

Health NZ



**New Zealand Cardiac Surgery
National Report**

2015



Preface

New Zealand Cardiac Surgical Annual Report 2015

This report of the New Zealand National Cardiac Surgery Registry (NZCS) covers the period of 1 January 2015 to 31 December 2015.

It presents analysis of all cardiac surgical procedures undertaken at the 5 District Health Boards (DHBs) performing publicly-funded cardiac surgery in New Zealand (Auckland, Waikato, Capital and Coast, Canterbury, Southern).

The data presents performance and outcomes of the most common procedures performed by cardiac surgeons, mainly coronary artery bypass surgery (CABG) and aortic valve replacement (AVR).

The report examines the impact of variables (risk factors) on surgical outcomes and compares these with international registries. In doing this we are able to benchmark New Zealand outcomes to internationally accepted standards.

The registry recognises that the data is a first year compilation and includes all surgeons new and old. It doesn't take into account previous results of units. In past years, data definitions and validation were incomplete hence comparison is not possible. It is the first time a data set has been collected and put together where all unit data has been able to be compared with a single comprehensive data set¹.

The data so far collected when compared with International data, suggests that New Zealand provides a high standard of Cardiac surgical services. For the data to be of any statistical significance we accept a minimum of 3 years of data needs to be available.

I would like to thank the members of the steering and implementation group, the data managers, DHB information services and the company Dendrite Clinical Systems for their effort and persistence.

The registry project acknowledges the Ministry of Health's (MOH) support, guidance commitment and funding which has made this important project a reality. The document would not be complete without acknowledging the work put in by Charlotte Allin who has helped put all the elements of this document together from data entry, verification and the final product.

Harsh Singh
Chairman

1. ADHB data are collected using a different registry. Although, the definitions are similar, comparison are close but not to 100% accuracy. We recommend going forward the DHB look at adopting the National platform.

Contents

Introduction

Preface	3
First and future reporting	6
Consumer advocate summary	8
Data presentation	9
Overview of people who had cardiac surgery	10
Risk factors	12
Types of operations performed	13
Isolated coronary artery bypass surgery	15
Quality of care of cardiac surgical patients	22
Aortic valve surgery	25
Summary	31
Definitions	32
Appendix	34



Tables

10. Table 1. All cardiac surgery patients in 2015: age and gender
11. Table 2. Ethnicity of patients undergoing cardiac surgery in 2015
12. Table 3. All patients in 2015: Pre-operative risk factors
13. Table 4. Procedures performed in 2015
15. Table 5. First-time isolated CABG in 2015: DHB where the surgery took place
16. Table 7. International BMI cut-off points for adults aged 18 years and over
16. Table 6. First-time isolated CABG in 2015: Body Mass Index
17. Table 8. First-time isolated CABG in 2015: Pre-operative risk factors
18. Table 9. First-time isolated CABG in 2015: age and gender
19. Table 10. First-time isolated CABG in 2015: age and in-hospital mortality
20. Table 11. First-time isolated CABG in 2015: operative urgency and in-hospital survival
21. Table 12. First-time isolated CABG in 2015: EuroSCORE II risk score and in-hospital mortality
22. Table 13. First-time isolated CABG in 2015: hospital resource utilisation
23. Table 14. First-time isolated CABG in 2015: complications
24. Table 15. Valve surgery in 2015
26. Table 16. First-time isolated AVR in 2015: Pre-operative risk factors
27. Table 17. First-time isolated AVR in 2015: operative urgency and in-hospital survival
28. Table 18. First-time isolated AVR in 2015: age and gender
29. Table 19. First-time isolated AVR in 2015: EuroSCORE II risk score and in-hospital mortality
30. Table 21. Isolated aortic valve surgery in 2015: complications
30. Table 20. First-time isolated AVR in 2015: hospital resource utilisation

Charts

10. Fig. 1 All cardiac surgery patients: Age & gender distributions; calendar year 2015 (n=2,763)
11. Fig. 2 All cardiac surgery patients: Ethnicity; calendar year 2015 (n=2,763)
12. Fig. 3 All cardiac surgery patients: Risk factors; calendar year 2015
13. Fig. 4 Operations performed in the calendar year 2015
15. Fig. 5 First-time isolated CABG: DHB of surgery (n=1,369)
17. Fig. 6 First-time isolated CABG: Risk factors; calendar year 2015
18. Fig. 7 First-time isolated CABG: Age & gender distributions; calendar year 2015 (n=1,368)
19. Fig. 8 First-time isolated CABG: In-hospital mortality and age; calendar year 2015 (n=1,369)
20. Fig. 9 First-time isolated CABG: In-hospital survival rates; calendar year 2015 (n=1,369)
21. Fig. 10 First-time isolated CABG: In-hospital mortality and pre-operative risk; calendar year 2015
26. Fig. 11 First-time isolated AVR: risk factors; calendar year 2015
27. Fig. 12 First-time isolated AVR: In-hospital survival rates; calendar year 2015 (n=349)
28. Fig. 13 First-time isolated AVR: Age & gender distributions; calendar year 2015 (n=349)
29. Fig. 14 First-time isolated AVR: In-hospital mortality and age; calendar year 2015 (n=349)

First and future reporting

The New Zealand National Cardiac Surgery Registry (NZCS) has been established by the NZ cardiac surgical community as a quality assurance tool that will enable us to audit our practice, review surgical outcomes and to compare these between units in New Zealand and also to benchmark against internationally reported standards. The registry was established in September 2014 and the first 18-months have focused on both the integration of the data collection and analysis tools in our clinical environments and ensuring accuracy of the data. This initial report is the early analysis of the year 2015 of patient enrolment in all 5 publicly-funded cardiac surgical units in New Zealand (Auckland, Waikato, Capital and Coast, Canterbury, Southern).

At an individual Surgeon and unit level NZCS facilitates analysis of work patterns and ensures that key performance indicators are met. It is used for regular multi-disciplinary discussion of individual patient morbidity and mortality as part of already well established peer review and audit processes. On a national level NZCS facilitates comparison of regional variation in surgical work load, patient characteristics, risk profiles, comparison of outcomes and will better inform national planning for current and future population and individual patient needs. With time the database will mature to become an important resource for ongoing improvement of patient care and also to facilitate the implementation of quality improvement projects. It will help us plan for national variations in healthcare needs of our population and to ensure equitable access to surgical treatment across the regions. The database is a tool for surgeons, cardiac surgical units and the New Zealand community to assess surgical intervention and outcomes across the country and to ensure the highest standard of care to our patients.

All data is collated and analysed independently by Dendrite Clinical Systems, an internationally respected specialist supplier of clinical database and analysis software. The project is overseen by the National Cardiac Surgery Clinical Network which comprises members from each of the 5 public cardiac surgical units in New Zealand along with members from the Ministry of Health, the National Cardiac Network and community representatives. In collaboration with Dendrite we aim to provide a patient focused, accurate and transparent report of outcomes for cardiac surgery in New Zealand. The 2 most common categories of operation in New Zealand are presented in this current report: isolated Coronary Artery Bypass Grafting (CABG) and isolated Aortic Valve replacement (AVR). Volume of procedure, patient characteristics, morbidity, mortality and indicators of resource utilisation are presented. These 2 groups combined make up approximately 65% of all cardiac surgery performed in New Zealand and are reflective of national surgical practice and results. Outcomes for individual patients are heavily influenced by factors such as overall health, age, co-existing medical conditions, acuity and magnitude of surgery. Therefore, major outcomes such as mortality will be risk adjusted using internationally validated and accepted risk scoring tools. Also we will compare outcomes in New Zealand by benchmarking against other internationally reported cardiac surgical registries. In comparison to these other registries New Zealand is a small surgical community, to ensure that reporting of outcomes does not reflect statistically insignificant variation we aim to produce a local yearly report and a national report 3 yearly. Ultimately our goal is to provide the highest standard of medical and surgical care to the population of New Zealand and to continue to reflect on and to improve our practice for the good of our patients.

Over the coming years as the registry grows we expect it will form the framework for development and ongoing reporting of a number of quality improvement programmes along with developing specific reports for individual groups of patients, examples include:

- The Health Quality and Safety Commission Surgical Site Infection programme. NZCS is currently developing a module that will allow the ongoing monitoring of a number of key interventions that have been shown to reduce surgical site infections (e.g. appropriate antibiotic at appropriate time). This module will facilitate the ongoing national public reporting of the incidence and potential causes of infections in cardiac surgery.
- A transcatheter heart valve replacement (TAVI) database. We are faced with an ageing population, increased healthcare burden of disease such as aortic stenosis and an explosion in technology such as transcatheter heart valve therapies. We need to ensure that we are choosing the appropriate treatment for each individual patient and have ongoing assessment of outcomes. The development of a national TAVI registry within NZCS will allow the comparison of outcomes between patients undergoing both surgical and transcatheter aortic valve surgery.
- At present there are no local risk scoring system tools available for analysis of outcome in a New Zealand cardiac surgical population. Also international risk scoring models are often developed and validated in surgical populations that do not reflect our ethnic, socioeconomic or patient risk profiles. These international scoring systems also suffer from model fade and lose accuracy with time. NZCS will allow us to develop NZ specific risk scoring models and also allow us to develop ongoing real-time risk modelling and adjustment for individuals and groups of patients.



Finally, it is important to stress that a cardiac surgical team is an extensive one and numerous medical professionals' support and provide care to each individual patient through their journey. Whilst the operation is ultimately the largest intervention undertaken it is important to stress that each of the medical professions involved (cardiologist, surgeon, perfusionist, intensive care specialist, anaesthetist, junior doctor, nurse, social worker, physiotherapist, pharmacist and occupational therapist) play an important role in the care provided to, and the outcomes for each individual patient. When we report outcomes these are collectively shared by all members of the team. The development of a robust and accurate database allows us to identify where the team is doing well but also where there is room for the team to improve. The national database is supported by a rigorous governance structure, each individual surgeon maintains professional development and practice audit in keeping with standards set by the New Zealand Medical Council (NZMC), the Australasian Society of Cardiac and Thoracic Surgeons (ANZCTS) and the Royal Australasian College of Surgeons (RACS). Whilst the database and our regulatory bodies (NZMC, RACS) have processes in place to identify and further assess underperforming individuals an important aspect of a national report is that it remains confidential at an individual surgeon and patient level. In reporting unit results we are acknowledging that the outcomes presented are not just attributable to individuals but are a product of the collaboration between and the contributions made by all members of the cardio surgical team.

Sean Galvin

on behalf of the National Cardiac Surgery Clinical Network (NCSCN)

NCSCN members who contributed to this report:

- P Allison
- P Davis
- K Evison
- G Devlin
- A El Gamel
- S Galvin
- D Haydock
- S Morgan
- K Murray
- H Singh
- I Ramanathan
- R Stewart

Other contributors:

- C Allin
- H Coolen
- R Kinsman
- A McGeorge
- P Walton
- S Wells

Consumer advocate summary

Dear consumer of cardiac surgery services:

My name is Kevin Murray and I have the honour to represent your voice on the working group that has produced this report. As your representative there was a number of conflicting emotions and concerns surrounding what is required in a report and what value it would bring to the consumer. It was argued that a performance scorecard would be a good starting point however I learned very quickly that this type of report would not be very useful to a consumer in fact it could undermine the good work and confidence in the Cardiac treatment and care professional teams currently deliver throughout New Zealand.

I soon learned that there was actually an existing prioritisation pathway in that those surgeons with specialist experience were already seeing more complex patients referred to them. So a performance scorecard would not be comparing apples with apples but would mislead you into thinking that it would be okay to shop around rather than getting the right surgeon assigned to you at the right place and time to meet your needs. I suggest this would have to be as a consumer the fundamental point that we require in Cardiac Care service delivery.

In order for you to understand this report and to understand the philosophy of the right person at the right time at the right place we need to start comparing apples with apples throughout our centres in New Zealand. Then we can benchmark that against others worldwide like how they perform in the United Kingdom and Australia and even across Europe. Whilst this initial report shows you how the committee is bringing all this information together in order to give you a consistent comparison please believe that the doctors are not trying to cover up anything but are trying to make sure that the information contained in this report is transparent, accurate and will show you how they strive to deliver world class Cardiac treatment and care.

I endorse the first report for your perusal and edification and confirm that subsequent reports will build on the basis of the information contained in this report to assist us learn how we can work together to put your needs at the heart of quality Cardiac treatment and care in New Zealand.

Yours faithfully,

Kevin Murray

Consumer Representative



Data presentation

- The data has been compiled for the period 1 January to 31 December 2015.
- It includes all public funded cardiac surgical procedures performed nationally.
- In this report we have analysed the risk factors and their impact on outcomes.
- The two standardised operations included are coronary artery bypass grafting (CABG), and aortic valve replacement (AVR) these account for over 65% of the workload of all cardiac surgical units.
- The data has been collected using Dendrite Clinical Systems clinical database an international medical audit software company.
- The definitions used in this database have been aimed to be identical with international definitions so a realistic comparison can be made with other international standards.
- In the development process Auckland DHB proceeded in collecting data with another data audit group hence some discrepancies occur in comparisons which are evident in this report and correction has been made for these. We all are presently working on implementing the audit dataset within the ADHB so that over the years this issue will be resolved.
- This dataset is a single year's results. It does not take into account retrospective years of surgical performance and as a result fails to recognise surgical experience and the unit's total performance. We suggest caution in interpreting performances of units. Overall with the limited data available it is reassuring to see all units and surgeons are performing above the accepted International bench marks.
- The National cardiac surgical network with the MOH help was set up as a working group to review public funded cardiac surgery and equity of care at a national level.
- The group recognised the lack of a uniform registry to review outcomes and performance. With an MOH initiative in 2008-2009 funding was allocated for development of a national registry.
- An independent company with previous experience in audit collection was contracted.
- This is the first report of the registry. It shows an analysis of the performance between the 5 DHB performing cardiac surgery for the one year period commencing 1 January 2015.

Overview of people who had cardiac surgery

In the 12 months period a total of 2,764 cardiac operations were performed across the 5 District Health Boards (DHB) undertaking Cardiac surgery: Auckland DHB, Waikato DHB, Capital and Coast DHB, Canterbury DHB, Southern DHB.

The risk of heart disease is influenced by a number of factors. These include age, sex, lifestyle choices (e.g., smoking), elevated cholesterol levels (familial, high cholesterol diet, lack of exercise), high blood pressure and diabetes.

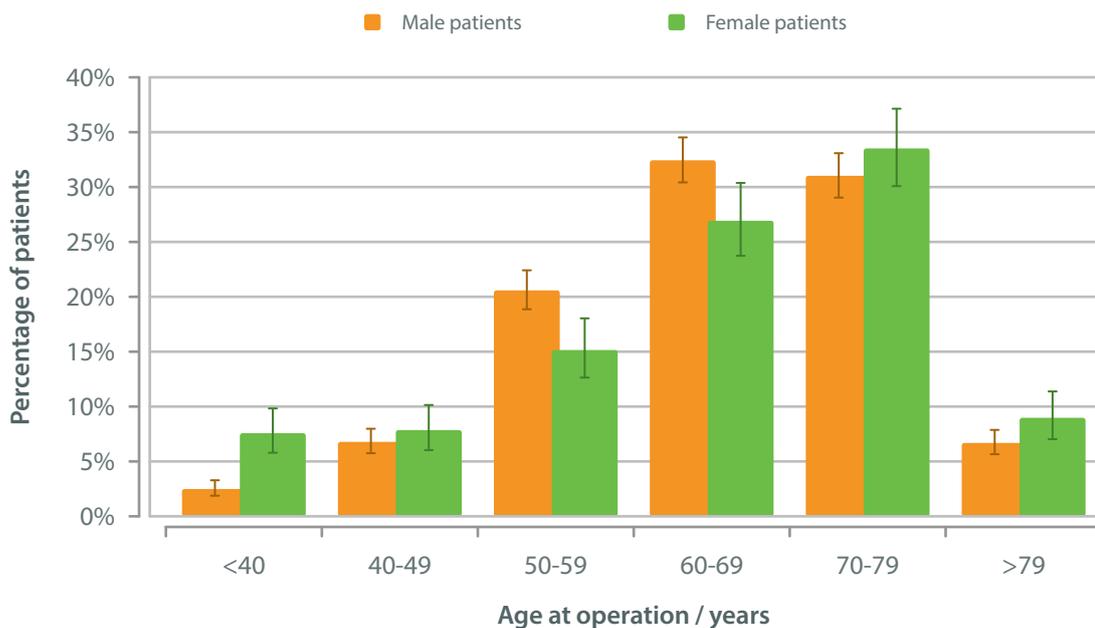
The presentation of over 70% of the patients was after 60 years of age. With men presenting at a slightly earlier age than women. Heart disease was more common in men who accounted for just over 70% of the total number (Table 1, Fig. 1). These match very similar to international figures.

Table 1. All cardiac surgery patients in 2015: age and gender

	Gender		
	Male	Female	All
<40	51	54	105
40-49	139	56	195
50-59	422	108	530
60-69	665	192	857
70-79	636	239	875
>79	137	64	201
Unspecified	1	0	1
All	2,051	713	2,764

Fig. 1

All cardiac surgery patients: Age & gender distributions; calendar year 2015 (n=2,763)



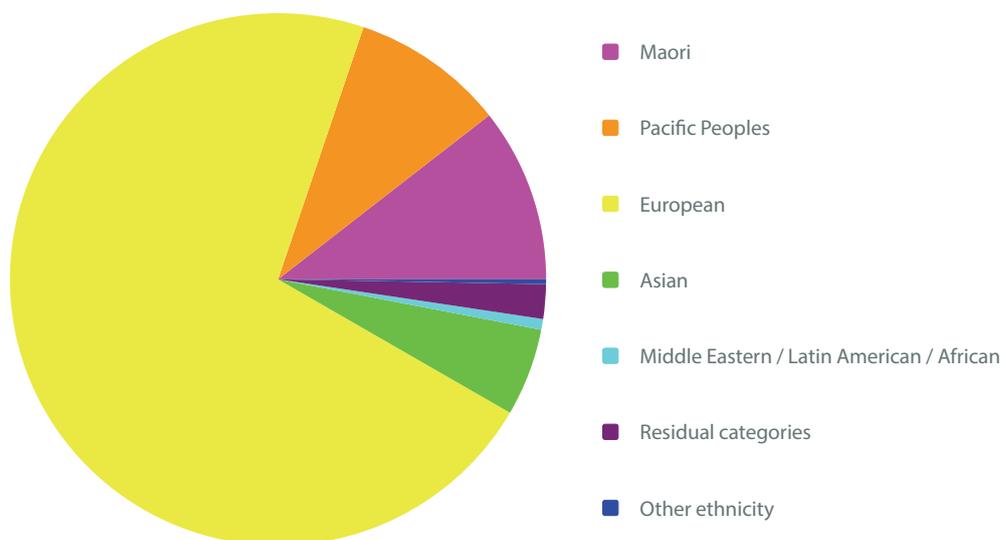


The ethnic distribution of the group showed just over 70% of the patients were of European origin and 10% Maori (Table 2).

Table 2. Ethnicity of patients undergoing cardiac surgery in 2015

	Count	Percentage
Maori	292	10.6%
Pacific Peoples	256	9.3%
European	1,984	71.8%
Asian	147	5.3%
Middle Eastern / Latin American / African	18	0.7%
Residual categories	58	2.1%
Other ethnicity	8	0.3%
Unspecified	1	
All	2,764	

Fig. 2 All cardiac surgery patients: Ethnicity; calendar year 2015 (n=2,763)



Risk factors

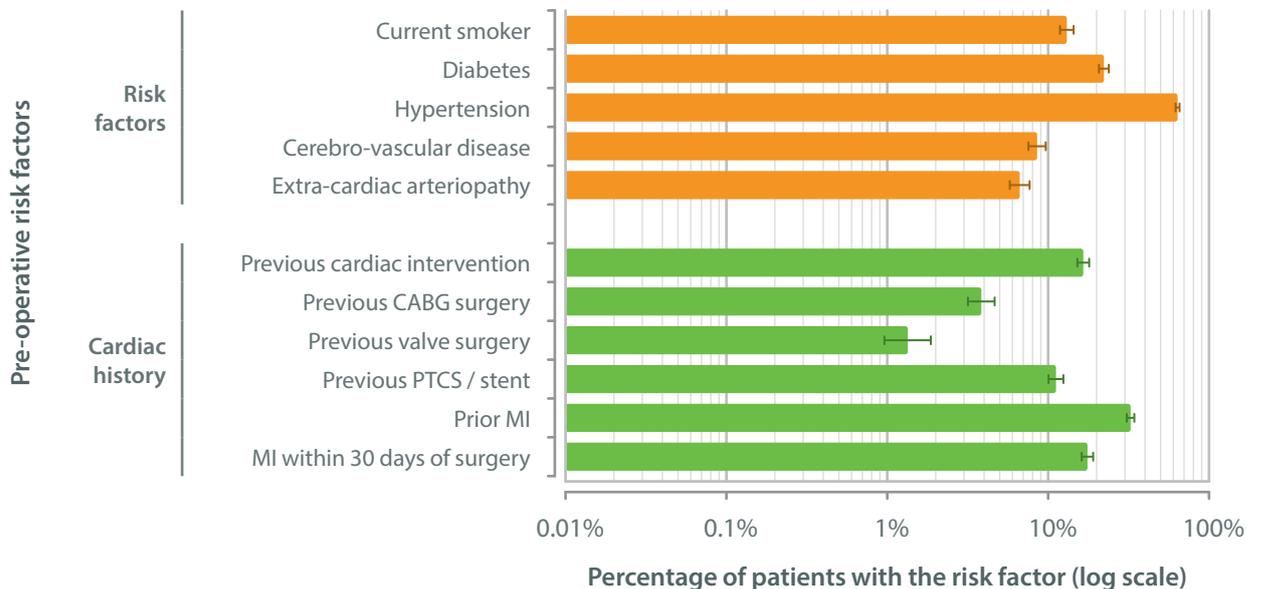
- One in nine patients were still smoking at the time of surgery.
- Approximately one-fourth of the patients had diabetes.
- Over 50% of the patients had high blood pressure.
- More than half the patients were obese.
- One in nine patients were morbidly obese.

Table 3. All patients in 2015: Pre-operative risk factors

	Risk factor present				
	No	Yes	Unspecified	Percentage with the risk factor	
Risk factors	Current smoker	2,401	361	2	13.1%
	Diabetes	2,149	614	1	22.2%
	Hypertension	1,000	1,763	1	63.8%
	Cerebro-vascular disease	2,526	236	2	8.5%
	Extra-cardiac arteriopathy	2,579	184	1	6.7%
Cardiac history	Previous cardiac intervention	2,306	457	1	16.5%
	Previous CABG surgery	2,651	106	7	3.8%
	Previous valve surgery	2,720	37	7	1.3%
	Previous PTCA / stent	2,452	309	3	11.2%
	Prior MI	1,863	899	2	32.5%
	Prior MI within 30 days of surgery	2,276	485	3	17.6%

Fig. 3

All cardiac surgery patients: Risk factors; calendar year 2015





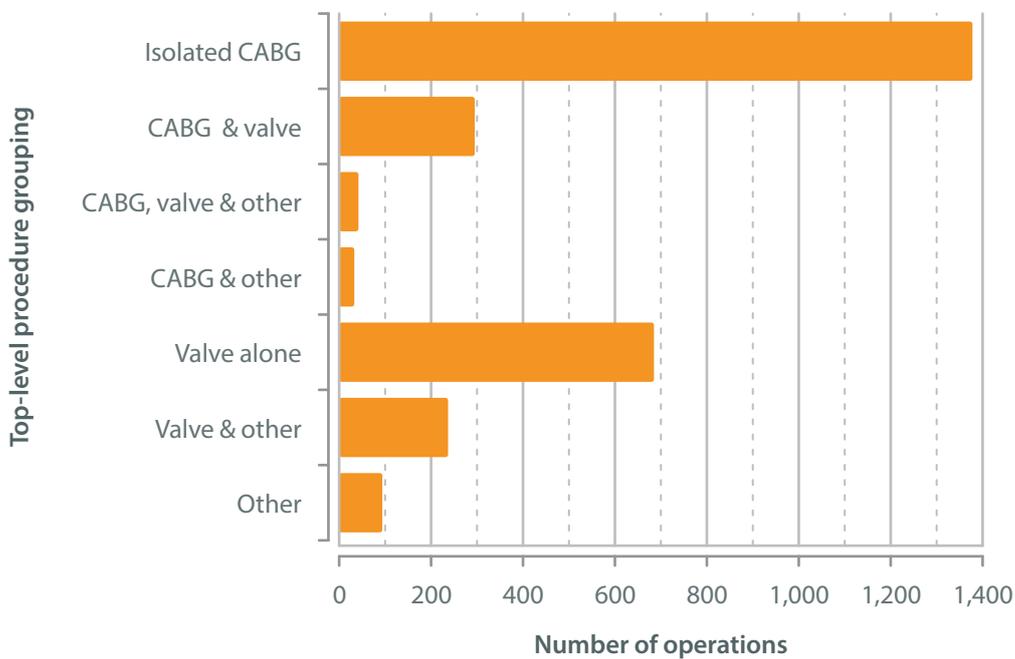
Types of operations performed

- Isolated coronary artery bypass accounted for 50% of the total volume of cases.
- Isolated heart valve operations were 25%.
- Combined valve and coronary artery bypass - 10.7%.
- 15% of cases were for *Other*, less common procedures.

Table 4. Procedures performed in 2015

	Count	Percentage
CABG	1,378	49.9%
CABG & valve	295	10.7%
CABG, valve & other	42	1.5%
CABG & other	33	1.2%
Valve alone	685	24.8%
Valve & other	237	8.6%
Other	94	3.4%
All	2,764	

Fig. 4 **Operations performed in the calendar year 2015**



Isolated CABG



Isolated coronary artery bypass surgery

Coronary artery bypass grafting (CABG) is an operation undertaken to bypass blocked arteries of the heart in patients who are not suitable for a non-surgical option (stent placement) or due to failure of stents.

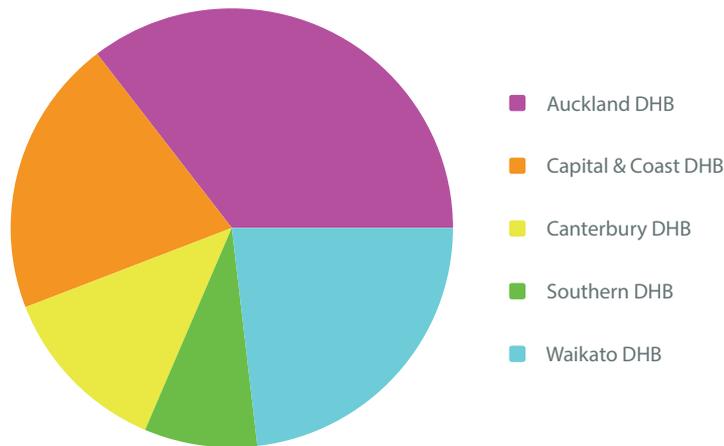
The operation is the most commonly performed operation by a Cardiac surgeon. In the year 2015 a total of 1,369 patients underwent a publicly-funded isolated CABG operation (50%) of the total volume of cardiac surgery. (Table 5).

Table 5. First-time isolated CABG in 2015: DHB where the surgery took place

Hospital	Count
Auckland DHB	485
Capital & Coast DHB	280
Canterbury DHB	174
Southern DHB	113
Waikato DHB	317
All	1,369

Fig. 5

First-time isolated CABG: DHB of surgery (n=1,369)



Coronary artery disease is a condition where cholesterol deposition occurs in the arteries supplying blood to the heart. Some people are unfortunately prone to the condition due to family genes. However in others it could be due to other risk factors such as diabetes, high blood pressure, smoking and obesity (Table 7, Fig. 6) or a combination of them. These factors also enhance early progression of the disease in those with a familial predisposition. They also influence outcome in terms of complications and early recovery from heart surgery.

In the New Zealand population entered in the registry, the incidence of these risk factors was:

- one in six patients (15%) were current smokers.
- one in four (29%) were diabetic.
- one in three (43%) were obese.

Table 6. First-time isolated CABG in 2015: Body Mass Index

	Count	Percentage
<20.0	19	1.4%
20.0-24.9	251	18.5%
25.0-29.9	527	38.8%
30.0-34.9	370	27.3%
35.0-39.9	130	9.6%
40.0-44.9	47	3.5%
>44.9	13	1.0%
Unspecified	12	0.9%
All	1,369	

BMI classifications

Ministry of Health New Zealand. Body size. Retrieved from: <http://www.health.govt.nz/our-work/populations/maori-health/tatau-kahukura-maori-health-statistics/nga-tauwehe-tupono-me-te-marumaruru-risk-and-protective-factors/body-size>.

Table 7. International BMI cut-off points for adults aged 18 years and over

Classification	BMI range (kg m ⁻²)	Risk of health conditions
Underweight	<18.5	Low risk
Normal range	18.5-24.9	Average risk
Overweight	25.0-29.9	Increased risk
Obese	>29.9	Substantially increased risk

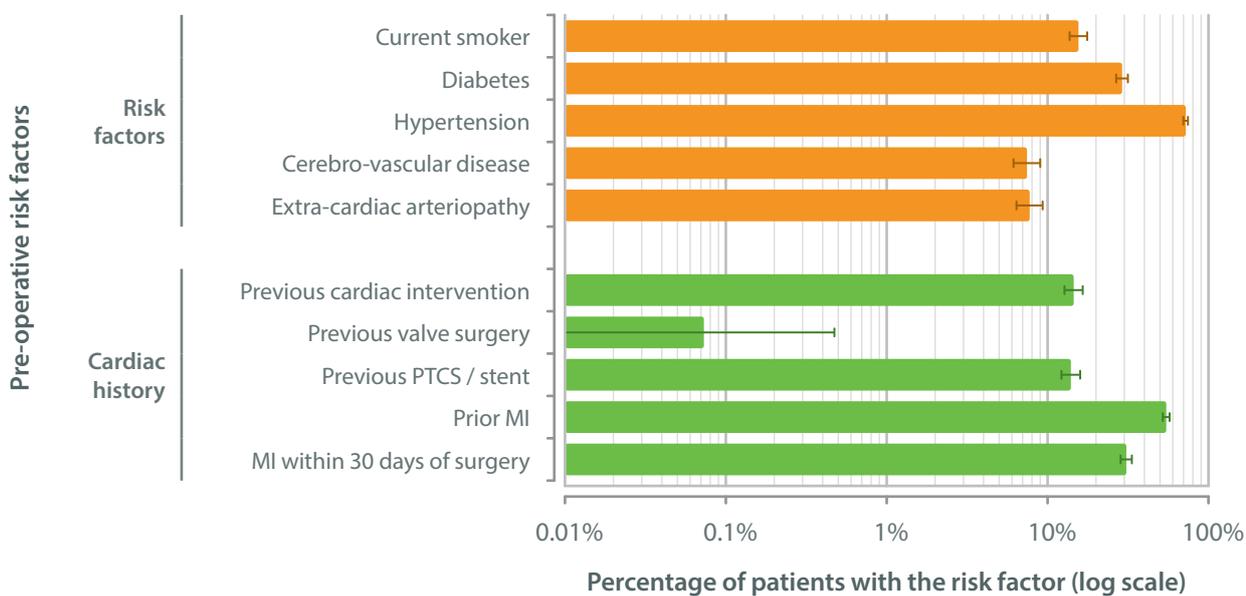


Table 8. First-time isolated CABG in 2015: Pre-operative risk factors

	Risk factor present			Percentage with the risk factor	
	No	Yes	Unspecified		
Risk factors	Current smoker	1,155	213	1	15.6%
	Diabetes	971	398	0	29.1%
	Hypertension	380	989	0	72.2%
	Cerebro-vascular disease	1,267	102	0	7.5%
	Extra-cardiac arteriopathy	1,263	106	0	7.7%
Cardiac history	Previous cardiac intervention	1,170	199	0	14.5%
	Previous valve surgery	1,368	1	0	0.1%
	Previous PTCA / stent	1,177	191	1	14.0%
	Prior MI	620	748	1	54.7%
	Prior MI within 30 days of surgery	945	422	2	30.9%

Isolated CABG

Fig. 6 First-time isolated CABG: Risk factors; calendar year 2015



Isolated CABG

Table 9. First-time isolated CABG in 2015: age and gender

Age at operation / years	Gender		
	Male	Female	All
<40	10	3	13
40-49	67	13	80
50-59	258	45	303
60-69	426	77	503
70-79	333	80	413
>79	43	13	56
Unspecified	1	0	1
All	1,138	231	1,369

Fig. 7

First-time isolated CABG: Age & gender distributions; calendar year 2015 (n=1,368)



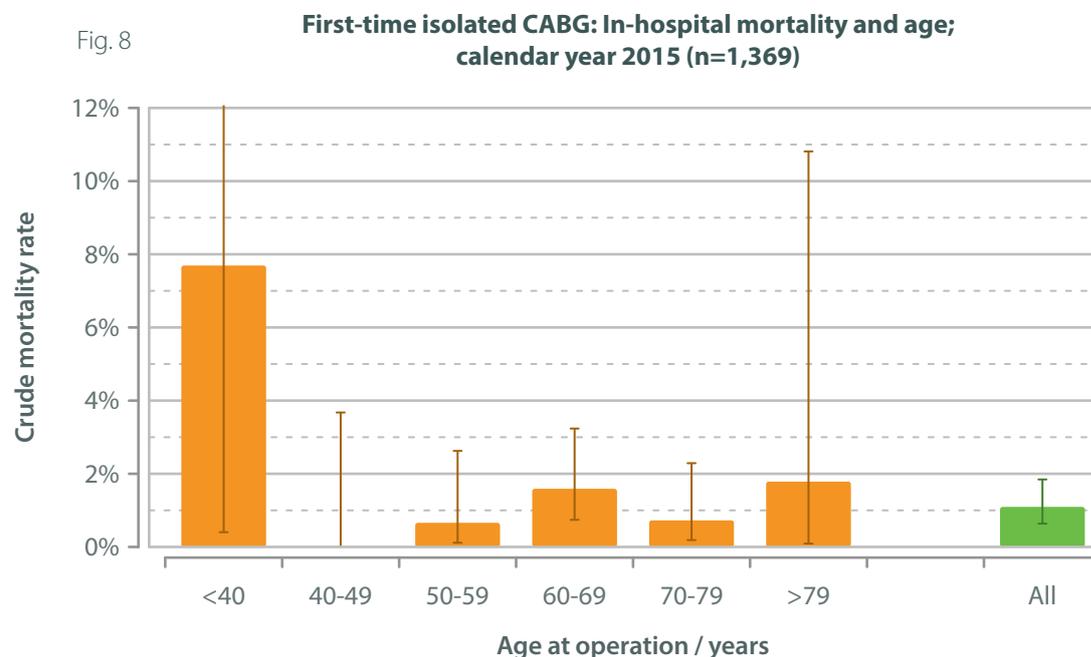


The overall survival results of isolated CABG operations nationwide is 98.9% which compares extremely well with international standards². The most common presentation of these patients is between 50 to 75 years of age which account for over 85% of the total volume. The majority of these patients present between 50 to 79 years of age, with men presenting at an earlier age than female patients. The overall male to female ratio is 5:1.

Table 10. First-time isolated CABG in 2015: age and in-hospital mortality

Age at operation / years	In-hospital mortality			Mortality rate (95% CI)	ANZCTS 2013 mortality rate (95% CI)
	No	Yes	All		
<40	12	1	13	7.7% (0.4-37.9%)	0.0% (0.0-5.8%)
40-49	80	0	80	0.0% (0.0-3.7%)	0.9% (0.2-2.9%)
50-59	301	2	303	0.7% (0.1-2.6%)	0.4% (0.1-1.0%)
60-69	495	8	503	1.6% (0.7-3.2%)	1.1% (0.7-1.7%)
70-79	410	3	413	0.7% (0.2-2.3%)	1.6% (1.1-2.4%)
>79	55	1	56	1.8% (0.1-10.8%)	3.2% (1.9-5.5%)
Unspecified	1	0	1	0.0% (0.0-95.0%)	
All	1,354	15	1,369	1.1% (0.6-1.8%)	1.2% (1.0-1.6%)

Isolated CABG



2. ANZCTS Cardiac Surgery Database program. National Annual Report (2013). Retrieved from: <http://anzcts.org/wp-content/uploads/2015/06/Database-National-Annual-Report-2013.pdf>

As expected the salvage and emergency procedures had a higher mortality, but it is hard to interpret based on small volumes. Based on **EuroSCORE** which takes into account risk factors the higher the score the greater risk of morbidity and mortality post-surgery. (e.g., **EuroSCORE** 6.0-7.9) **EuroSCORE II** is a method of calculating predicted operative mortality for patients undergoing cardiac surgery (Table 11).

Table 11. First-time isolated CABG in 2015: operative urgency and in-hospital survival

		In-hospital survival			
		Yes	No	All	Survival rate (95% CI)
Operative urgency	Elective	914	4	918	99.6% (98.8-99.9%)
	Urgent	422	8	430	98.1% (96.2-99.1%)
	Emergency / salvage	18	3	21	85.7% (62.6-96.2%)
	All	1,354	15	1,369	98.9% (98.2-99.4%)

Fig. 9 First-time isolated CABG: In-hospital survival rates; calendar year 2015 (n=1,369)

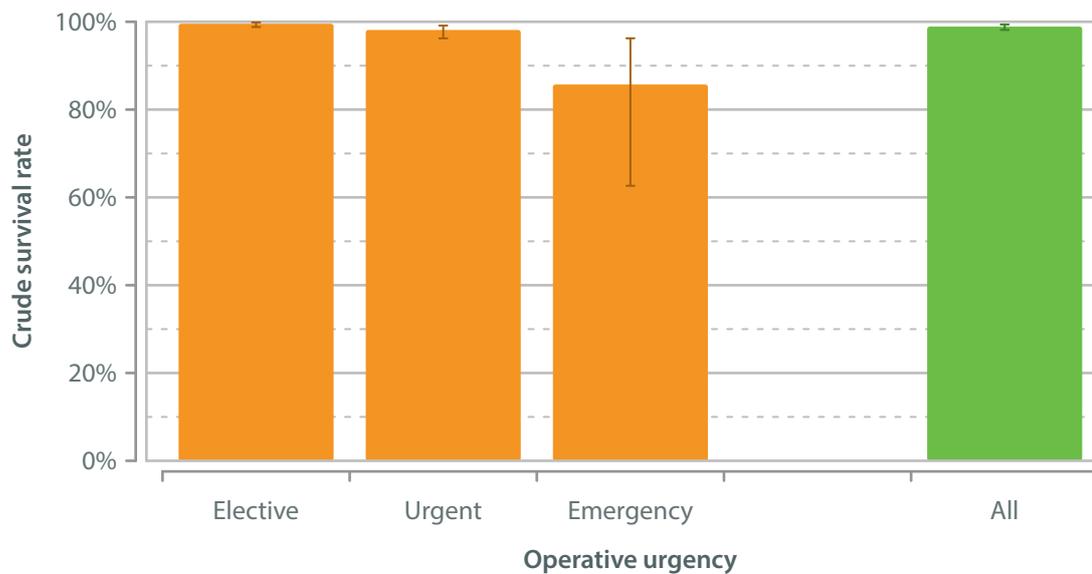


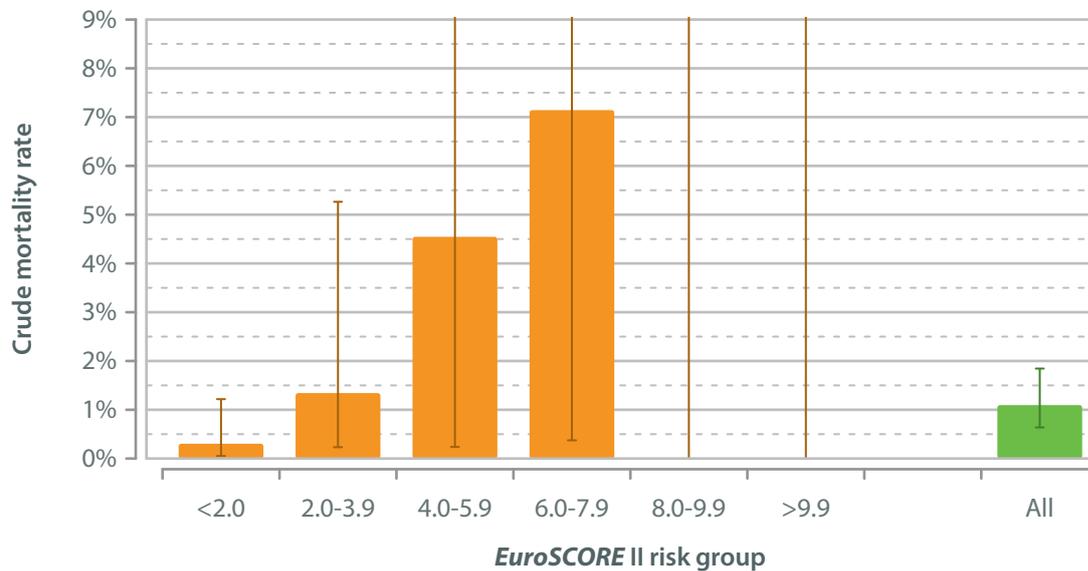


Table 12. First-time isolated CABG in 2015: **EuroSCORE** II risk score and in-hospital mortality

EuroSCORE II	In-hospital mortality			
	No	Yes	All	Mortality rate (95% CI)
<2.0	656	2	658	0.3% (0.1-1.2%)
2.0-3.9	147	2	149	1.3% (0.2-5.3%)
4.0-5.9	21	1	22	4.5% (0.2-24.9%)
6.0-7.9	13	1	14	7.1% (0.4-35.8%)
8.0-9.9	6	0	6	0.0% (0.0-39.3%)
>9.9	14	0	14	0.0% (0.0-19.3%)
Unspecified	497	9	506	1.8% (0.9-3.5%)
All	1,354	15	1,369	1.1% (0.6-1.8%)

Isolated CABG

Fig. 10 First-time isolated CABG: In-hospital mortality and pre-operative risk; calendar year 2015



Quality of care of cardiac surgical patients

The success and quality of care provided for a Cardiac surgical patient is determined far more on the journey of the patient. From the time of being accepted for surgery to the discharge from the hospital following the surgery and not only the mortality associated with the procedure. The impact of the team in delivery of a satisfactory outcome cannot be underestimated. The registry is designed to measure these quality measures to allow us to identify and focus on specific areas and help improve quality of care. Some of these markers include mechanical ventilation, time spent in the intensive care unit, hospital stay and wound infection.

Mechanical ventilation is temporarily required following cardiac surgery. The duration of ventilated assistance is determined to a large extent by the complexity of the patient's procedure and the presence or absence of pre-existing risk factors such as obesity and lung function (Table 13). The median ventilation time for 2015 was 6 hours.

Following cardiac surgery patients usually spend a period of time in intensive care (ICU) and are transferred to the ward once fully recovered. The median time spent in ICU for 2015 was 23 hours. Time spent in ICU is determined by how quickly the patients recover which is impacted by core morbidity conditions and complications of the procedure.

Patients' length-of-stay in hospital following a CABG procedure was on average 6 days. These all compare favourably with the international literature.

Complications following cardiac surgery are not only determined by patient conditions but also reflect the quality of care that the patient receives; commonly monitored by measurement of.

- deep sternal wound infection.
- return to theatre.
- readmission rates following surgery.

Table 13. First-time isolated CABG in 2015: hospital resource utilisation

		No	Yes	Rate
Resource utilisation	Same day admission	1,337	32	2.3%
		Count	Median	Inter-quartile range
	Ventilation time / hours	1,351	6.0	4.0-11.0
	Time on ICU / hours	1,346	23.0	20.0-43.0
	Post-operative stay / days	1,360	6.0	5.0-7.0
	Hospital stay / days	1,362	9.0	7.0-15.0



All five public cardiac surgery units performed CABG procedures well above international guidelines with low complication rates.

Table 14. First-time isolated CABG in 2015: complications

		Complication			
		No	Yes	Unspecified	Rate (95% CI)
In-hospital	Deep sternal wound infection	1,363	6	0	0.4% (0.2-1.0%)
	Any return to theatre	1,307	62	0	4.5% (3.5-5.8%)
	Return to theatre for bleeding ³	1,316	24	29	1.8% (1.2-2.7%)
30-day	Readmission	1,257	112	0	8.2% (6.8-9.8%)
	Deep sternal wound infection	1,341	6	22	0.4% (0.2-1.0%)

3. The **unspecified** data for the **Return to theatre for bleeding** outcome represent entries where the patient has been flagged as returning to theatre, but the reason for the return to theatre has not been recorded.

Aortic valve surgery



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.

In the year 2015 363 Isolated AVR procedures were performed of which 349 were first time aortic valve procedures, which is approximately 13% of the overall surgical volume (Table 15).

Table 15. Valve surgery in 2015

	Top-level procedure classification	
	Valve alone	CABG & valve
Aortic valve alone	363	237
Mitral valve alone	191	38
Aortic & mitral valves	37	10
Mitral & tricuspid valves	56	6
Others	34	4
Unspecified	4	0
All	685	295

Valves treated

Aortic valve surgery may be required because of either leakage of the valve (aortic regurgitation) or blockage of the valve (aortic stenosis). These conditions can occur for a variety of reasons, the most common being degenerative age related calcification or hardening of the valve. Dysfunction of the valve may also be due to conditions such as rheumatic fever that can damage the structure of the valve or in some cases be due to a congenital abnormality (bicuspid aortic valve) that causes it to fail at an earlier age. In some cases the valve may need to be replaced because of infection on the leaflets that lead to valve destruction. The majority of patients have age related calcific aortic stenosis and this tends to occur later in life in particular in the >70 years of age group (see Table 18 and Fig. 13). Younger patients are more likely to have an AVR due to rheumatic fever, a bicuspid valves or infection on the leaflets.

As expected a significant number of the patients have additional cardiovascular risk factors including:

- 17.5% diabetics,
- 54.7% with hypertension.
- 10.9% having had a previous cardiovascular intervention.

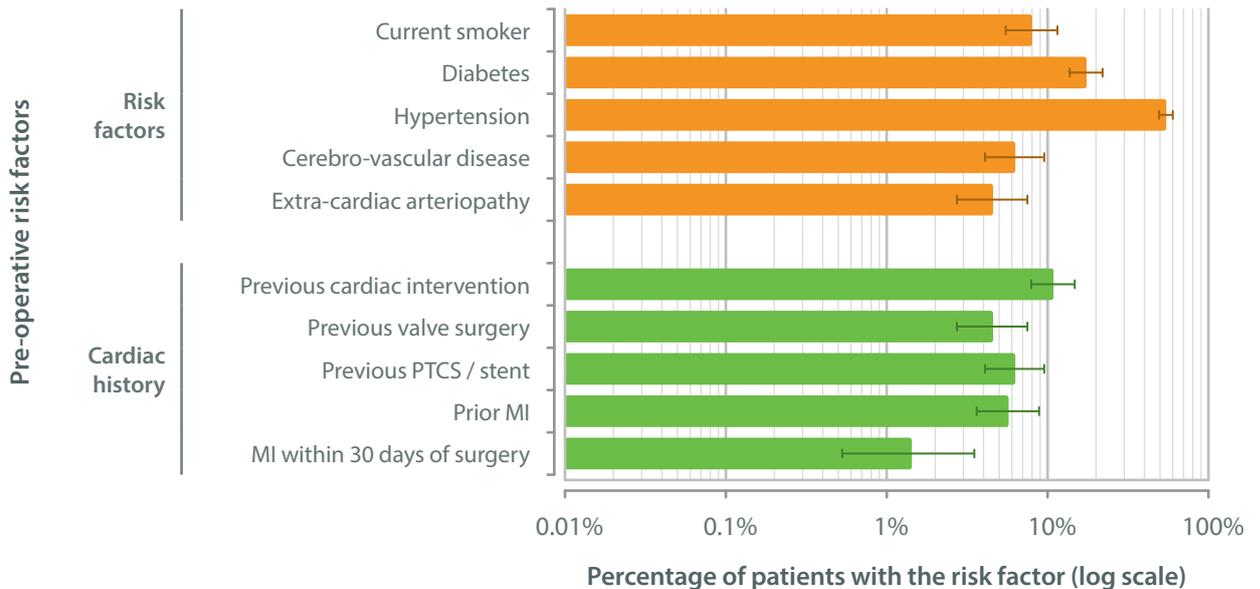
Aortic valve surgery

Table 16. First-time isolated AVR in 2015: Pre-operative risk factors

Risk factors	Risk factor present			Percentage with the risk factor
	No	Yes	Unspecified	
Current smoker	321	28	0	8.0%
Diabetes	288	61	0	17.5%
Hypertension	158	191	0	54.7%
Cerebro-vascular disease	327	22	0	6.3%
Extra-cardiac arteriopathy	333	16	0	4.6%
Cardiac history				
Previous cardiac intervention	311	38	0	10.9%
Previous CABG surgery	333	16	0	4.6%
Previous PTCA / stent	327	22	0	6.3%
Prior MI	329	20	0	5.7%
Prior MI within 30 days of surgery	344	5	0	1.4%

Fig. 11

First-time isolated AVR: risk factors; calendar year 2015





Most patients undergo surgery in a planned or elective fashion with smaller numbers undergoing urgent, emergency or salvage surgery (Table 17).

Table 17. First-time isolated AVR in 2015: operative urgency and in-hospital survival

	In-hospital survival			
	Yes	No	All	Survival rate (95% CI)
Operative urgency				
Elective	297	3	300	99.0% (96.9-99.7%)
Urgent	45	1	46	97.8% (87.0-99.9%)
Emergency / salvage	3	0	3	100.0% (36.8-100.0%)
All	345	4	349	98.9% (96.9-99.6%)

Fig. 12 First-time isolated AVR: In-hospital survival rates; calendar year 2015 (n=349)

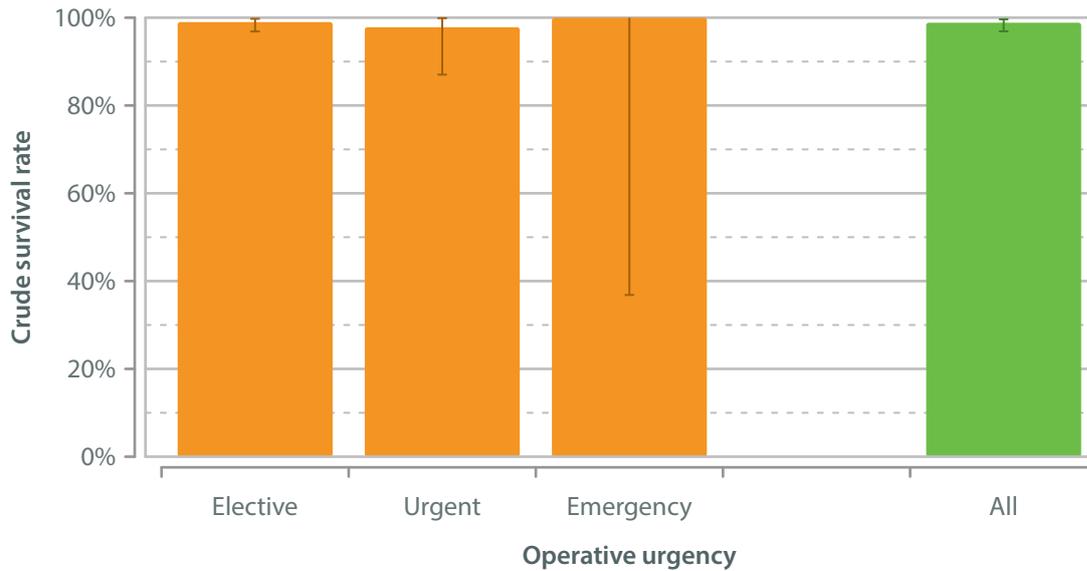


Table 18. First-time isolated AVR in 2015: age and gender

Age at operation / years	Gender		
	Male	Female	All
<40	7	6	13
40-49	12	4	16
50-59	38	12	50
60-69	48	30	78
70-79	81	56	137
>79	34	21	55
Unspecified	0	0	0
All	220	129	349

Fig. 13

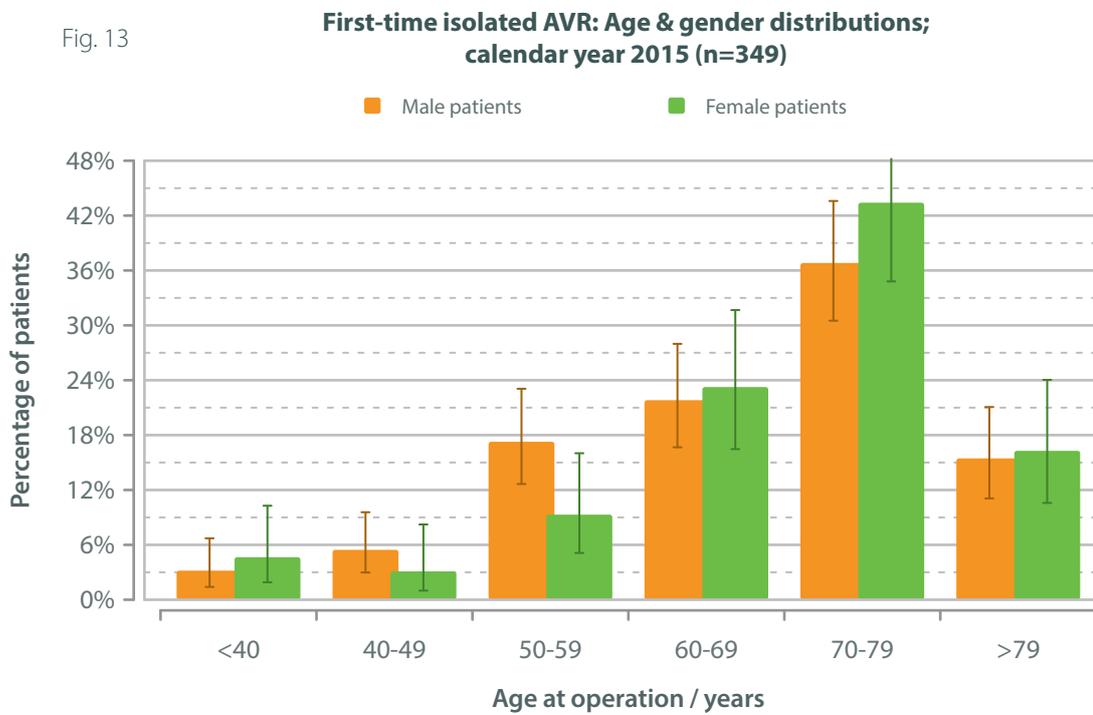




Table 19 shows the distribution of risk profiles in patients undergoing isolated AVR and the observed mortality rate.

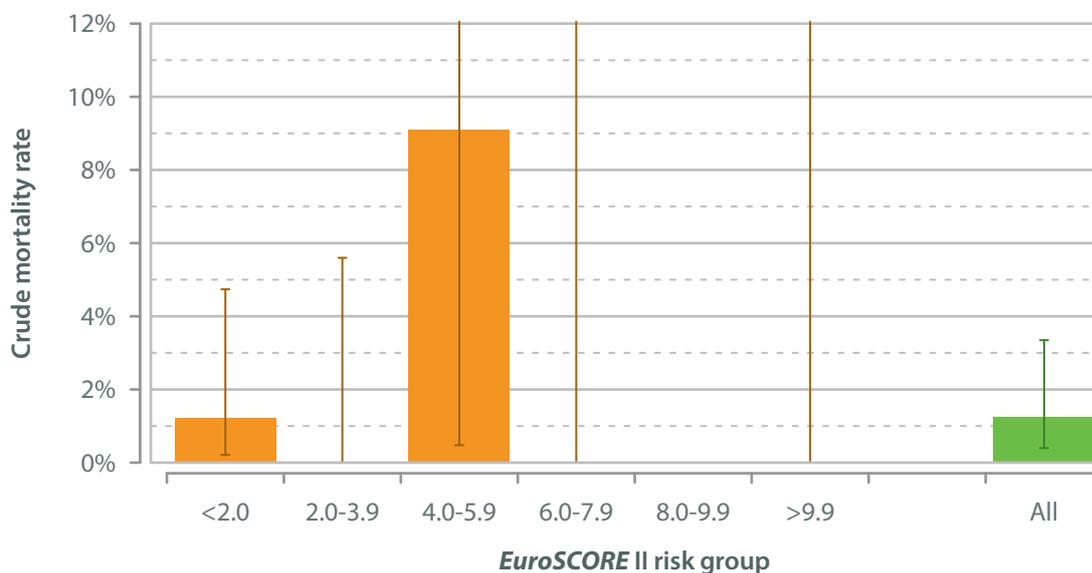
- The overall observed mortality for isolated AVR in New Zealand was low (1.1%), which is in keeping with internationally accepted outcomes.
- The majority of patients (166) are in the low risk category with an observed mortality of 1.2%.
- Reported outcomes in groups with fewer numbers of patients (e.g., **EuroSCORE** 4.0-5.9) are heavily influenced by those small numbers (1 / 11) and therefore mortality rates (9.1%) have to be interpreted in the context of statistical variance.
- There was 1 death recorded in patients with a **EuroSCORE** II >2 (n=70), but that death occurred in a group with a very small number of patients (n=11).
- As the registry grows we will be able to make more accurate assessment of outcomes in these higher risk cohorts.
- ADHB are unable to generate **EuroSCORE** data as they do not collect all the necessary data fields for the **EuroSCORE** to be calculated. This means that 113 patients cannot be risk stratified (*unspecified*). Despite not being able to risk stratify it is reassuring to note that the observed mortality in this un-risk stratified group is low (0.9%) and in keeping with outcomes across the rest of New Zealand. ADHB is working toward a system upgrade that will allow risk modelling in future reports.

Table 19. First-time isolated AVR in 2015: **EuroSCORE** II risk score and in-hospital mortality

	In-hospital mortality			
	No	Yes	All	Mortality rate (95% CI)
EuroSCORE II <2.0	164	2	166	1.2% (0.2-4.7%)
2.0-3.9	52	0	52	0.0% (0.0-5.6%)
4.0-5.9	10	1	11	9.1% (0.5-42.9%)
6.0-7.9	5	0	5	0.0% (0.0-45.1%)
8.0-9.9	0	0	0	NA
>9.9	2	0	2	0.0% (0.0-77.6%)
Unspecified	112	1	113	0.9% (0.0-5.5%)
All	345	4	349	1.1% (0.4-3.1%)

Fig. 14

First-time isolated AVR: In-hospital mortality and age; calendar year 2015 (n=349)



Major morbidity including return to theatre for bleeding and deep sternal wound infection rates (Table 21) are in keeping with internationally published outcomes.

Comparison with the 2013 ANZCTS National Annual Report is favourable. It showed that total AVR mortality was 1.9% and post-operative length-of-stay was 8 days; deep sternal wound infection was reported as 0.5%, return to theatre as 5.2%, and return to theatre for bleeding 2.6%⁴.

Aortic valve surgery

Table 20. First-time isolated AVR in 2015: hospital resource utilisation

		No	Yes	Rate
Resource utilisation	Same day admission	329	20	5.7%
		Count	Median	Inter-quartile range
	Ventilation time / hours	349	6.0	4.0-11.0
	Time on ICU / hours	349	23.0	20.0-41.0
	Post-operative stay / days	345	7.0	5.0-8.0
	Hospital stay / days	346	8.0	6.5-12.0

Table 21. Isolated aortic valve surgery in 2015: complications

		Complication			
		No	Yes	Unspecified	Rate (95% CI)
In-hospital	Deep sternal wound infection	347	1	1	0.3% (0.0-1.8%)
	Any return to theatre	327	22	0	6.3% (4.1-9.5%)
	Return to theatre for bleeding ⁵	332	7	10	2.1% (0.9-4.4%)
30-day	Readmission	322	27	0	7.7% (5.3-11.2%)
	Deep sternal wound infection	345	1	3	0.3% (0.0-1.9%)

4. ANZCTS Cardiac Surgery Database program. National Annual Report (2013). Retrieved from: <http://anzscts.org/wp-content/uploads/2015/06/Database-National-Annual-Report-2013.pdf>.

5. The **unspecified** data for the **Return to theatre for bleeding** outcome represent entries where the patient has been flagged as returning to theatre, but the reason for the return to theatre has not been recorded.



Summary

1. The New Zealand Cardiac Surgery Registry has been created to record and provide analysis of publicly funded cardiac surgical procedures.
2. In our first year of data collection we have bench marked against the ANZCTS dataset and used **EuroSCORE** II as the risk stratification tool.
3. We note that the risk adjusted outcomes and other measures of quality of care (ventilator time, ICU and hospital stay) for all five units for the two most common procedures (CABG and AVR) performed by adult cardiac surgeons compare well with internationally accepted standards. ADHB data despite not being risk adjusted is still above accepted international benchmarked data^{6,7,8}.
4. The spectrum of different operations performed is not dissimilar to other developed countries.
5. Other smaller volume operations will be able to be analysed once a few years data has been compiled and statistically significant volumes are available.
6. The New Zealand Cardiac Surgery Registry will allow us in the future to research improved quality measures.
7. We are working towards integration of ADHB database to the same platform as the other units making the comparison easier and seamless in the future.
8. It is important to stress that a cardiac surgical team is an extensive one and numerous medical professionals' support and provide care to each individual patient through their journey. Whilst the operation is ultimately the largest intervention undertaken it is important to stress that each of the medical professionals involved (cardiologist, surgeon, perfusionist, intensive care specialist, anaesthetist, junior doctor, nurse, social worker, physiotherapist, pharmacist and occupational therapist) play an important role in the care provided to, and the outcomes for each individual patient.
9. Whilst the registry and our regulatory bodies (NZMC, RACS) have processes in place to identify and further assess underperforming individuals an important aspect of a national report is that it remains confidential at an individual surgeon and patient level. In reporting unit results we are acknowledging that the outcomes presented are not just attributable to individuals, but are a product of the collaboration between and the contributions made by all members of the cardiosurgical team.
10. The New Zealand Cardiac Surgical Registry is supported by a rigorous governance structure. Each individual surgeon maintains professional development and practice audit in keeping with standards set by the New Zealand Medical Council (NZMC), the Australasian Society of Cardiac and Thoracic Surgeons (ANZCTS) and the Royal Australasian College of Surgeons (RACS).

6. ANZCTS Cardiac Surgery Database program. National Annual Report (2013). Retrieved from: <http://anzscts.org/wp-content/uploads/2015/06/Database-National-Annual-Report-2013.pdf>.
7. Bridgewater B, Kinsman R, Walton P and Keogh B. Demonstrating quality: the Sixth National Adult Cardiac Surgery database report. ISBN 1-903968-23-2. Published by Dendrite Clinical Systems Ltd, Henley-on-Thames, Oxfordsh
8. The Society of Thoracic Surgeons. (2016). Harvest 2 Executive Summary Adult Cardiac Surgery Database. Retrieved from: http://www.sts.org/sites/default/files/documents/2016Harvest2_ExecutiveSummary_new.pdf

Definitions

1. **Deep sternal wound infection:** is a serious post-operative complication of cardiac surgery.
2. **Elective:** the procedure could be deferred without the risk of compromised cardiac outcome.
3. **Urgent:** not routine; there is a medical reason for operating this admission.
4. **Emergency:** unscheduled surgery required in next available theatre on same day due to refractory angina or cardiac compromise.
5. **Salvage:** the patient is undergoing CPR *en route* to the operating room, that is, prior to surgical incision.
6. **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 countries⁶.
7. **MI:** myocardial infarction.
8. **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.
9. **PTCA:** percutaneous transluminal coronary angioplasty.

6. 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.

Appendix

Appendix

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 1; Version 1.0 (13 Dec 2013)



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



Powered by
Dendrite Clinical Systems



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 2; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

Admission information continued ...

Elective Day of Surgery Admit Patient	<input type="radio"/> No	<input type="radio"/> Yes
Insurance	<input type="radio"/> Public	<input type="radio"/> Self funded
	<input type="radio"/> Private health insurance	<input type="radio"/> Other
Operation number	<input type="radio"/> 1	<input type="radio"/> 4
	<input type="radio"/> 2	<input type="radio"/> 5
	<input type="radio"/> 3	<input type="radio"/> 6
Height	<input type="text"/>	cm
Weight	<input type="text"/>	kg



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 3; Version 1.0 (13 Dec 2013)

Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> 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"/> Oral <input type="radio"/> Diet <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"/> RIND or TIA <input type="radio"/> CVA <input type="radio"/> Carotid test
Cerebrovascular disease: when	<input type="radio"/> Recent <input type="radio"/> Remote
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



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 4; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery 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"/> 6-24 hours <input type="radio"/> 1-30 days	<input type="radio"/> 31-90 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"/> 1 <input type="radio"/> 2	<input type="radio"/> 3 <input type="radio"/> 4
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"/> 2	<input type="radio"/> 3 <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"/> Atrial <input type="radio"/> Heart block/pacing	<input type="radio"/> Ventricular <input type="radio"/> Other abnormal rhythm
Atrial arrhythmia: type	<input type="radio"/> Paroxysmal <input type="radio"/> Persistent	<input type="radio"/> Permanent
Permanent pacemaker <i>in situ</i>	<input type="radio"/> No	<input type="radio"/> Yes

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 5; Version 1.0 (13 Dec 2013)

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="radio"/> ≤2 days	<input type="radio"/> 3-7 days
Clopidogrel within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
Clopidogrel: when	<input type="radio"/> ≤2 days	<input type="radio"/> 3-7 days
IIb / IIIa blockade within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
IIb / IIIa blockade: when	<input type="radio"/> ≤2 days	<input type="radio"/> 3-7 days
Aggrostat within 7 days of surgery	<input type="radio"/> No	<input type="radio"/> Yes
Aggrostat: when	<input type="radio"/> ≤2 days	<input type="radio"/> 3-7 days
Other antiplatelet therapy within 7 days of surgery	<input type="radio"/> No <input type="radio"/> Yes	
Other antiplatelet: when	<input type="radio"/> ≤2 days	<input type="radio"/> 3-7 days



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 6; Version 1.0 (13 Dec 2013)



Unique patient identifier

Date of surgery dd/mm/yyyy

Previous interventions (surgical or percutaneous)

Previous cardiothoracic intervention No Yes

Previous surgery No 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 No Yes

PTCA / stent No Yes

PTCA / stent: which admission Prior admission This admission

PTCA / stent: interval (same admission) hours

Other percutaneous interventions

<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

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 7; Version 1.0 (13 Dec 2013)

Unique patient identifier	<input type="text"/>
Date of surgery	<input type="text"/> 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"/> LV gram <input type="radio"/> Radionuclide <input type="radio"/> Echo <input type="radio"/> MRI
EF	<input type="text"/> %
EF estimate	<input type="radio"/> Normal <input type="radio"/> Mild <input type="radio"/> Moderate <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"/> One <input type="radio"/> Two <input type="radio"/> Three
PA systolic	<input type="text"/> mm Hg
Pulmonary hypertension	<input type="radio"/> No <input type="radio"/> Moderate <input type="radio"/> Severe



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 8; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

Operation status / category

Surgery data

Consultant surgeon	<input 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"/> Prosthetic / homograft valve failure <input type="checkbox"/> Thrombosis <input type="checkbox"/> Dehiscence <input type="checkbox"/> Embolism <input type="checkbox"/> Infection <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	

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 9; Version 1.0 (13 Dec 2013)

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"/> Pulmonary vein isolation <input type="radio"/> Radial <input type="radio"/> Left atrial only <input type="radio"/> Mini-Maze <input type="radio"/> Right atrial only <input type="radio"/> Left atrial reduction <input type="radio"/> Other	
Atrial arrhythmia surgery: energy source	<input type="radio"/> Cut & sew <input type="radio"/> Microwave <input type="radio"/> Unipolar RF <input type="radio"/> Laser <input type="radio"/> Bipolar RF <input type="radio"/> Ultrasound <input type="radio"/> Cryoablation <input type="radio"/> Other	
Type of other cardiac surgery	<input type="checkbox"/> AF ablation surgery <input type="checkbox"/> LV rupture <input type="checkbox"/> ASD <input type="checkbox"/> Pericardiectomy <input type="checkbox"/> Atrial myxoma <input type="checkbox"/> Peripheral vascular <input type="checkbox"/> Cardiac transplant <input type="checkbox"/> Permanent LV epicardial lead <input type="checkbox"/> Cardiac trauma <input type="checkbox"/> Primary VAD <input type="checkbox"/> Cardiac trauma - iatrogenic <input type="checkbox"/> Pulm. thromboendarterectomy <input type="checkbox"/> Cardiac tumour <input type="checkbox"/> Pulmonary embolectomy <input type="checkbox"/> Epicardial pacemaker <input type="checkbox"/> Pulmonary transplant <input type="checkbox"/> Left ventricular reconstruction <input type="checkbox"/> VSD (acquired) <input type="checkbox"/> LV aneurysm <input type="checkbox"/> Other congenital <input type="checkbox"/> LVOT myectomy of HOCM <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	



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 10; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

CPB and support

Minimally invasive

Minimally invasive techniques attempted No Yes
Minimally invasive techniques indication Choice Contraindication Catheter
Performed off pump No Yes
Robotically assisted No Yes

CPB and mechanical support

Cardiopulmonary bypass used No Yes
Cardioplegia used No Yes
Cumulative cross clamp time min
Cumulative cardiopulmonary bypass time min
IABP No Yes
IABP: when inserted Pre-op Intra-op Post-op
IABP: indication Haemodynamic instability PTCA support Unstable angina CPB wean Prophylactic
Rota-pump No Yes
Rota-pump: when inserted Pre-op Intra-op Post-op
Rota-pump: indication Haemodynamic instability PTCA support Unstable angina CPB wean Prophylactic
Other mechanical support No Yes
Other mechanical support: when inserted Pre-op Intra-op Post-op
Other mechanical support: indication Haemodynamic instability PTCA support Unstable angina CPB wean Prophylactic

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 11; Version 1.0 (13 Dec 2013)



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"/> Trasylo ^l	<input type="radio"/> Other
	<input type="radio"/> Tranexamic acid	



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 12; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

Coronary bypass

Intra-operative decision to graft coronary artery No Yes

IMA used No Yes

Which IMA used Left Right

Number of distal arterial grafts integer: 0-9

Number of IMA distal anastomoses integer: 0-6

Number of RA conduits harvested integer: 0-2

Number of radial distal anastomoses integer: 0-6

Number of vein distal anastomoses integer: 0-9

Number of GEPA distal anastomoses integer: 0-6

Were arterial T or Y grafts used No Yes

Total number of distal anastomoses integer: 0-30

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 13; Version 1.0 (13 Dec 2013)

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
- Decalcification of valve only

Implant - type

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

Implant - manufacturer's model number select from table

Implant - serial number select from table

Implant - size mm

Explant - type

- None
- Autograft
- Mechanical
- Homograft/allograft
- Bioprosthesis
- 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
- Moderate
- Trivial
- Severe
- Mild

Aortic pathology / aetiology

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



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 14; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

Mitral valve surgery

Mitral valve procedure

- Annuloplasty only
- Replacement
- Repair / reconstruction with annuloplasty
- Repair / reconstruction without annuloplasty
- Commissurotomy with annuloplasty ring
- Commissurotomy without annuloplasty ring
- Repair paravalvular leak
- Inspection only
- Decalcification of valve only

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

Mitral stenosis

- No
- Yes

Mitral regurgitation / insufficiency

- None
- Trivial
- Mild
- Moderate
- Severe

Mitral pathology / aetiology

- Functional or isolated annular dilataion
- Rheumatic
- Congenital
- Ischaemic
- Idiopathic calcific
- Myxomatous degen
- Failed prior repair
- Prosthetic valve failure
- Peri-prosthetic leak
- Prosthetic valve thrombosis
- Active infection
- Previous infection
- Marfans
- Other degenerative disease
- Tumour
- Trauma
- Iatrogenic
- Other

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
 Baseline section; Page 15; Version 1.0 (13 Dec 2013)

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

Implant - type

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

Implant - manufacturer's model number select from table

Implant - serial number select from table

Implant - size mm

Explant - type

- None
- Autograft
- Mechanical
- Homograft / allograft
- Bioprosthesis
- 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
- Trivial
- Moderate
- Mild
- Severe

Tricuspid pathology / aetiology

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



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 16; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery dd/mm/yyyy

Pulmonary valve surgery

Pulmonary valve procedure
 Replacement
 Repair/reconstruction without annuloplasty
 Commissurotomy without annuloplasty ring
 Repair paravalvular leak

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

Implant - manufacturer's model number select from table

Implant - serial number select from table

Implant - size mm

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

Explant - manufacturer's model number select from table

Explant - serial number select from table

Explant - size mm

Pulmonary stenosis
 No Yes

Pulmonary regurgitation / insufficiency
 None Moderate
 Trivial Severe
 Mild

Pulmonary pathology / aetiology
 Rheumatic Active infection
 Congenital Previous infection
 Ischaemic Marfans
 Idiopathic calcific Other degenerative disease
 Myxomatous degen Tumour
 Failed prior repair Trauma
 Prosthetic valve failure Iatrogenic
 Peri-prosthetic leak Functional
 Prosthetic valve thrombosis Other

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 17; Version 1.0 (13 Dec 2013)

Unique patient identifier	<input type="text"/>	
Date of surgery	<input type="text"/>	dd/mm/yyyy
Post-operative data		
RBC blood bank products	<input type="radio"/> No	<input type="radio"/> Yes
Non-RBC blood bank products	<input type="radio"/> No	<input type="radio"/> Yes
Peri-operative transfusion: bank RBC	<input type="text"/>	units
Peri-operative transfusion: platelets	<input type="text"/>	units
Peri-operative transfusion: Novo 7	<input type="text"/>	units
Peri-operative transfusion: FFP	<input type="text"/>	units
Peri-operative transfusion: Cryo	<input type="text"/>	units
ICU admission: date and time	<input type="text"/>	dd/mm/yyyy
Extubation: date and time	<input type="text"/>	dd/mm/yyyy
ICU discharge: date and time	<input type="text"/>	dd/mm/yyyy
Readmitted to ICU	<input type="radio"/> No	<input type="radio"/> Yes
Reintubated	<input type="radio"/> No	<input type="radio"/> Yes
Reintubation: date and time	<input type="text"/>	dd/mm/yyyy
Reextubation: date and time	<input type="text"/>	dd/mm/yyyy
ICC loss (first 4 hours post surgery)	<input type="text"/>	dd/mm/yyyy
Returned to theatre		
Return to theatre	<input type="radio"/> No	<input type="radio"/> Yes
Reason for re-operation	<input type="checkbox"/> Valve dysfunction	<input type="checkbox"/> Sternal infection
	<input type="checkbox"/> Bleeding / tamponade	<input type="checkbox"/> Other cardiac
	<input type="checkbox"/> Graft occlusion	<input type="checkbox"/> Other non-cardiac



New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 18; Version 1.0 (13 Dec 2013)



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"/> $\mu\text{mol l}^{-1}$	
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

New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 19; Version 1.0 (13 Dec 2013)

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
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





New Zealand Ministry of Health
NZ Adult Cardiac Surgical Database
Baseline section; Page 20; Version 1.0 (13 Dec 2013)



Unique patient identifier
Date of surgery 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	

Date of discharge dd/mm/yyyy

Mortality post discharge No Yes

Mortality date 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"/> 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

Cognisant patient withdraws from treatment No Yes

Readmission

Readmitted ≤ 30 days from surgery No Yes

Reason for readmission

- Anticoagulant complication
- Arrhythmia
- Congestive heart failure
- Valve dysfunction
- Pericardial effusion
- Cardiac tamponade
- Deep sternal infection
- Other incisional complication
- Respiratory complication including pneumonia
- Myocardial infarction
- Recurrent angina
- Other complication related to cardiac surgery
- Other readmission unrelated to cardiac surgery

