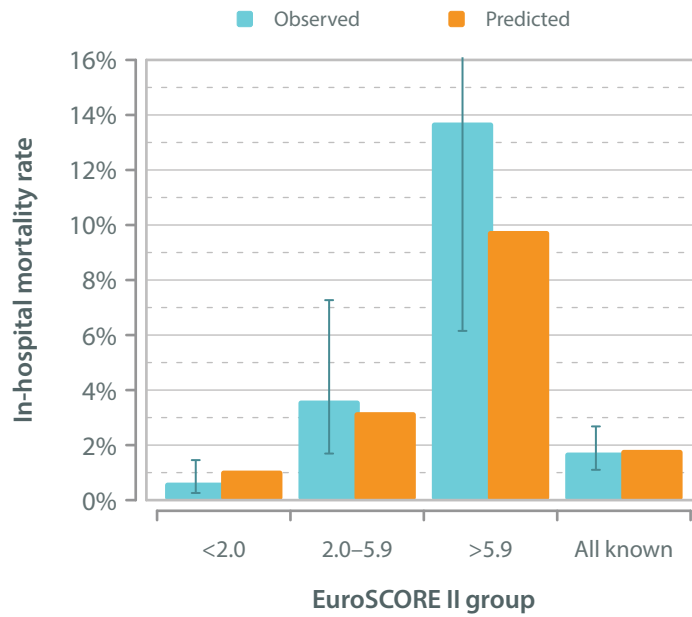
In-hospital mortality
EuroSCORE II

Table 09 First-time isolated CABG in 2018: observed and predicted in-hospital mortality; entries with known EuroSCORE data

Isolated CABG

EuroSCORE II group	In hospital mortality			Mortality rate	
	No	Yes	Unspecified	Observed	Predicted
<2.0	936	6	0	0.6%	1.1%
2.0–5.9	213	8	0	3.6%	3.2%
>5.9	44	7	0	13.7%	9.8%
All	1,193	21	0	1.7%	1.8%

Fig. 08 **First-time isolated CABG: In-hospital mortality; calendar year 2018 (n=1,214)**



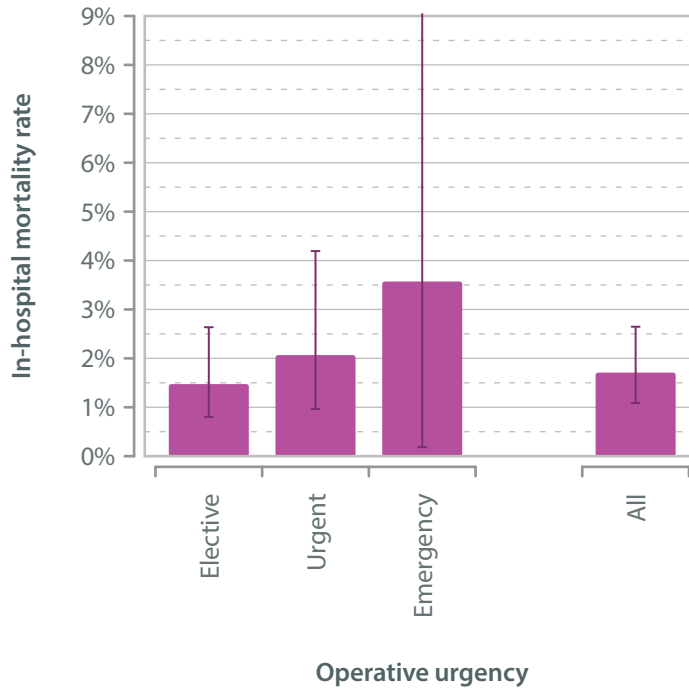


Operative urgency

Table 10 First-time isolated CABG: urgency and in-hospital mortality

	In hospital mortality			Rate (95% CI)
	No	Yes	Unspecified	
Elective	802	12	0	1.5% (0.8–2.6%)
Urgent	379	8	0	2.1% (1.0–4.2%)
Emergency / salvage	27	1	0	3.6% (0.2–20.2%)
Unspecified	0	0	0	NA
All	1,208	21	0	1.7% (1.1–2.6%)

Fig. 09 First-time isolated CABG: In-hospital survival and urgency; calendar year 2018 (n=1,229)



Quality of care
Resource utilisation

Table 11 First-time isolated CABG in 2018: hospital resource utilisation

		Count	Median	Interquartile range
Resource utilisation	Ventilation time / hours	1,212	7.0	4.0–12.0
	Time on ICU / hours	1,220	24.0	20.0–46.0
	Post-operative stay / days	1,222	6.0	5.0–7.0
	Hospital stay / days	1,225	10.0	7.0–17.0

Isolated CABG



Complications

Table 12 First-time isolated CABG in 2018: complications

	Complication			Rate (95% CI)
	No	Yes	Unspecified	
In hospital complications				
Deep sternal wound infection	1,218	5	6	0.4% (0.2–1.0%)
Return to theatre ... for any reason	1,171	58	0	4.7% (3.6–6.1%)
... for bleeding	1,188	41	0	3.3% (2.4–4.5%)
... for sternal wound infection	1,227	2	0	0.2% (0.0–0.7%)
... for non-cardiac	1,215	14	0	1.1% (0.6–2.0%)
... for other cardiac	1,224	5	0	0.4% (0.1–1.0%)
New renal failure	1,189	40	0	3.3% (2.4–4.4%)
Permanent stroke	1,216	10	3	0.8% (0.4–1.5%)
New onset atrial arrhythmia	882	257	90	22.6% (20.2–25.1%)
Peri-operative acute MI	1,221	1	7	0.1% (0.0–0.5%)
Pneumonia	1,197	28	4	2.3% (1.6–3.3%)
In-hospital mortality	1,208	21	0	1.7% (1.1–2.6%)
30-day complications				
Readmission	1,088	140	1	11.4% (9.7–13.3%)
Deep sternal wound infection	1,215	10	4	0.8% (0.4–1.5%)
Post-discharge complications				
Mortality post-discharge	1,207	1	0	0.1% (0.0–0.5%)

Isolated CABG



Aortic valve surgery

Aortic valve replacement (AVR) is undertaken to replace a diseased aortic valve. This is done with either a synthetic mechanical valve or a valve made from animal tissue. Damage to the native aortic valve leads to symptoms that may include shortness of breath, chest pain, dizziness or fainting. Internationally AVR is the most commonly performed isolated valve procedure performed by a cardiac surgeon. It is used internationally as an index procedure for benchmarking and reporting of key performance indicators and quality of care reporting.

Surgical aortic valve replacement (sAVR) is the gold standard intervention for the majority of patients with aortic valve disease and is performed by a cardiac surgical team by an incision in the chest and with the use of a heart and lung / cardiopulmonary bypass machine. The outcomes for 354 patients undergoing isolated sAVR in 2018 are presented in this report. Trans-catheter aortic valve interventions (TAVI or TAVR) are also performed in New Zealand for patients with aortic stenosis. At this time TAVR is currently performed in high-risk surgical patients and is used in a smaller patient population when compared to sAVR. The decision to perform TAVR in an individual patient is made by a multi-disciplinary team of physicians, surgeons and allied health specialists in combination with the patient and their Whanau. The outcomes of TAVR are not currently discussed in this report.

Recent reports of acceptable clinical outcomes in older low and intermediate risk patients having TAVI have emerged and it is likely that the indications for TAVI in a NZ context will broaden. However it is important to recognize that the current outcomes for all patients having surgical AVR in NZ appear to be excellent and better than those reported in similar international registries from the UK and USA. In particular an observed mortality rate of 0.4% in low risk and also in elective patients with a 1.2% incidence of all comor permanent stroke is superior to other published international figures. Ultimately long term studies on valve durability, re-intervention rates, paravalvular leak rates and requirement for permanent pacemaker in both TAVR and sAVR will help to guide treatment decisions. This highlights the need for progressing a TAVI device registry linked to the NZ cardiac surgery registry to help answer some of these questions. For the mean time, the current ANZSCTS position that in an ANZ⁴ context, all patients requiring aortic valve intervention should be discussed in a multi-disciplinary team meeting to advise on appropriate treatment options and that TAVI should not be considered in patients at low or intermediate risk with a life expectancy of greater than 10 years, seems appropriate³.

Key points for patients undergoing isolated AVR in 2018

- The majority of patients under the age of 50 years have a mechanical prosthesis. Over the age of 60 the majority of patients receive a bioprosthetic valve. 25% of bioprosthetic implants are in smaller sizes (19–21 mm) with the remainder being 23 mm or greater (Table 14; Table 15; Fig. 10).
- The gender mix of patients having AVR is different to those having CABG with 32% of patients being female (Table 16, Fig. 11).
- 8.3% of patients have had a previous cardiac intervention with 4.3% having had previous PCI or angioplasty (Table 17).
- Mortality was lower than expected in all risk groups undergoing isolated AVR in NZ. Overall observed unadjusted mortality was 0.9% with a 0.4% mortality in low risk patients who represented 76.7% of patients reported (Table 18, Fig. 12) ANZSCTS reports a mortality of 1.8% for isolated aortic valve intervention in the period 2014–2017 and 1.2% in 2018.
- The rate of return to theatre for bleeding seem elevated in the report at 6.8% (ANZSCTS 3.7%). The reason for this is unclear and will need to be monitored in the next report.
- Rates of major complications including the reported KPIs are comparable to ANZSCTS reported outcomes.
 - 0.6% deep sternal wound infection (ANZSCTS 2018: 0.83%).
 - 1.2% permanent stroke (ANZSCTS 2018: 1.04%).
 - 9.3% readmission (ANZSCTS 2018: 10.2%)

3. ANZSCTS - position statement TAVI in low risk patients 2 August 2019.

4. ANZ: Australia, New Zealand.

Type of valve surgery

Table 13 Valve surgery in 2018

Isolated AVR

		Top-level procedure classification	
		Valve alone	CABG & valve
Valves treated	Aortic alone	354	206
	Mitral alone	161	56
	Aortic & mitral	34	9
	Mitral & tricuspid	41	7
	Other valves	27	2
	Unspecified	3	5
	All	620	285



Implant prosthesis

Table 14 First-time isolated AVR in 2018: implant prosthesis

	Implant prosthesis			
	Mechanical	Bioprosthesis	Other implant	Unspecified
<50	29 (46.0%)	9 (3.5%)	0 (0.0%)	0
50–59	22 (34.9%)	19 (7.3%)	1 (100.0%)	0
60–69	11 (17.5%)	64 (24.6%)	0 (0.0%)	1
70–79	1 (1.6%)	130 (50.0%)	0 (0.0%)	0
>79	0 (0.0%)	38 (14.6%)	0 (0.0%)	0
All	63	260	1	1

Isolated AVR

Fig. 10 Isolated first-time AVR: Type of implant; calendar year 2018

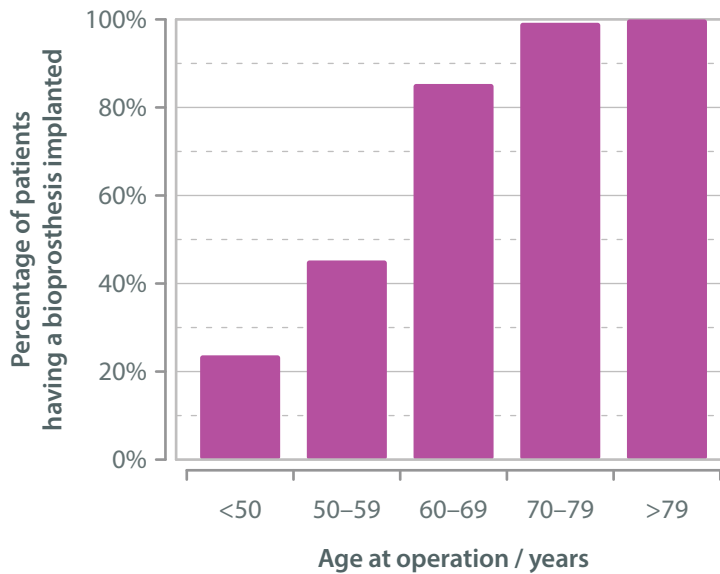


Table 15 First-time isolated AVR in 2018: implant size for bioprostheses

	Count	Percentage
19	10	4.0%
21	55	22.0%
23	74	29.6%
25	63	25.2%
>25	48	19.2%
Unspecified	10	
All	260	

Pre-operative patient characteristics

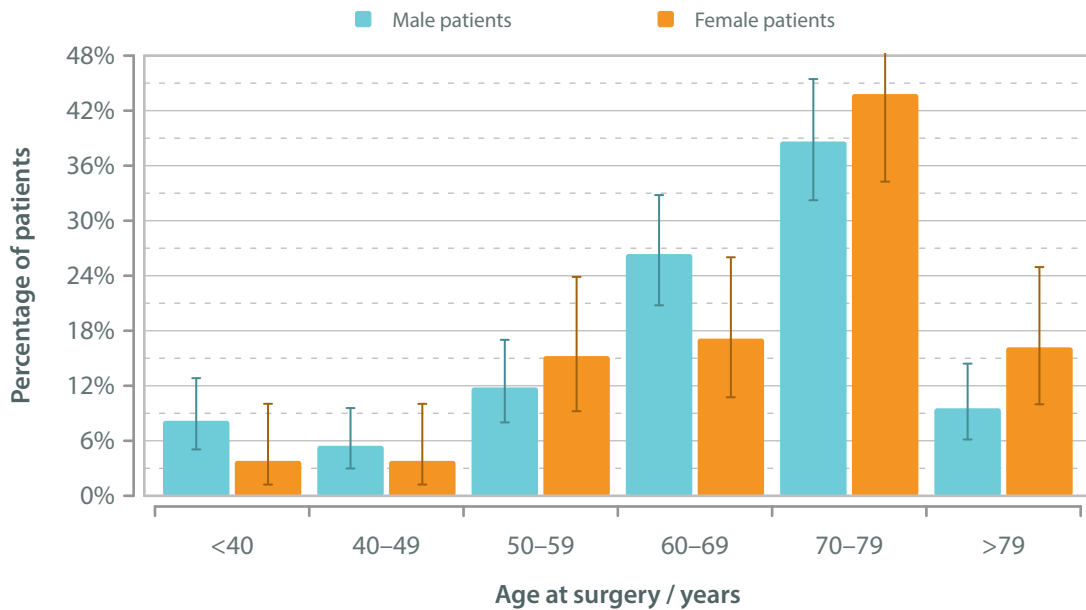
Age and gender

Isolated AVR

Table 16 First-time isolated AVR in 2018: age and gender

Age at surgery / years	Gender		
	Male	Female	All
<40	18 (8.2%)	4 (3.8%)	22 (6.8%)
40–49	12 (5.5%)	4 (3.8%)	16 (4.9%)
50–59	26 (11.8%)	16 (15.2%)	42 (12.9%)
60–69	58 (26.4%)	18 (17.1%)	76 (23.4%)
70–79	85 (38.6%)	46 (43.8%)	131 (40.3%)
>79	21 (9.5%)	17 (16.2%)	38 (11.7%)
Unspecified	0	0	0
All	220	105	325

Fig. 11 **First-time isolated AVR: Age and gender; calendar year 2018 (n=325)**





Risk factors and cardiac history

Table 17 First-time isolated AVR in 2018: pre-operative risk factors & cardiac history

Isolated AVR

	No	Yes	Unspecified	Percentage with the risk factor	
Risk factors	Current smoker	298	27	0	8.3%
	Diabetes	278	47	0	14.5%
	Hypertension	110	215	0	66.2%
	Cerebro-vascular disease	302	23	0	7.1%
	Extra-cardiac arteriopathy	318	7	0	2.2%
Cardiac history	Previous cardiac intervention	298	27	0	8.3%
	Previous CABG surgery	323	2	0	0.6%
	Previous valve surgery	325	0	0	0.0%
	Previous PTCA / stent	311	14	0	4.3%
	Prior MI	312	13	0	4.0%
	Prior MI within 30 days of surgery	321	3	1	0.9%

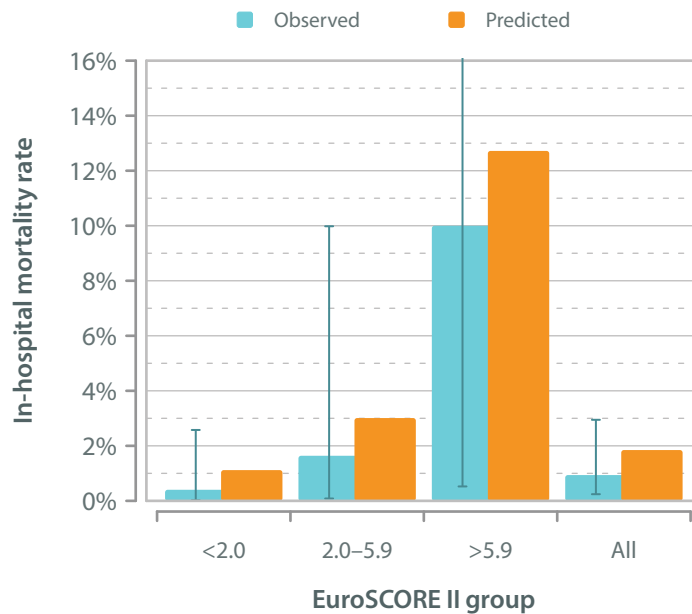
In-hospital mortality
EuroSCORE II

Table 18 First-time isolated AVR in 2018: observed and predicted in-hospital mortality; entries with known EuroSCORE data

Isolated AVR

EuroSCORE II group	In hospital mortality			Mortality rate	
	No	Yes	Unspecified	Observed	Predicted
<2.0	247	1	0	0.4%	1.1%
2.0–5.9	61	1	0	1.6%	3.0%
>5.9	9	1	0	10.0%	12.7%
All	317	3	0	0.9%	1.8%

Fig. 12 **First-time isolated AVR: In-hospital mortality; calendar year 2018 (n=320)**





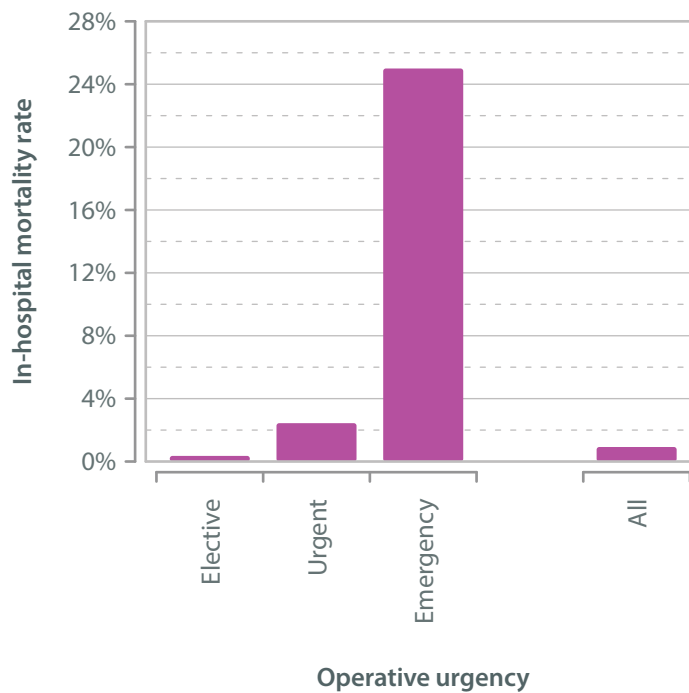
Operative urgency

Isolated AVR

Table 19 First-time isolated AVR: urgency and in-hospital mortality

	In hospital mortality			Rate (95% CI)
	No	Yes	Unspecified	
Elective	279	1	0	0.4% (0.0–2.3%)
Urgent	40	1	0	2.4% (0.1–14.4%)
Emergency / salvage	3	1	0	25.0% (1.3–78.1%)
Unspecified	0	0	0	NA
All	322	3	0	0.9% (0.2–2.9%)

Fig. 13 First-time isolated AVR: In-hospital survival and urgency; calendar year 2018 (n=325)



Quality of care
Resource utilisation

Table 20 First-time isolated AVR in 2018: hospital resource utilisation

Isolated AVR

	Count	Median	Interquartile range
Resource utilisation Ventilation time / hours	322	6.0	4.0–12.0
Time on ICU / hours	321	24.0	20.0–44.0
Post-operative stay / days	325	6.0	5.0–8.0
Hospital stay / days	325	8.0	7.0–12.0



Complications

Table 21 First-time isolated AVR in 2018: complications

	Complication			Rate (95% CI)
	No	Yes	Unspecified	
In hospital complications				
Deep sternal wound infection	321	2	2	0.6% (0.1–2.5%)
Return to theatre ... for any reason	300	25	0	7.7% (5.1–11.3%)
... for bleeding	303	22	0	6.8% (4.4–10.2%)
... for sternal wound infection	325	0	0	0.0% (0.0–0.9%)
... for non-cardiac	324	1	0	0.3% (0.0–2.0%)
... for other cardiac	322	3	0	0.9% (0.2–2.9%)
New renal failure	319	6	0	1.8% (0.8–4.2%)
Permanent stroke	319	4	2	1.2% (0.4–3.4%)
New onset atrial arrhythmia	218	73	34	25.1% (20.3–30.6%)
Peri-operative acute MI	322	1	2	0.3% (0.0–2.0%)
Pneumonia	319	4	2	1.2% (0.4–3.4%)
In-hospital mortality	322	3	0	0.9% (0.2–2.9%)
30-day complications				
Readmission	294	30	1	9.3% (6.4–13.1%)
Deep sternal wound infection	322	1	2	0.3% (0.0–2.0%)
Post-discharge complications				
Mortality post-discharge	320	2	3	0.6% (0.1–2.5%)

Isolated AVR

Appendix Definitions

1. **DSWI:** deep sternal wound infection is a serious post-operative complication of cardiac surgery.
2. **Elective:** routine admission for operation.
3. **Emergency:** operation before the beginning of the next working day after decision to operate.
4. **EuroSCORE II:** an internationally recognised tool used to predict mortality in patients undergoing cardiac surgery. It is a tool that is used to risk stratify patients. **EuroSCORE II** has been developed by studying large numbers of patients (22,381) undergoing cardiac surgery in 154 hospitals in 43 countries ⁵.
5. **ICU:** intensive care unit.
6. **MI:** myocardial infarction.
7. **Mortality:** includes all deaths at the 5 public hospitals where cardiac surgery is performed prior to discharge and within 30 days of the date of surgery.
8. **PTCA:** percutaneous transluminal coronary angioplasty.
9. **Salvage:** patients requiring cardiopulmonary resuscitation (external cardiac massage) en route to the operating theatre or prior to induction of anaesthesia. This does not include cardiopulmonary resuscitation following induction of anaesthesia.
10. **Urgent:** patients who have not been electively admitted for operation but who require intervention or surgery on the current admission for medical reasons. These patients cannot be sent home without a definitive procedure..
11. **ANZ:** Australia, New Zealand
12. **Whanau:** extended family, family group, a familiar term of address to a number of people; the primary economic unit of traditional Māori society. In the modern context the term is sometimes used to include friends who may not have any kinship ties to other members ⁶.

5. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, Goldstone AR, Lockowandt U. EuroSCORE II. *European Journal of Cardiothorac Surgery*. 2012; **41(4)**: 734-745.

6. Maori Dictionary. 2019. Whanau. Accessed 21 November 2019. <https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&keywords=whanau>



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NZ Adult Cardiac Surgical Database
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Basic demographic data

All baseline data refer to the condition of the patient when they were originally diagnosed.

Unique patient identifier

Gender Male Female

Date of birth dd/mm/yyyy

Registry data

Admission information

Date of admission dd/mm/yyyy

Ethnicity 1 European
 Maori
 Pacific peoples
 Asian
 Middle Eastern/Latin American/African
 Other ethnicity
 Residual categories


Ethnicity 2 European not further defined
 NZ European
 Other European
 NZ Maori
 Pacific Island not further defined
 Samoan
 Cook Island Maori
 Tongan
 Niuean
 Tokelauan
 Fijian
 Other Pacific Island
 Asian not further defined
 Southeast Asian
 Chinese
 Indian
 Other Asian
 Middle Eastern
 Latin American/Hispanic
 African
 Other ethnicity
 Don't know
 Refused to answer
 Response unidentifiable
 Not stated

Date of surgery dd/mm/yyyy

New Zealand Ministry of Health

NZ Adult Cardiac Surgical Database

Baseline section; Page 2; Version 2.0 (6 Dec 2019)



Unique patient identifier

Date of surgery dd/mm/yyyy

Admission information continued ...


Elective Day of Surgery Admit Patient No Yes

Insurance Public Self funded
 Private health insurance Other

Operation number 1 4
 2 5
 3 6

Height cm

Weight kg



Powered by
Dendrite Clinical Systems



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Unique patient identifier
Date of surgery dd/mm/yyyy

Patient risk factors

Smoking history	<input type="radio"/> No	<input type="radio"/> Yes
Current smoker	<input type="radio"/> No	<input type="radio"/> Yes
Family history of CAD	<input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> Undiscovered
Diabetes	<input type="radio"/> No	<input type="radio"/> Yes
Diabetes control	<input type="radio"/> None <input type="radio"/> Diet	<input type="radio"/> Oral <input type="radio"/> Insulin
Hypercholesterolaemia	<input type="radio"/> No	<input type="radio"/> Yes
Renal: last pre-op creatinine	<input type="text"/>	$\mu\text{mol l}^{-1}$
Renal: dialysis	<input type="radio"/> No	<input type="radio"/> Yes
Renal: transplant	<input type="radio"/> No	<input type="radio"/> Yes
Renal: impairment	<input type="radio"/> Normal (CC >85 ml min ⁻¹) <input type="radio"/> Moderate (CC 50-85 ml min ⁻¹)	<input type="radio"/> Severe (CC <50 ml min ⁻¹)
Hypertension	<input type="radio"/> No	<input type="radio"/> Yes
Cerebrovascular disease	<input type="radio"/> No	<input type="radio"/> Yes
Cerebrovascular disease: type	<input type="radio"/> Coma <input type="radio"/> CVA	<input type="radio"/> RIND or TIA <input type="radio"/> Carotid test
Cerebrovascular disease: when	<input type="radio"/> Recent	<input type="radio"/> Remote
Cerebrovascular disease: Carotid test result	<input type="radio"/> No	<input type="radio"/> Yes
PVD / extra-cardiac arteriopathy	<input type="radio"/> No	<input type="radio"/> Yes
Respiratory / pulmonary disease	<input type="radio"/> No	<input type="radio"/> Yes
Respiratory / pulmonary disease: type	<input type="radio"/> Mild <input type="radio"/> Moderate	<input type="radio"/> Severe
Infective endocarditis	<input type="radio"/> No <input type="radio"/> Active	<input type="radio"/> Treated
Immunosuppressive treatment	<input type="radio"/> No	<input type="radio"/> Yes
Poor mobility due to any non-cardiac reason	<input type="radio"/> No	<input type="radio"/> Yes

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Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> dd/mm/yyyy
Pre-operative cardiac status	
Pre-operative cardiac status	
Myocardial infarction	<input type="radio"/> No <input type="radio"/> Yes
Myocardial infarction: type	<input type="radio"/> NSTEMI <input type="radio"/> STEMI
Myocardial infarction: when	<input type="radio"/> <= 6 hours <input type="radio"/> 8-21 days <input type="radio"/> 6-24 hours <input type="radio"/> 22-90 days <input type="radio"/> 1-7 days <input type="radio"/> >90 days
Date of last MI (if known)	<input type="text"/> dd/mm/yyyy
Angina: CCS classification	<input type="radio"/> 0 <input type="radio"/> 3 <input type="radio"/> 1 <input type="radio"/> 4 <input type="radio"/> 2
Treatment of angina: iv GTN	<input type="radio"/> No <input type="radio"/> Yes
Treatment of angina: iv heparin	<input type="radio"/> No <input type="radio"/> Yes
Treatment of angina: full dose heparinoids	<input type="radio"/> No <input type="radio"/> Yes
History of congestive heart failure	<input type="radio"/> No <input type="radio"/> Yes
CHF at current admission	<input type="radio"/> No <input type="radio"/> Yes
Dyspnoea: NYHA classification	<input type="radio"/> 1 <input type="radio"/> 3 <input type="radio"/> 2 <input type="radio"/> 4
Cardiogenic shock	<input type="radio"/> No <input type="radio"/> Yes
Resuscitation within 1 hour of operation	<input type="radio"/> No <input type="radio"/> Yes
Critical pre-operative state	<input type="radio"/> No <input type="radio"/> Yes
Pre-operative cardiac status - arrhythmia	
Arrhythmia	<input type="radio"/> No <input type="radio"/> Yes
Arrhythmia: type	<input type="radio"/> Sinus rhythm <input type="radio"/> Ventricular <input type="radio"/> Atrial <input type="radio"/> Other abnormal rhythm <input type="radio"/> Heart block/pacing
Atrial arrhythmia: type	<input type="radio"/> Paroxysmal <input type="radio"/> Permanent <input type="radio"/> Persistent
Permanent pacemaker <i>in situ</i>	<input type="radio"/> No <input type="radio"/> Yes



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Baseline section; Page 5; Version 2.0 (6 Dec 2019)



Unique patient identifier
Date of surgery dd/mm/yyyy

Medication at the time of surgery

Inotropes	<input type="radio"/> No	<input type="radio"/> Yes
iv nitrates	<input type="radio"/> No	<input type="radio"/> Yes
Anticoagulation therapy	<input type="radio"/> No	<input type="radio"/> Yes
Steroids	<input type="radio"/> No	<input type="radio"/> Yes
Thrombolysis (this admission)	<input type="radio"/> No	<input type="radio"/> Yes
Thrombolysis: interval	<input type="text"/>	hours
Aspirin within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
Aspirin: when	<input type="text"/>	days
Thienopiridine within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
Thienopiridine: when	<input type="text"/>	days
Long acting IIb / IIIa blockade within 7 days of surgery	<input type="radio"/> No <input type="radio"/> Yes	
Long acting: when	<input type="text"/>	days
Short acting within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
Short acting: when	<input type="text"/>	days
Other antiplatelet therapy within 7 days of surgery	<input type="radio"/> No <input type="radio"/> Yes	
Other antiplatelet: when	<input type="text"/>	days

Appendix

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NZ Adult Cardiac Surgical Database
 Baseline section; Page 6; Version 2.0 (6 Dec 2019)

Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> dd/mm/yyyy
Previous interventions (surgical or percutaneous)	
Previous cardiothoracic intervention	<input type="radio"/> No <input type="radio"/> Yes
Previous surgery	<input type="radio"/> No <input type="radio"/> Yes
Type of previous surgery	<input type="checkbox"/> CABG <input type="checkbox"/> Congenital cardiac <input type="checkbox"/> Off-pump CABG <input type="checkbox"/> Aortic surgery (ascending / arch) <input type="checkbox"/> Valve <input type="checkbox"/> Other cardiac
Number of prior cardiac operations requiring cardiopulmonary bypass	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 4 <input type="radio"/> 7 <input type="radio"/> 2 <input type="radio"/> 5 <input type="radio"/> 8 <input type="radio"/> 3 <input type="radio"/> 6 <input type="radio"/> 9
Number of prior cardiac operations without cardiopulmonary bypass	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 4 <input type="radio"/> 7 <input type="radio"/> 2 <input type="radio"/> 5 <input type="radio"/> 8 <input type="radio"/> 3 <input type="radio"/> 6 <input type="radio"/> 9
Previous percutaneous intervention	<input type="radio"/> No <input type="radio"/> Yes
PTCA / stent	<input type="radio"/> No <input type="radio"/> Yes
PTCA / stent: which admission	<input type="radio"/> Prior admission <input type="radio"/> This admission
PTCA / stent: interval (same admission)	<input type="text"/> hours
PTCA / stent	<input type="radio"/> No <input type="radio"/> Yes
Other percutaneous interventions	<input type="radio"/> No <input type="checkbox"/> Non Surgical Balloon Valvuloplasty <input type="checkbox"/> ASD Device Closure <input type="checkbox"/> VSD Device Closure <input type="checkbox"/> Percutaneous SVT/VT Ablation <input type="checkbox"/> Left atrial appendage occlusion <input type="checkbox"/> TAVR <input type="checkbox"/> TMV repair <input type="checkbox"/> TMVR



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Unique patient identifier
Date of surgery dd/mm/yyyy

Haemodynamic data


Cardiac catheterisation	<input type="radio"/> No	<input type="radio"/> Yes
Date of cardiac catheterisation	<input type="text"/>	dd/mm/yyyy
LVEF method	<input type="radio"/> Not measured	<input type="radio"/> Echo
	<input type="radio"/> Angiogram	<input type="radio"/> MRI
	<input type="radio"/> Radionuclide	
EF	<input type="text"/>	%
EF estimate	<input type="radio"/> Normal	<input type="radio"/> Moderate
	<input type="radio"/> Mild	<input type="radio"/> Severe
Left main stenosis >50%	<input type="radio"/> No	<input type="radio"/> Yes
Number of diseased coronary systems	<input type="radio"/> None	<input type="radio"/> Two
	<input type="radio"/> One	<input type="radio"/> Three
PA systolic	<input type="text"/>	mm Hg
Pulmonary hypertension	<input type="radio"/> No	<input type="radio"/> Severe
	<input type="radio"/> Moderate	

Appendix


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NZ Adult Cardiac Surgical Database

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Unique patient identifier	<input style="width: 100%;" type="text"/>	
Date of surgery	<input style="width: 100%;" type="text"/>	dd/mm/yyyy
Operation status / category		
Surgery data		
Consultant surgeon	<input style="width: 100%;" type="text"/>	
Operating surgeon	<input type="radio"/> Consultant <input type="radio"/> Senior registrar <input type="radio"/> Trainee <input type="radio"/> Overseas fellow <input type="radio"/> Oversight	
Operative urgency / status	<input type="radio"/> Elective <input type="radio"/> Urgent <input type="radio"/> Emergency <input type="radio"/> Salvage	
Direct transfer from cath lab to theatre	<input type="radio"/> No <input type="radio"/> Yes	
Coronary artery bypass	<input type="radio"/> No <input type="radio"/> Yes	
Valve surgery	<input type="radio"/> No <input type="radio"/> Yes	
Valve type	<input type="checkbox"/> Aortic <input type="checkbox"/> Mitral <input type="checkbox"/> Tricuspid <input type="checkbox"/> Pulmonary	
Redo valve	<input type="radio"/> No <input type="radio"/> Yes	
Reason for repeat valve placement	<input type="checkbox"/> Thrombosis <input type="checkbox"/> Dehiscence <input type="checkbox"/> Embolism <input type="checkbox"/> Infection <input type="checkbox"/> Homograft valve failure <input type="checkbox"/> Haemolysis <input type="checkbox"/> Prior valve repair <input type="checkbox"/> Other reason	
Aortic procedure	<input type="radio"/> No <input type="radio"/> Yes	
Other cardiac procedures	<input type="radio"/> No <input type="radio"/> Yes	
Other non-cardiac procedures	<input type="radio"/> No <input type="radio"/> Yes	
Aortic procedure		
Aortic aneurysm repair (type)	<input type="radio"/> No repair <input type="checkbox"/> Ascending <input type="checkbox"/> Arch <input type="checkbox"/> Descending <input type="checkbox"/> Thoracic/abdominal	
Aortic dissection repair (type)	<input type="radio"/> No repair <input type="radio"/> Ascending <input type="radio"/> Descending	
Aortic dissection: when	<input type="radio"/> Acute <input type="radio"/> Non-acute	
Acute traumatic aortic transection	<input type="radio"/> No <input type="radio"/> Yes	



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Unique patient identifier
Date of surgery dd/mm/yyyy

Other cardiac surgery

Atrial arrhythmia surgery	<input type="radio"/> No <input type="radio"/> Yes	
Atrial arrhythmia surgery: lesion set	<input type="radio"/> Cox Maze III <input type="radio"/> Cox Maze IV <input type="radio"/> Radial <input type="radio"/> Mini-Maze <input type="radio"/> Left atrial reduction	
Atrial arrhythmia surgery: energy source	<input type="radio"/> Pulmonary vein isolation <input type="radio"/> Left atrial only <input type="radio"/> Right atrial only <input type="radio"/> Other	
Atrial arrhythmia surgery: energy source	<input type="radio"/> Cut & sew <input type="radio"/> Unipolar RF <input type="radio"/> Bipolar RF <input type="radio"/> Cryoablation	
Type of other cardiac surgery	<input type="radio"/> Microwave <input type="radio"/> Laser <input type="radio"/> Ultrasound <input type="radio"/> Other	
Type of other cardiac surgery	<input type="checkbox"/> None <input type="checkbox"/> LV aneurysm <input type="checkbox"/> VSD (Acquired) <input type="checkbox"/> Atrial myxoma <input type="checkbox"/> Pulmonary embolectomy <input type="checkbox"/> Cardiac transplant <input type="checkbox"/> Pulmonary transplant <input type="checkbox"/> Cardiac trauma <input type="checkbox"/> Epicardial pacemaker <input type="checkbox"/> Pericardiectomy <input type="checkbox"/> ASD <input type="checkbox"/> Other congenital	
Type of other cardiac surgery	<input type="checkbox"/> Pulm thromboendarterectomy <input type="checkbox"/> AF ablation surgery <input type="checkbox"/> Primary VAD <input type="checkbox"/> LVOT myectomy for HOCM <input type="checkbox"/> Peripheral vascular <input type="checkbox"/> Cardiac trauma - iatrogenic <input type="checkbox"/> LV Rupture repair <input type="checkbox"/> LV Reconstruction <input type="checkbox"/> Cardiac Tumour <input type="checkbox"/> Permanent LV epicardial lead <input type="checkbox"/> Cardiopulmonary transplant <input type="checkbox"/> Other	

Other non-cardiac surgery

Carotid endarterectomy	<input type="radio"/> No <input type="radio"/> Yes	
Lung resection	<input type="radio"/> No <input type="radio"/> Yes	
Other vascular surgery	<input type="radio"/> No <input type="radio"/> Yes	
Other thoracic surgery	<input type="radio"/> No <input type="radio"/> Yes	
Other surgery	<input type="radio"/> No <input type="radio"/> Yes	

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Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> dd/mm/yyyy
CPB and support	
Minimally invasive	
Minimally invasive techniques attempted	<input type="radio"/> No <input type="radio"/> Yes
Minimally invasive techniques indication	<input type="radio"/> Choice <input type="radio"/> Contraindication <input type="radio"/> Catheter
Performed off pump	<input type="radio"/> No <input type="radio"/> Yes
Robotically assisted	<input type="radio"/> No <input type="radio"/> Yes
CPB and mechanical support	
Cardiopulmonary bypass used	<input type="radio"/> No <input type="radio"/> Yes
Cardioplegia used	<input type="radio"/> No <input type="radio"/> Yes
Cumulative cross clamp time	<input type="text"/> min
Cumulative cardiopulmonary bypass time	<input type="text"/> min
IABP	<input type="radio"/> No <input type="radio"/> Yes
IABP: when inserted	<input type="radio"/> Pre-op <input type="radio"/> Intra-op <input type="radio"/> Post-op
IABP: indication	<input type="radio"/> Haemodynamic instability <input type="radio"/> PTCA support <input type="radio"/> CPB wean <input type="radio"/> Unstable angina <input type="radio"/> Prophylactic
Rota-pump	<input type="radio"/> No <input type="radio"/> Yes
Rota-pump: when inserted	<input type="radio"/> Pre-op <input type="radio"/> Intra-op <input type="radio"/> Post-op
Rota-pump: indication	<input type="radio"/> Haemodynamic instability <input type="radio"/> PTCA support <input type="radio"/> CPB wean <input type="radio"/> Unstable angina <input type="radio"/> Prophylactic
Other mechanical support	<input type="radio"/> No <input type="radio"/> Yes
Other mechanical support: when inserted	<input type="radio"/> Pre-op <input type="radio"/> Intra-op <input type="radio"/> Post-op
Other mechanical support: indication	<input type="radio"/> Haemodynamic instability <input type="radio"/> PTCA support <input type="radio"/> CPB wean <input type="radio"/> Unstable angina <input type="radio"/> Prophylactic



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Unique patient identifier
Date of surgery dd/mm/yyyy

CPB and support continued ...

Other support


Intra-operative TOE	<input type="radio"/> No	<input type="radio"/> Yes
Intra-operative TOE: type	<input type="radio"/> Non-elective	<input type="radio"/> Elective
Intra-operative antifibrinolytic use	<input type="radio"/> No	<input type="radio"/> Yes
Intra-operative antifibrinolytic use: type	<input type="radio"/> Trasylool <input type="radio"/> Tranexamic acid	<input type="radio"/> Other

Appendix


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Unique patient identifier	<input type="text"/>	
Date of surgery	<input type="text"/>	dd/mm/yyyy
Coronary bypass		
Intra-operative decision to graft coronary artery	<input type="radio"/> No <input type="radio"/> Yes	
IMA used	<input type="radio"/> No <input type="radio"/> Yes	
Which IMA used	<input type="checkbox"/> Left <input type="checkbox"/> Right	
Were arterial T or Y grafts used	<input type="radio"/> No <input type="radio"/> Yes	
Number of IMA distal anastomoses	<input type="text"/>	integer: 0-6
Number of radial distal anastomoses	<input type="text"/>	integer: 0-6
Number of GEPA distal anastomoses	<input type="text"/>	integer: 0-6
Number of distal arterial grafts	<input type="text"/>	integer: 0-9
Number of vein distal anastomoses	<input type="text"/>	integer: 0-9
Total number of distal anastomoses	<input type="text"/>	integer: 0-30
Number of RA conduits harvested	<input type="text"/>	integer: 0-2



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Unique patient identifier
Date of surgery dd/mm/yyyy

Aortic valve surgery

Aortic valve procedure

- Replacement
- Repair/Reconstruction without annuloplasty
- Root Reconstruction with Valve Conduit (Bentall procedure)
- Root Reconstruction with Valve Sparing (David procedure)
- Resuspension Aortic Valve
- Resection Sub-Aortic Stenosis
- Repair Paravalvular leak
- Valvotomy
- Ross Procedure
- Inspection only
- Transcatheter Aortic Valve Replacement (TAVR)
- Aortic Valvuloplasty with subcommissural annuloplasty
- Aortic Valvuloplasty without subcommissural annuloplasty
- Removal of tumour valve tissue (e.g. Fibroelastoma)

Decalcification of valve only

Subcommissural annuloplasty

Thrombus removal

Root enlargement (Manouagian type excludes Nicks)

Implant - type

- None
- Mechanical
- Bioprosthesis
- Autograft
- Homograft/allograft
- Ring / band

Implant - manufacturer's model number select from table

Implant - serial number select from table

Implant - size mm

Explant - type

- None
- Mechanical
- Bioprosthesis
- Autograft
- Homograft/allograft
- Ring / band

Explant - manufacturer's model number select from table

Explant - serial number select from table

Explant - size mm

Aortic stenosis

- No
- Yes

Aortic regurgitation / insufficiency

- None
- Trivial
- Mild
- Moderate
- Severe

Aortic pathology / aetiology

- Rheumatic
- Congenital
- Ischaemic
- Idiopathic calcific
- Myxomatous degen
- Failed prior repair
- Prosthetic valve failure
- Peri-prosthetic leak
- Prosthetic valve thrombosis
- Active infection
- Previous infection
- Marfans
- Annuloaortic ectasia
- Other degenerative disease
- Dissection
- Tumour
- Trauma
- Iatrogenic
- Other

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NZ Adult Cardiac Surgical Database
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Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> dd/mm/yyyy
Mitral valve surgery	
Mitral valve procedure	<input type="radio"/> Annuloplasty only <input type="radio"/> Replacement <input type="radio"/> Repair/Reconstruction with annuloplasty <input type="radio"/> Repair/Reconstruction without annuloplasty <input type="radio"/> Commissurotomy with annuloplasty ring <input type="radio"/> Commissurotomy without annuloplasty ring <input type="radio"/> Repair Paravalvular leak <input type="radio"/> Inspection only <input type="radio"/> Decalcification of valve only <input type="radio"/> Thrombus removal <input type="radio"/> Alfieri Suture <input type="radio"/> Removal of tumour valve tissue (e.g. Fibroelastoma) <input type="radio"/> Insertion of Mitraclip device <input type="radio"/> Transcatheter Aortic Valve Replacement (TMVR)
Implant - type	<input type="radio"/> None <input type="radio"/> Bioprosthesis <input type="radio"/> Homograft/allograft <input type="radio"/> Mechanical <input type="radio"/> Autograft <input type="radio"/> Ring /band
Implant - manufacturer's model number	<input type="text"/> select from table
Implant - serial number	<input type="text"/> select from table
Implant - size	<input type="text"/> mm
Explant - type	<input type="radio"/> None <input type="radio"/> Bioprosthesis <input type="radio"/> Homograft/allograft <input type="radio"/> Mechanical <input type="radio"/> Autograft <input type="radio"/> Ring /band
Explant - manufacturer's model number	<input type="text"/> select from table
Explant - serial number	<input type="text"/> select from table
Explant - size	<input type="text"/> mm
Mitral stenosis	<input type="radio"/> No <input type="radio"/> Yes
Mitral regurgitation / insufficiency	<input type="radio"/> None <input type="radio"/> Mild <input type="radio"/> Severe <input type="radio"/> Trivial <input type="radio"/> Moderate
Mitral pathology / aetiology	<input type="radio"/> Functional or isolated annular dilatation <input type="radio"/> Rheumatic <input type="radio"/> Active infection <input type="radio"/> Congenital <input type="radio"/> Previous infection <input type="radio"/> Ischaemic <input type="radio"/> Marfans <input type="radio"/> Idiopathic calcific <input type="radio"/> Other degenerative disease <input type="radio"/> Myxomatous degeneration <input type="radio"/> Tumour <input type="radio"/> Failed prior repair <input type="radio"/> Trauma <input type="radio"/> Prosthetic valve failure <input type="radio"/> Iatrogenic <input type="radio"/> Peri-prosthetic leak <input type="radio"/> Failed TMVR <input type="radio"/> Prosthetic valve thrombosis <input type="radio"/> Other



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Unique patient identifier
Date of surgery dd/mm/yyyy

Tricuspid valve surgery

Tricuspid valve procedure

Annuloplasty only Replacement
 Repair/Reconstruction with annuloplasty
 Repair/Reconstruction without annuloplasty
 Commissurotomy with annuloplasty ring
 Commissurotomy without annuloplasty ring
 Repair Paravalvular leak
 Valvectomy (no replacement)
 Inspection only
 Thrombus removal
 Removal of tumour valve tissue (e.g. Fibroelastoma)

Implant - type

None Bioprosthesis Homograft/allograft
 Mechanical Autograft Ring /band

Implant - manufacturer's model number select from table

Implant - serial number select from table

Implant - size mm

Explant - type

None Bioprosthesis Homograft/allograft
 Mechanical Autograft Ring /band

Explant - manufacturer's model number select from table

Explant - serial number select from table

Explant - size mm

Tricuspid stenosis

No Yes

Tricuspid regurgitation / insufficiency

None Mild Severe
 Trivial Moderate

Tricuspid pathology / aetiology

Rheumatic Previous infection
 Congenital Marfans
 Ischaemic Other degen. Disease
 Idiopathic Calcific Tumour
 Myxomatous degen Trauma
 Failed prior repair Iatrogenic
 Prosthetic valve failure Functional tricuspid valve
 Peri-prosthetic leak Carcinoid syndrome
 Prosthetic valve thrombosis Other
 Active infection

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Unique patient identifier
 Date of surgery dd/mm/yyyy

Pulmonary valve surgery

Pulmonary valve procedure	<input type="radio"/> Replacement <input type="radio"/> Repair/Reconstruction without annuloplasty <input type="radio"/> Valvotomy with annuloplasty ring <input type="radio"/> Commissurotomy without annuloplasty ring <input type="radio"/> Repair Paravalvular leak <input type="radio"/> Inspection only <input type="radio"/> Removal of tumour valve tissue (e.g. Fibroelastoma) <input type="radio"/> Replacement of pulmonary root as part of a Ross procedure	
Implant - type	<input type="radio"/> None <input type="radio"/> Mechanical <input type="radio"/> Bioprosthesis	
	<input type="radio"/> Autograft <input type="radio"/> Homograft / allograft <input type="radio"/> Ring / band	
Implant - manufacturer's model number	<input type="text"/>	select from table
Implant - serial number	<input type="text"/>	select from table
Implant - size	<input type="text"/>	mm
Explant - type	<input type="radio"/> None <input type="radio"/> Mechanical <input type="radio"/> Bioprosthesis	
	<input type="radio"/> Autograft <input type="radio"/> Homograft / allograft <input type="radio"/> Ring / band	
Explant - manufacturer's model number	<input type="text"/>	select from table
Explant - serial number	<input type="text"/>	select from table
Explant - size	<input type="text"/>	mm
Pulmonary stenosis	<input type="radio"/> No <input type="radio"/> Yes	
Pulmonary regurgitation / insufficiency	<input type="radio"/> None <input type="radio"/> Trivial <input type="radio"/> Mild	
	<input type="radio"/> Moderate <input type="radio"/> Severe	
Pulmonary pathology / aetiology	<input type="radio"/> Rheumatic <input type="radio"/> Congenital <input type="radio"/> Ischaemic <input type="radio"/> Idiopathic calcific <input type="radio"/> Myxomatous degeneration <input type="radio"/> Failed prior repair <input type="radio"/> Prosthetic valve failure <input type="radio"/> Peri-prosthetic leak <input type="radio"/> Prosthetic valve thrombosis	
	<input type="radio"/> Active infection <input type="radio"/> Previous infection <input type="radio"/> Marfans <input type="radio"/> Other degenerative disease <input type="radio"/> Tumour <input type="radio"/> Trauma <input type="radio"/> Iatrogenic <input type="radio"/> Other	



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Unique patient identifier
Date of surgery dd/mm/yyyy

Post-operative data

RBC blood bank products No Yes

Non-RBC blood bank products No Yes

Peri-operative transfusion: bank RBC units

Peri-operative transfusion: platelets units

Peri-operative transfusion: Novo 7 units

Peri-operative transfusion: FFP units

Peri-operative transfusion: Cryo units

ICU admission: date and time dd/mm/yyyy

Extubation: date and time dd/mm/yyyy

ICU discharge: date and time dd/mm/yyyy

Readmitted to ICU No Yes

Reintubated No Yes

Reintubation: date and time dd/mm/yyyy

Reextubation: date and time dd/mm/yyyy

ICC loss (first 4 hours post surgery)

Reintubation and ventilation No Yes

Returned to theatre

Return to theatre No Yes

Reason for re-operation

<input type="checkbox"/> Valve Dysfunction	<input type="checkbox"/> Other cardiac
<input type="checkbox"/> Bleeding / tamponade	<input type="checkbox"/> Other non cardiac
<input type="checkbox"/> Graft occlusion	<input type="checkbox"/> Insertion of pacemaker / AICD
<input type="checkbox"/> Sternal infection	
<input type="checkbox"/> Deep thoracotomy wound infection	

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Unique patient identifier
 Date of surgery dd/mm/yyyy

Complications

Renal and neurological complications

New renal failure	<input type="radio"/> No	<input type="radio"/> Yes
Haemofiltration	<input type="radio"/> No	<input type="radio"/> Yes
Highest post-op creatinine	<input type="text"/>	μmol l ⁻¹
Perioperative cardiogenic shock	<input type="radio"/> No	<input type="radio"/> Yes
New neurological status	<input type="radio"/> No	<input type="radio"/> Yes
Stroke permanent	<input type="radio"/> No	<input type="radio"/> Yes
Stroke transient	<input type="radio"/> No	<input type="radio"/> Yes
New continuous coma (≥24 hours)	<input type="radio"/> No	<input type="radio"/> Yes

Cardiac complications

Perioperative AMI	<input type="radio"/> No	<input type="radio"/> Yes
Cardiac inotrope use: >4 hours post-operatively	<input type="radio"/> No <input type="radio"/> Yes	
Cardiac inotrope use: low cardiac output syndrome	<input type="radio"/> No <input type="radio"/> Yes	
Cardiac inotrope use: low SVR syndrome	<input type="radio"/> No	<input type="radio"/> Yes
New cardiac arrhythmia	<input type="radio"/> No	<input type="radio"/> Yes
New heart block (requiring PPM)	<input type="radio"/> No	<input type="radio"/> Yes
New other brady arrhythmia (requiring PPM)	<input type="radio"/> No	<input type="radio"/> Yes
Cardiac arrest	<input type="radio"/> No	<input type="radio"/> Yes
New atrial arrhythmia (requiring Rx)	<input type="radio"/> No	<input type="radio"/> Yes
New ventricular tachycardia	<input type="radio"/> No	<input type="radio"/> Yes



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Unique patient identifier
Date of surgery dd/mm/yyyy

Complications continued ...

Pulmonary, infection, vascular and other complications


Prolonged ventilation >24 hours	<input type="radio"/> No	<input type="radio"/> Yes
Pulmonary embolism	<input type="radio"/> No	<input type="radio"/> Yes
Pneumonia	<input type="radio"/> No	<input type="radio"/> Yes
Reintubation and ventilation	<input type="radio"/> No	<input type="radio"/> Yes
Deep sternal wound infection	<input type="radio"/> No	<input type="radio"/> Yes
Superficial access wound infection	<input type="radio"/> No	<input type="radio"/> Yes
Donor site deep wound infection	<input type="radio"/> No	<input type="radio"/> Yes
Deep thoracotomy wound infection	<input type="radio"/> No	<input type="radio"/> Yes
Septicaemia	<input type="radio"/> No	<input type="radio"/> Yes
Aortic dissection (complication)	<input type="radio"/> No	<input type="radio"/> Yes
Acute limb ischaemia	<input type="radio"/> No	<input type="radio"/> Yes
Anti-coagulant complication	<input type="radio"/> No	<input type="radio"/> Yes
GIT complication	<input type="radio"/> No	<input type="radio"/> Yes
Multi-system failure	<input type="radio"/> No	<input type="radio"/> Yes

Appendix


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Unique patient identifier	<input type="text"/>	
Date of surgery	<input type="text"/>	dd/mm/yyyy
Discharge / mortality		
Discharge	<input type="radio"/> Home	<input type="radio"/> Local or referring hospital
	<input type="radio"/> Hospital in the home	<input type="radio"/> Hospital mortality
	<input type="radio"/> Rehabilitation unit / hospital	<input type="radio"/> Other cardiac unit
Date of discharge	<input type="text"/>	dd/mm/yyyy
Mortality post discharge	<input type="radio"/> No <input type="radio"/> Yes	
Mortality date	<input type="text"/>	dd/mm/yyyy
Mortality location	<input type="radio"/> Operating room	<input type="radio"/> Home
	<input type="radio"/> Hospital	<input type="radio"/> Other facility
Mortality: primary cause	<input type="radio"/> Cardiac	<input type="radio"/> Multisystem failure
	<input type="radio"/> Neurological	<input type="radio"/> Pulmonary embolism
	<input type="radio"/> Renal	<input type="radio"/> Aortic dissection
	<input type="radio"/> Vascular	<input type="radio"/> Valvular
	<input type="radio"/> Infection	<input type="radio"/> Other
	<input type="radio"/> Respiratory failure	<input type="radio"/> Unknown
Mortality: subsequent cause	<input type="radio"/> Ischaemia	<input type="radio"/> Endocarditis
	<input type="radio"/> Other cardiac	<input type="radio"/> Other infection
	<input type="radio"/> Septicaemia	
Cognisant patient withdraws from treatment	<input type="radio"/> No <input type="radio"/> Yes	
Readmission		
Readmitted ≤30 days from surgery	<input type="radio"/> No <input type="radio"/> Yes	
Reason for readmission	<input type="radio"/> Anticoagulant complication <input type="radio"/> Arrhythmia <input type="radio"/> Congestive heart failure <input type="radio"/> Valve dysfunction <input type="radio"/> Pericardial effusion <input type="radio"/> Cardiac tamponade <input type="radio"/> Deep sternal infection <input type="radio"/> Other incisional complication <input type="radio"/> Respiratory complication including pneumonia <input type="radio"/> Myocardial infarction <input type="radio"/> Recurrent angina <input type="radio"/> Other complication related to cardiac surgery <input type="radio"/> Other readmission unrelated to cardiac surgery	



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