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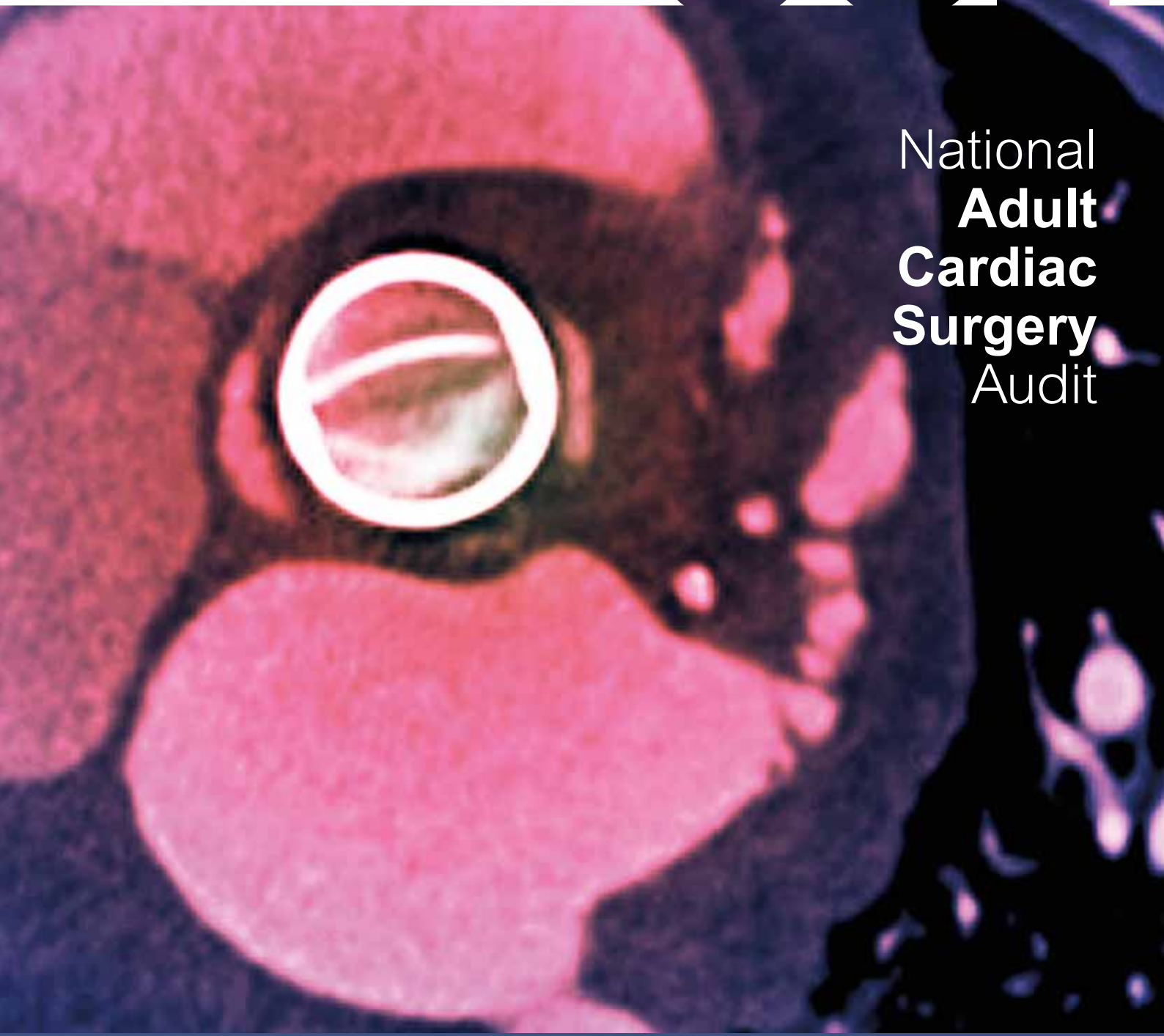

National **Adult Cardiac Surgery** Audit

Annual Report 2010 – 2011

The Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS) is an affiliated group of the Royal College of Surgeons of England and has charitable status. The Charity's objectives are to enable surgeons to achieve and maintain the highest standards of surgical practice and patient care.

National Institute for Cardiovascular Research provides information to improve the quality of care and outcomes for patients with heart disease. We are a unique partnership of clinicians (from local hospitals, the national specialist societies and the Department of Health), IT experts, analysts, academics and managers.

The Healthcare Quality Improvement Partnership (HQIP) promotes quality in healthcare. HQIP holds commissioning and funding responsibility for the national audit of adult cardiac surgery and other national clinical audits.

The Northwest Institute for BioHealth Informatics is an e-Health innovation hub, centred at the University of Manchester.

Part of this research was funded by Heart Research UK [Grant Number RG2583].

Prepared by

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The National Adult Cardiac Surgery audit has been developed and run by the Society for Cardiothoracic Surgery in GB and Ireland (SCTS) since 1977. It has been commissioned by the Healthcare Quality Improvement Partnership (HQIP). Data were collected at each unit (and we are very grateful for the support of the surgeons and database managers in each hospital) and collated at the Central Cardiac Audit Database (CCAD) which is part of the National Institute for Cardiovascular Outcomes Research (NICOR) at University College London. The analysis in this report was undertaken by Graeme Hickey at the University of Manchester. Graeme's salary was kindly provided through a grant from Heart Research UK.

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Electronic copies of the report can be found at **www.ucl.ac.uk/nicor/audits/Adultcardiacsurgery**

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COVER IMAGE: Heart valve implant, CT scan; SOVEREIGN, ISM/SCIENCE PHOTO LIBRARY

National **Adult Cardiac Surgery** Audit Report

Annual Report 2010 – 2011

Contents

Introduction

This is the annual report of the adult cardiac surgery audit in England and Wales. The audit is conducted by the Society for Cardiothoracic Surgery of GB and Ireland (SCTS) in conjunction with the National Institute for Cardiovascular Outcomes Research (NICOR). The National Adult Cardiac Surgery Audit is one of six national cardiac clinical audits managed by NICOR. NICOR is part of the National Centre for Cardiovascular Prevention and Outcomes which is part of the Institute of Cardiovascular Science at University College London (UCL). The programme is funded by the Healthcare Quality Improvement Partnership (HQIP) and the analyses have been conducted at the University of Manchester, supported by a grant from Heart Research UK

The main objective of this audit is to collect information on activity, trends and outcomes in adult cardiac surgery in GB and Ireland. In this this report we present the data for surgery performed in England and Wales up to the end of March 2011.

The report is aimed at healthcare professionals, medical directors, managers, clinical governance leads and the public.

Foreword

A modern professional society has a responsibility to act on behalf of its members (who are largely the doctors and other healthcare professionals who deliver care) to work for the patients for whom they are responsible each and every day of their working lives. The Society for Cardiothoracic Surgery in Great Britain and Ireland and its members take these responsibilities seriously. We have conducted a number of activities configured to deliver defined objectives of improving clinical quality, providing a framework for medical regulation and acting to maintain public trust in the profession.

Possibly the most important specific activity we undertake is the collection, collation, dissemination and publication of clinical outcomes data through the SCTS national clinical audits. This report of the adult cardiac surgery database marks another step in this journey, which started when we first began collecting the results of our operations back in 1977.

This most recent report shows that we continue to see on going and dramatic improvement in the quality of surgical outcomes, despite a relentless increase in the complexity and risk of patients coming to surgery. The mortality for almost every operation group that we undertake has fallen significantly over the last 10 years. The mortality for elective isolated first time coronary artery surgery was as low as 0.8% in 2010, the mortality for isolated aortic valve replacement was 1.7% and the mortality for mitral valve repair was 0.6%. We believe that these results are as good as any other national results and pay testament to the high quality of care given in our hospitals and the professional attitude of our membership. We are happy to openly publish these results for patients and the public.

As well as looking at overall trends and mortality rates in this report, we have also looked in more detail at some process measures, including the use of mitral repair, rather than replacement for degenerative mitral valve disease, the use of the left internal mammary artery graft and off pump surgery for coronary artery disease. We have also examined in more detail urgent coronary artery surgery (when surgery is undertaken on patients who have been admitted directly with acute chest pain or other manifestations of ischaemic heart disease) to increase understanding and aid further quality improvements. We hope this report will be of interest to patients, the public, politicians and commissioners of healthcare as well as the hospitals and surgeons providing care to patients.

James Roxburgh
President of SCTS

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Executive summary

All NHS cardiac surgery centres and three private hospitals in England and Wales submit data to the adult cardiac surgery audit.

There were 16,408 isolated first time coronary artery bypass graft (CABG) operations performed in the financial year 2010/2011. This is a small decrease from the total in 2008/2009. The CABG rate in England (300 per million in 2010/2011) is higher than in Wales (226 per million in 2010/2011).

The predicted risk of patients who have cardiac surgery has increased year on year from 2001/02 to 2010/11. This is due to an increase in the proportion of elderly and female patients having surgery along with an increase in the proportion of more complex operations.

The proportion of patients receiving isolated first time CABG as hospital in-patients (urgent cases) rather than coming into hospital from home has increased from 27% (2001/02) to 37% in 2011/12.

Despite the increasing patient risk profiles, mortality for all cardiac surgery continues to fall. The mortality for all cardiac surgery has fallen from 4.0% in 2001/2002 to 3.1% in 2010/2011. The mortality for elective isolated first time CABG (those patients who come in from home for surgery) was 0.8% in 2010/11.

An increased number of centres are achieving repair rates for degenerative mitral valve disease of over 80% (mitral repair is generally accepted to be a better treatment for these patient than mitral replacement). However the overall repair rate remains stable at just over 66%. The overall mortality for isolated mitral repair has continued to fall and was 0.6% in 2010/2011.

Rates of off-pump CABG have increased slightly to just under 20%. There has been a significant increase in the use of internal mammary artery (LIMA) grafts to the left anterior descending coronary artery for patients undergoing isolated first time CABG (this is shown to be associated with the best outcomes for patients). In 2010/11 just over 95% of patients who underwent CABG had LIMA grafts.

Mortality rates by named hospital are given for all cardiac surgery, isolated first time CABG and isolated first time aortic valve surgery. All hospitals are performing significantly better than the European standard for isolated first time CABG set by the European Association for Cardiothoracic Surgery. The data show that all hospitals are also performing to the standard we have previously set for the UK.

About adult cardiac surgery

There are a variety of diseases which lead to abnormalities of the coronary arteries (the blood vessels that supply oxygen to heart muscles), or the valves in the heart that ensure one way flow of blood through the cardiac pumping chambers. In addition, some disorders lead to increased size of the major blood vessels taking blood from the heart around the body, additionally there are some problems which affect the heart muscle itself reducing its pumping ability. Many of these disorders can be treated by cardiac surgery.

The most common heart operation performed in adults is CABG. This is a treatment for patients who have narrowing or blockages in their coronary arteries. CABG is a good option for this problem as it restores normal blood flow back to heart muscle, relieves symptoms (usually angina) and can also increase the patient's life expectancy.

Heart valve disorders can either be present from birth or develop as people get older. Even problems which are present from birth can often go undetected until middle age or later. The commonest valve to require surgical treatment is the aortic valve which sits at the outlet of the heart. This can become narrowed (aortic stenosis) or it may leak (aortic regurgitation). Severe aortic stenosis may lead to symptoms of chest pain, shortness of breath, dizziness, heart failure or occasionally sudden death. When severe, aortic valve problems are usually treated by valve replacement surgery. The mitral valve (which effectively sits between the lungs and the heart) can also become leaky (mitral regurgitation) or narrowed (mitral stenosis).

Mitral valve problems usually lead to shortness of breath. Mitral stenosis is most often a result of patients contracting rheumatic heart disease earlier in life and whilst it used to be quite common, it is now rare in people who are born and raised in the UK. Mitral regurgitation is the most common mitral valve problem requiring surgery and patients are usually best treated by a mitral valve repair procedure rather than a replacement.

Another problem that can require an operation from a cardiac surgeon is dilation of the major blood vessel at the outlet of the heart, this is called an aneurysm. When it becomes significantly enlarged there is a risk of it bursting and it is best treated by surgery. In certain circumstances this can be a complex and high-risk procedure.

Results of cardiac surgery in the UK have been subjected to more detailed scrutiny than perhaps any other branch of surgery anywhere in the world. This is because the surgeons have a long history of collecting details on the operations that they perform (which is uncommon amongst hospital doctors).

Following the problems in children's cardiac surgery in Bristol in the 1990s, politicians, the media and the public have demanded to see mortality rates for cardiac surgical operations to ensure that all patients received good treatment. The cardiac surgeons responded to this and have published results of surgery since 2001. This national audit report updates this information and includes detailed results of surgery for operations in England and Wales between 2008 and 2011.

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The adult cardiac surgery audit programme

Our current programme consists of:

1. Systematic collection of an agreed minimum dataset at each contributing centre on all patients undergoing cardiac surgery
2. Aggregation and validation of the data
3. Analysis and development of risk stratification models for outcome measures
4. Regular feedback of risk adjusted clinical outcomes to contributing centres
5. Continuous evaluation of performance, changing practice and the influence of risk factors
6. Intermittent governance analyses to look for surgeons or hospitals whose mortality rates are higher than expected
7. Publication of named surgeon and hospital mortality rates for patients and the public.
   http://heartsurgery.cqc.org.uk/
8. Intermittent comprehensive reports of trends and outcomes in cardiac surgery (The Blue Books). The most recent Blue Book (Demonstrating Quality) was published in 2009.
   www.scts.org/modules/resources/default.aspx?type=bluebook

The SCTS adult cardiac surgery database programme was awarded the prestigious British Medical Journal award for best quality improvement programme in 2010.

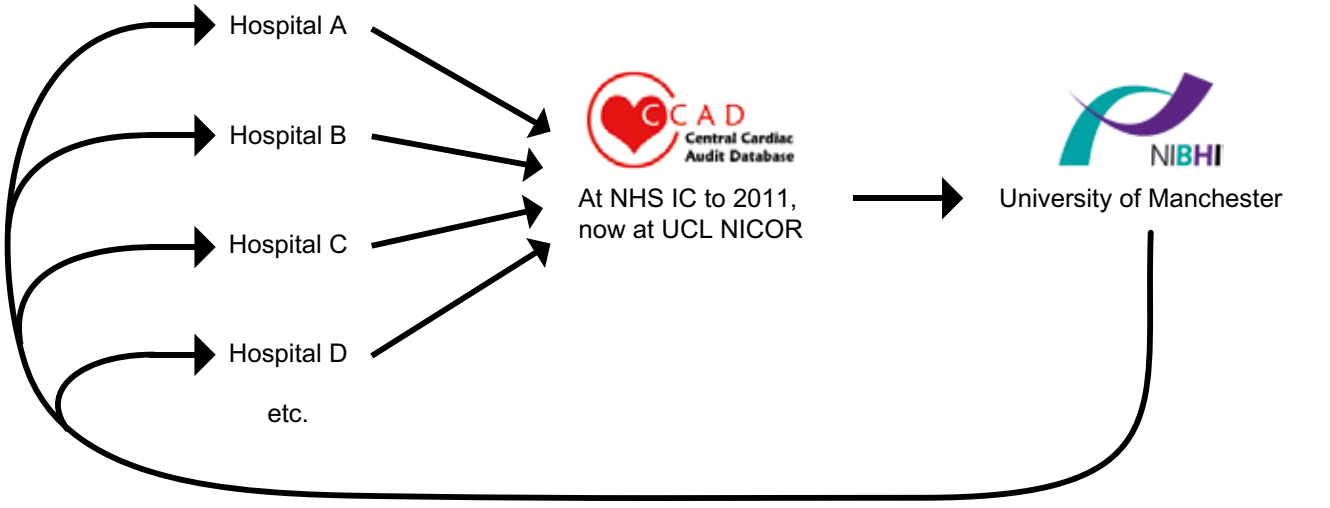
The data included in this report relates to procedures performed between 1st April 2001 and 31st March 2011. The report is aimed at healthcare professionals, medical directors, managers, clinical governance leads and the public.

Data processing and analysis

The data collection, transmission, validation and analysis processes are summarised in the flow chart below. Data are collected in each unit performing adult cardiac surgery according to the definitions in the SCTS minimum dataset. Data are subjected to various levels of local validation. The data are transmitted by complex methodology which ensures patient confidentiality to the Central Cardiac Audit Database (CCAD) which is now part of NICOR at UCL. The data are subjected to further validation and logic checks following import from the units to CCAD. All processes are compliant with appropriate data protection legislation and patient confidentiality principles.

Data (stripped of any patient identifiable or sensitive information) are then exported from CCAD to the Northwest Institute of BioHealth Informatics (NIHBI) at Manchester University. Here the data are cleaned further (by rationalising any duplicate records, merging database versions, mapping all variable synonyms to consistent definitions, resolving temporal and numerical anomalies and combining some variables to create clinically relevant indicator variables for definitive analysis). Full details and logic for cleaning processes are given at **www.scts.org**

An extract of the relevant data was produced and after the various stages described previously had been undertaken, analyses about unit activity levels, incidence of risk factors and mortality rates were returned to each unit for local validation. Any data issues identified were then resolved. The data were re-uploaded to CCAD and a further extract of data was exported to Manchester University, where the final definitive analyses were undertaken.



Collection of SCTS minimum dataset and local validation.

Secure transmission and collation of data. Provides export of data for analysis.

Cleaning of data, preliminary analyses for data validation, communication of data with units for data validation and definitive analyses.

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Data completeness

All NHS centres in England and Wales submitted data to CCAD for each financial year starting April 1st 2008 to 2010. In addition three private hospitals also submitted data. The completeness of the fields used to generate predicted risk for patients, which are in turn used to create the mortality comparisons presented later in this report, are given below.

Table 1
Risk factor data completeness for individual hospitals (April 2008 – March 2011)

Hospital	Age	Female	Pulmonary disease	Extracardiac arteriopathy	Neurological dysfunction disease	Previous cardiac surgery	Creatinine > 200 µmol/l	Active endo-carditis	Critical preoperative state	Unstable angina	LV dysfunction (moderate)	LV dysfunction (Poor)
Barts and The London	100	100	99.5	99.4	99.5	100	100	99.3	100	99.5	99.1	99.1
Basildon Hospital	100	100	100	100	100	100	100	99.8	100	100	95.6	95.6
Liverpool Heart and Chest Hospital	100	100	100	97.7	100	100	100	93.2	100	99.9	99.6	99.6
Bristol Royal Infirmary	100	100	99.4	99.5	99.6	100	100	98.2	99.9	99.6	97.2	97.2
Castle Hill Hospital	100	100	100	100	100	100	100	100	100	100	100	100
Nottingham City Hospital	100	100	100	100	100	100	100	99.8	100	100	100	100
Freeman Hospital	100	100	100	100	100	100	100	100	100	100	99.8	99.8
St George's Hospital	100	100	100	100	100	100	100	98.9	100	100	100	100
Glenfield Hospital	100	100	96.6	96.9	95.1	100	100	99.2	100	97	90	90
Hammersmith Hospital	100	100	93.9	95.5	38.4	100	100	93.9	96.8	90.9	95.3	95.3
Harefield Hospital	100	100	99.5	99.8	99.9	100	100	99.3	100	99.8	99.5	99.5
Wellington Hospital North	100	100	97.8	97.5	98.2	100	100	90.2	100	94.7	72.1	72.1
Harley Street Clinic	100	100	100	100	100	100	100	100	100	100	100	100
King's College Hospital	100	100	99.8	99.9	99.9	100	100	99.6	100	99.9	99.5	99.5
London Bridge Hospital	100	100	98	96.8	93.5	100	100	94.4	100	97.4	90.3	90.3
Leeds General Infirmary	100	100	99.9	99.9	99.9	100	100	98.5	100	99.9	99.3	99.3
Morriston Hospital	100	100	99.8	99.8	99.8	100	100	99.9	100	99.6	99.8	99.8
Manchester Royal Infirmary	100	100	100	100	100	100	100	99.2	100	100	100	100
New Cross Hospital	100	100	100	100	100	100	100	100	100	100	100	100
Northern General Hospital	100	100	99.9	99.9	99.9	100	100	99.9	100	99.7	96.2	96.2
Royal Brompton Hospital	100	100	100	100	100	100	100	99.7	100	100	100	100
Papworth Hospital	100	100	98.6	100	100	100	100	74.1	100	100	94.7	94.7
Derriford Hospital	100	100	98.9	98.7	100	100	100	99.1	99.7	98.1	97.7	97.7
Queen Elizabeth Hospital	100	100	100	100	100	100	100	99.8	100	100	98.7	98.7
John Radcliffe Hospital	100	100	99.2	95.5	99.3	100	100	99.7	99.8	99.2	99.2	99.2
Royal Sussex County Hospital	100	100	99.8	100	100	100	100	99.9	100	100	100	100
James Cook University Hospital	100	100	100	100	100	100	100	99.9	100	100	99.7	99.7
Southampton General Hospital	100	100	97.6	99.6	99.8	100	100	100	100	100	99.8	99.8
St Thomas Hospital	100	100	99.9	100	100	100	100	99.9	100	100	91.2	91.2
University Hospital of North Staffordshire	100	100	99.7	99.7	99.7	100	100	100	100	99.9	99.7	99.7
University College Hospital	100	99.8	99.8	99.8	99.8	100	100	99.1	100	100	99.8	99.8
University Hospital of Wales	100	100	98.3	98.5	98.1	100	100	97.3	100	100	95.2	95.2
Victoria Hospital	100	100	99.2	98.9	98.6	100	100	98.6	99.9	99.4	98.8	98.8
University Hospital Coventry	100	100	99.9	99.9	99.9	100	100	99.9	100	99.9	99.9	99.9
University Hospital of South Manchester	100	100	100	100	100	100	100	100	100	100	100	100

Data completeness continued

Table 1 (continued)
Risk factor data completeness for individual hospitals (April 2008 – March 2011)

Hospital	Recent myocardial infarction	Pulmonary hypertension	Emergency	Other than isolated CABG	Surgery on thoracic aorta	Post infarct septal rupture	CABG	Mitral valve	Tricuspid valve	Other cardiac procedure	overall % complete
Barts and The London	99.3	100	100	100	99.9	100	100	99.6	99.6	100	98.2
Basildon Hospital	38.5	100	100	100	99.9	100	100	100	100	100	37.5
Liverpool Heart and Chest Hospital	100	100	100	100	97.6	100	99.3	99.2	99.2	100	87.3
Bristol Royal Infirmary	83.7	100	99.5	100	99.8	100	100	99.7	99.7	100	80.8
Castle Hill Hospital	100	100	100	100	100	100	100	100	100	100	100
Nottingham City Hospital	100	100	100	100	99.3	100	100	100	100	100	99.2
Freeman Hospital	100	99.9	100	100	99.8	100	100	100	100	100	99.6
St George's Hospital	100	100	100	98	99.9	100	99.1	97.9	97.9	100	95.9
Glenfield Hospital	96.3	100	99.7	100	99.1	100	100	99.4	99.4	100	85.3
Hammersmith Hospital	94.5	100	96.1	100	99.7	100	100	97	97	100	33
Harefield Hospital	99.9	100	99.8	100	99.8	100	100	99.4	99.4	100	98.2
Wellington Hospital North	95.4	100	99.6	100	99.1	100	100	96.8	96.8	100	68.7
Harley Street Clinic	100	100	100	100	100	100	100	100	100	100	100
King's College Hospital	99.9	99.9	100	100	99.8	100	100	99.6	99.6	100	98.4
London Bridge Hospital	96.6	100	98.8	99.4	99.2	100	99.4	96	96	100	87.7
Leeds General Infirmary	99.9	100	100	100	99.4	100	100	98.9	98.9	100	97.2
Morriston Hospital	99.8	100	100	100	99.4	100	100	99.9	99.9	100	98.9
Manchester Royal Infirmary	100	100	100	100	100	100	100	100	100	100	99.2
New Cross Hospital	100	100	100	100	99.8	100	100	100	100	100	99.8
Northern General Hospital	99.8	99.8	100	100	99.8	100	100	100	100	100	95.5
Royal Brompton Hospital	100	100	100	100	98.9	100	100	100	100	100	98.5
Papworth Hospital	100	100	100	100	99.7	100	100	100	100	100	69.3
Derriford Hospital	31.2	100	99.2	100	99.5	100	100	99.7	99.7	100	30.8
Queen Elizabeth Hospital	100	100	100	100	99.9	100	100	100	100	100	98.4
John Radcliffe Hospital	99.4	100	99.7	99.9	99.7	100	99.8	99.8	99.8	100	94.2
Royal Sussex County Hospital	99.9	100	100	100	99.9	100	100	100	100	100	99.4
James Cook University Hospital	100	100	100	100	99.9	100	100	100	100	100	99.5
Southampton General Hospital	100	100	99.6	100	99	100	100	100	100	100	95.8
St Thomas Hospital	100	100	100	100	100	100	100	99.9	99.9	100	91
University Hospital of North Staffordshire	99.9	100	100	100	100	100	100	100	100	100	99.7
University College Hospital	99.9	100	100	100	99.8	100	100	99.7	99.7	100	98.2
University Hospital of Wales	95.1	99.9	99.9	100	98.7	100	100	98.9	98.9	100	87.7
Victoria Hospital	99.3	99.9	97.6	100	99.7	100	100	99.8	99.8	100	95.8
University Hospital Coventry	99.9	100	99.9	100	99.9	100	100	99.9	99.9	100	99.7
University Hospital of South Manchester	100	100	100	100	99.8	100	100	100	100	100	99.8

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Mortality completeness

The completeness of the in-hospital mortality returns are given in the following table. Mortality data is taken from fields 'status at discharge' and 'discharge destination' of the SCTS adult cardiac dataset. For the analyses of mortality presented later in this report, we have utilised mortality records from the Office of National Statistics (ONS) to 'backfill' any missing or contradictory mortality data.

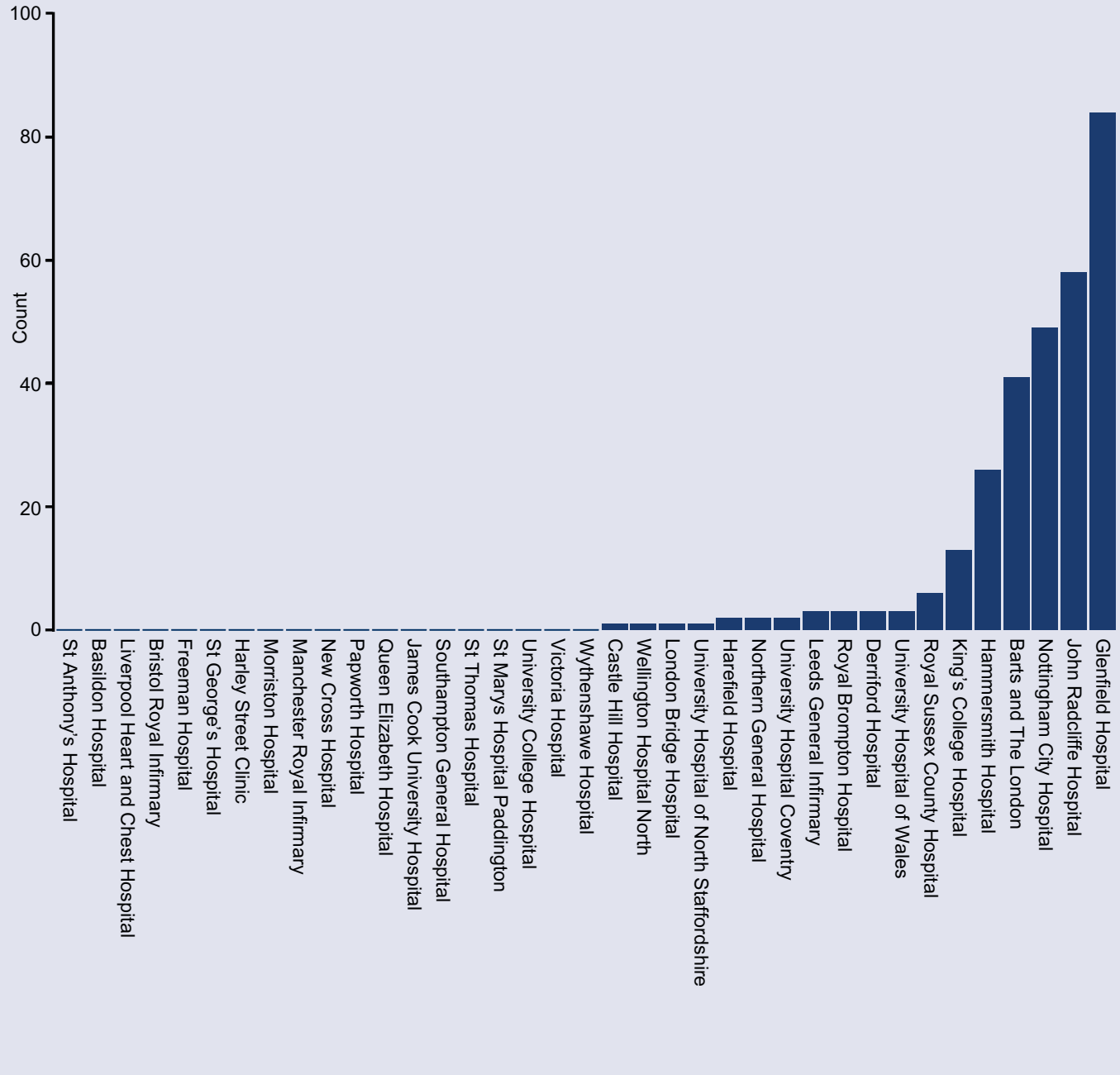

Figure 1
Missing in-hospital mortality data for individual hospitals (April 2008–March 2011)

Cardiac surgery rates in England and Wales

The numbers of operations in England and Wales each year from 2001 to 2010 are given in the following figures. Since 2007 there has been a decrease in the overall rates of cardiac surgery and the total number of CABG cases, and a fall in the number of procedures per million population (ppm). For notes about changes in the SCTS database and possible implications on total operation counts please see **www.scts.org**

The activity levels and procedures per million for isolated CABG in England and Wales are given in figure 5. The rates in England are higher for all cardiac surgery, isolated CABG surgery and valve surgery.

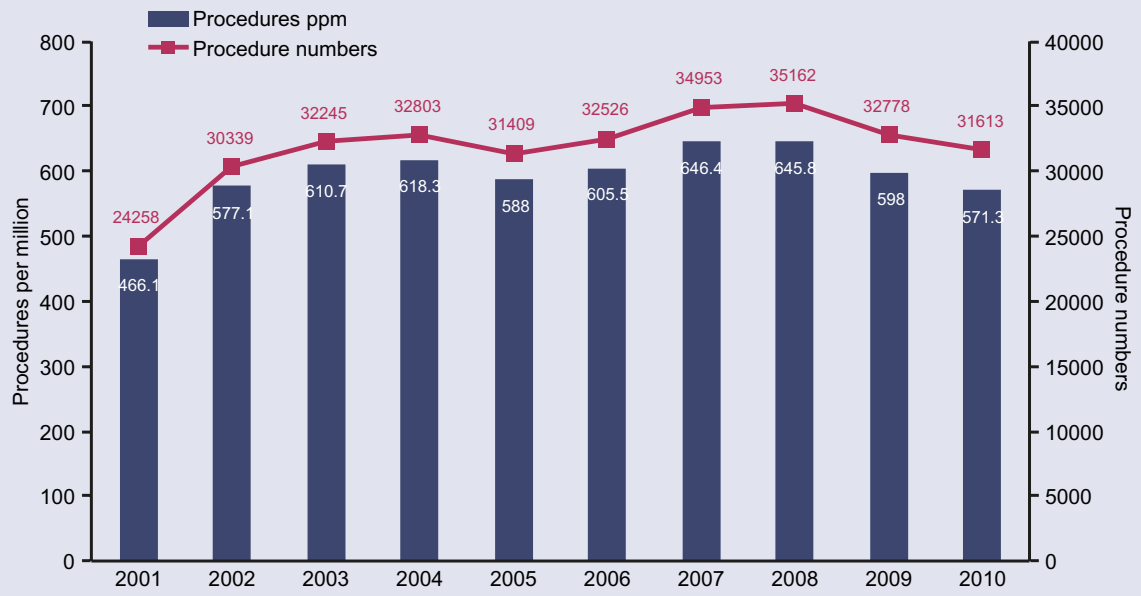

Figure 2
Activity levels and procedures per million for all cardiac surgery

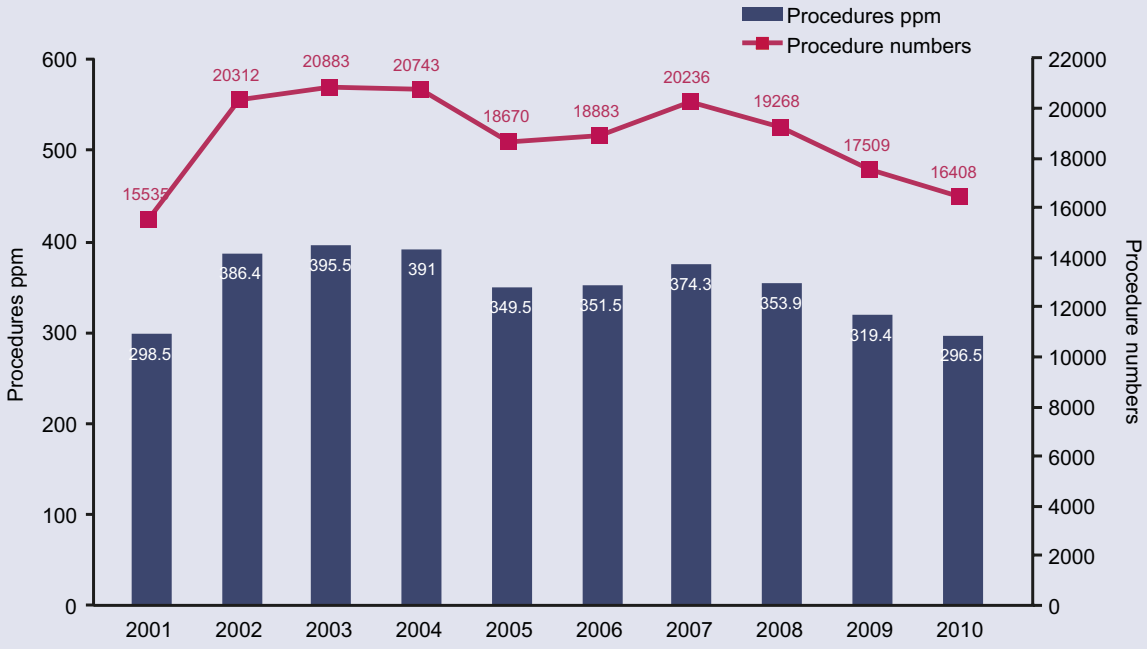

Figure 3
Activity levels and procedures per million for all isolated CABG surgery

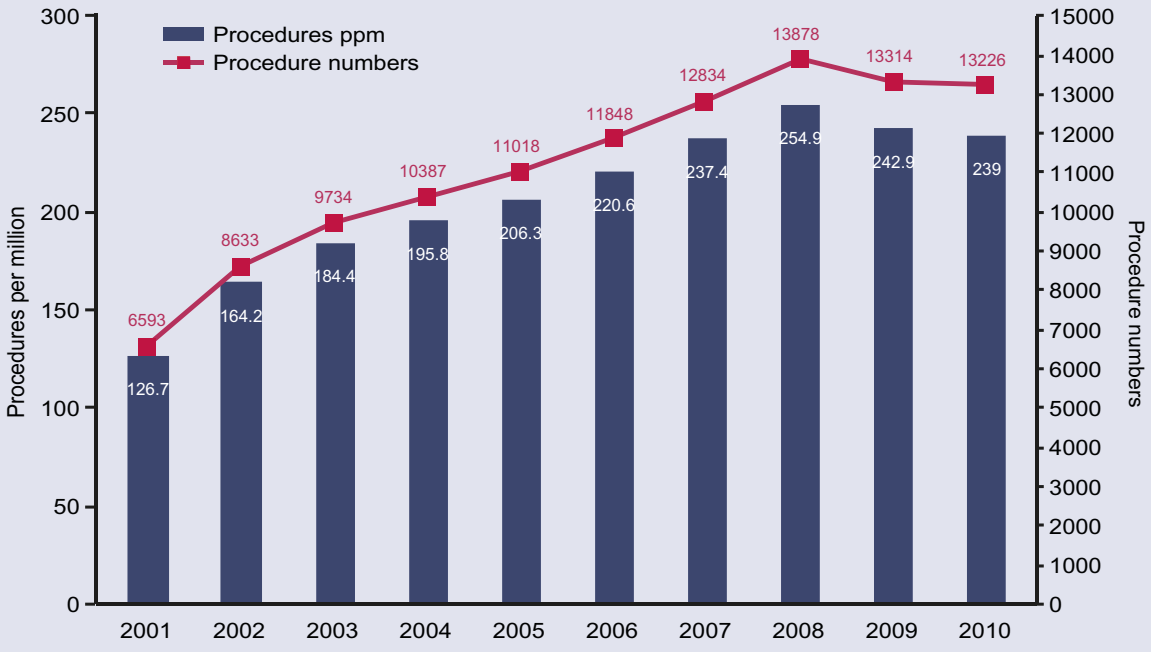

Figure 4
Activity levels and procedures per million for isolated valve surgery

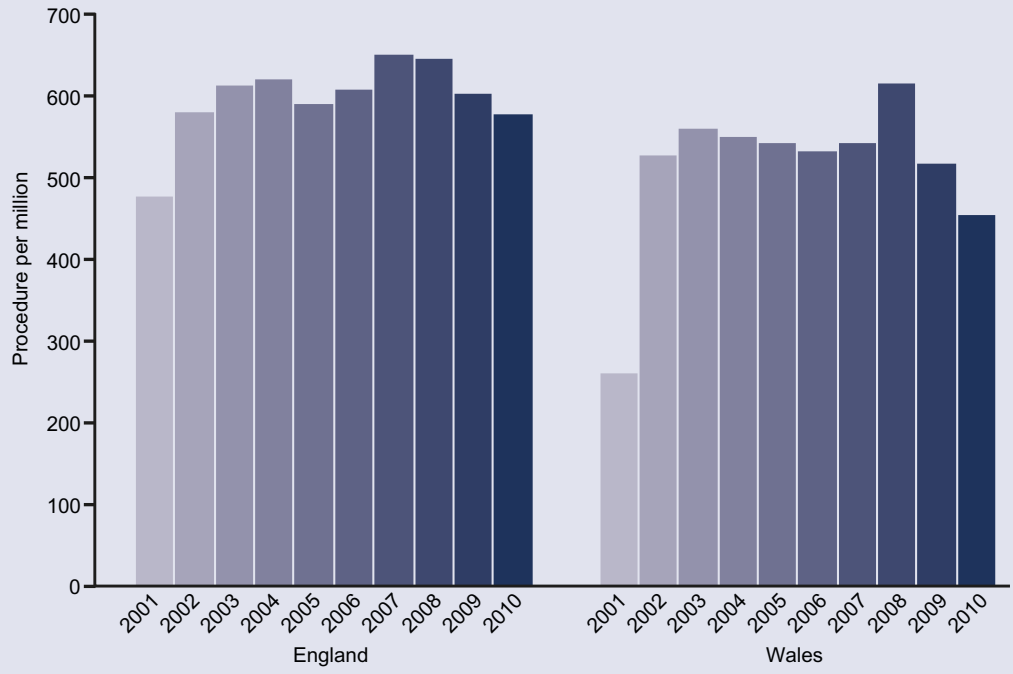

Figure 5
Procedures per million population for all cardiac surgery (England and Wales)

Figure 6
Procedures per million population for isolated CABG (England and Wales)

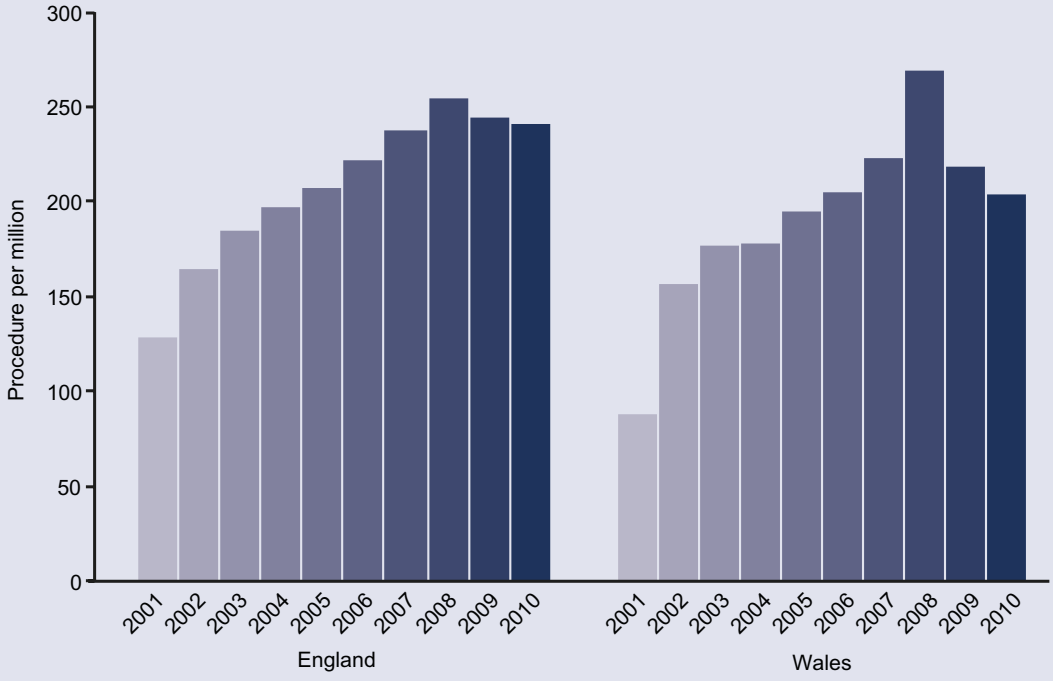

Figure 7
Procedures per million population for valve surgery (England and Wales)

Change in incidence in risk factors

Over time the population of patients undergoing cardiac surgery is becoming more high risk. Patients are becoming older, more likely to be female, have neurological dysfunction, and undergo operations other than isolated CABG (CABG is in general a lower risk operation than valve surgery or other more complex cardiac surgical operations).

The overall predicted mortality of the population as assessed by the mean logistic EuroSCORE (mEuroSCORE) has gone up over time from 3.7% in 2001 to 4.6% in 2010, as shown in figure 8.

Figure 9 shows the changes in incidence over time of the various risk factors that are used to calculate the predicted risk of in-hospital mortality. Some such as age, pulmonary disease and neurological dysfunction have increased relentlessly over time. Others such as the proportion of cases that are isolated CABG have decreased, but this contributes to an overall increase in the predicted risk for all cardiac surgery. Some risk factors such as emergency status and impairment of the left ventricular (LV) function have decreased over time.

Figure 8
Mean modified logistic EuroSCORE by year

Figure 9
Distribution of mEuroSCORE risk factors in the overall population over time

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Process measures

LIMA use

It is widely accepted that the use of the left internal mammary artery (LIMA) as a bypass graft to the left anterior descending (LAD) coronary artery is associated with better outcomes than the long saphenous vein (which is taken from the patient's leg). We have collected data on the proportion of patients who have the LIMA used in CABG surgery. This information is fed that back to all units to drive quality improvements.

The proportion of patients undergoing isolated first time CABG currently receiving an LIMA graft has risen to just over 95%.

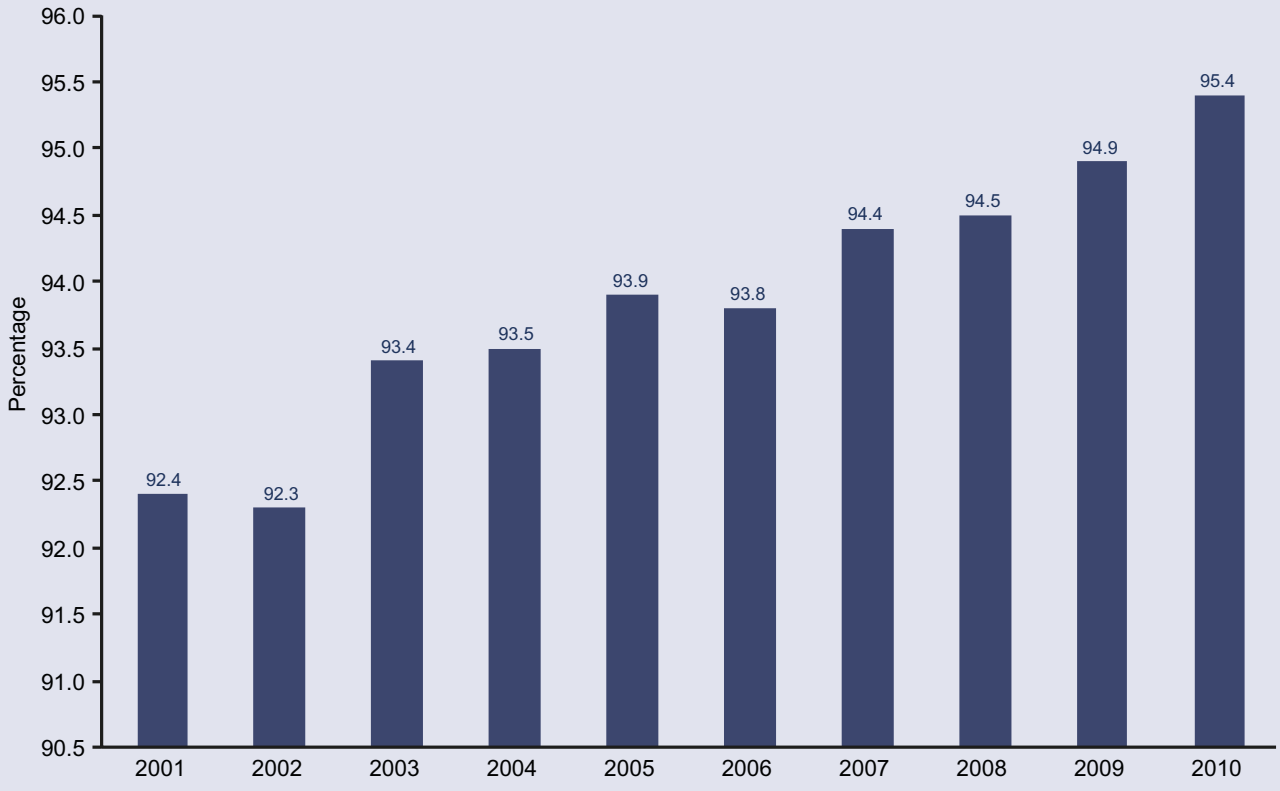

Figure 10
Percentage of patients undergoing isolated first time CABG receiving LIMA to LAD

Off-pump coronary artery surgery

There is increasing evidence suggesting that in-hospital mortality rates are better if patients have coronary artery surgery performed without using a cardiopulmonary bypass machine; so called off-pump surgery. The long term results of off-pump surgery are less well established which makes some surgeons more resistant to use the technique. Currently about 20% of patients in England and Wales have isolated first time CABG performed 'off-pump'.

We are currently conducting a major research study into the comparative short and long-term outcomes of off-pump and on-pump surgery.

Figure 11
Percentage of isolated first time CABG procedures performed by off-pump surgery

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Mitral repair surgery for degenerative mitral disease

It is generally accepted that degenerative mitral valve disease is best treated by mitral valve repair, rather than mitral valve replacement. Our previous analysis showed that in the UK 66.6% of cases were treated by repair. This figure has not improved, however in the previous analysis only 5 hospitals had repair rates above 80%; now 9 hospitals are achieving this benchmark. We would hope that the following data would stimulate units to improve their mitral valve repair rates.

See also table 10 in Appendix 2: *Mitral valve replacement and repair rates for individual hospitals (April 2008 – March 2011).*

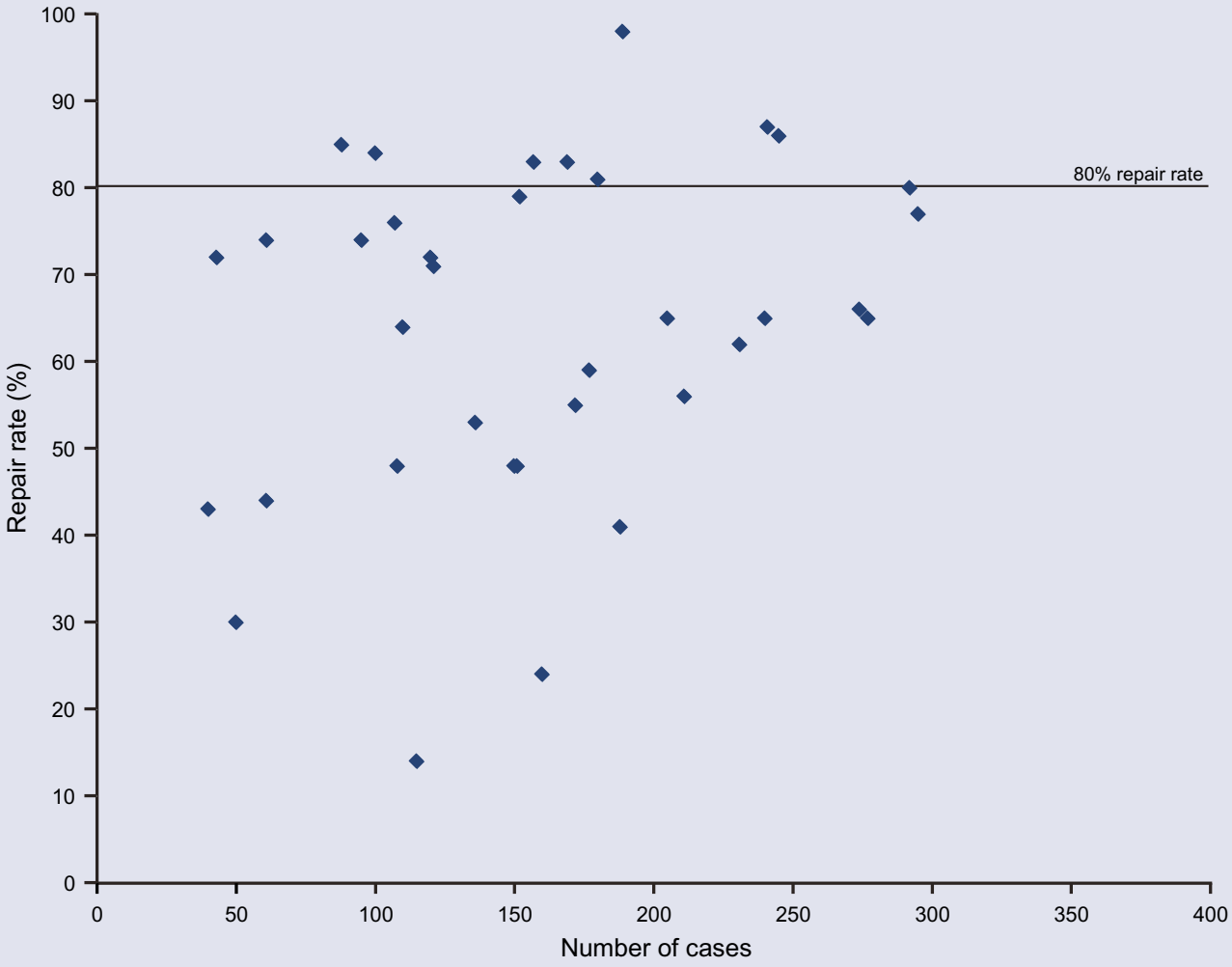

Figure 12
Percentage of mitral valve procedures performed as repair for individual hospitals

Mortality outcomes

The mortality rate for most cardiac surgery has fallen over time, despite an increase in the predicted risk of the patients who undergo surgery.

This improvement has been seen in all types of surgery reported below, with the exception of combined mitral valve replacement and coronary artery surgery.

These findings are statistically significant and therefore unlikely to be due to chance alone.

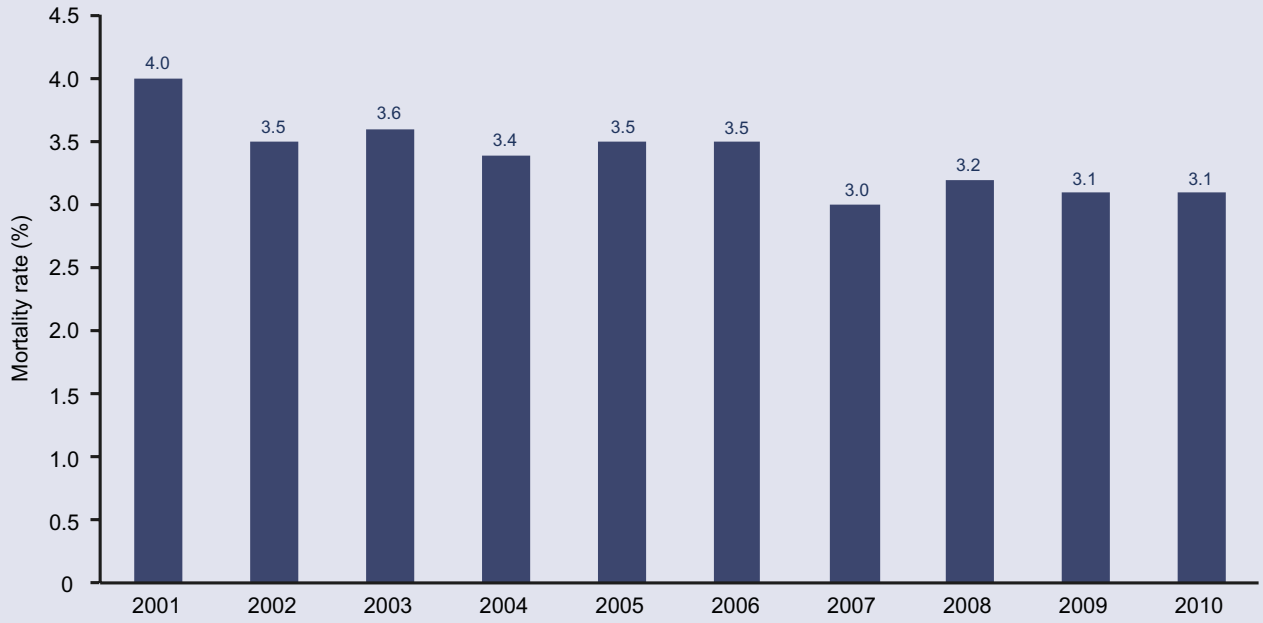

Figure 13
Crude mortality rate for all cardiac surgery procedures

Figure 14
Crude mortality rate for isolated first time CABG

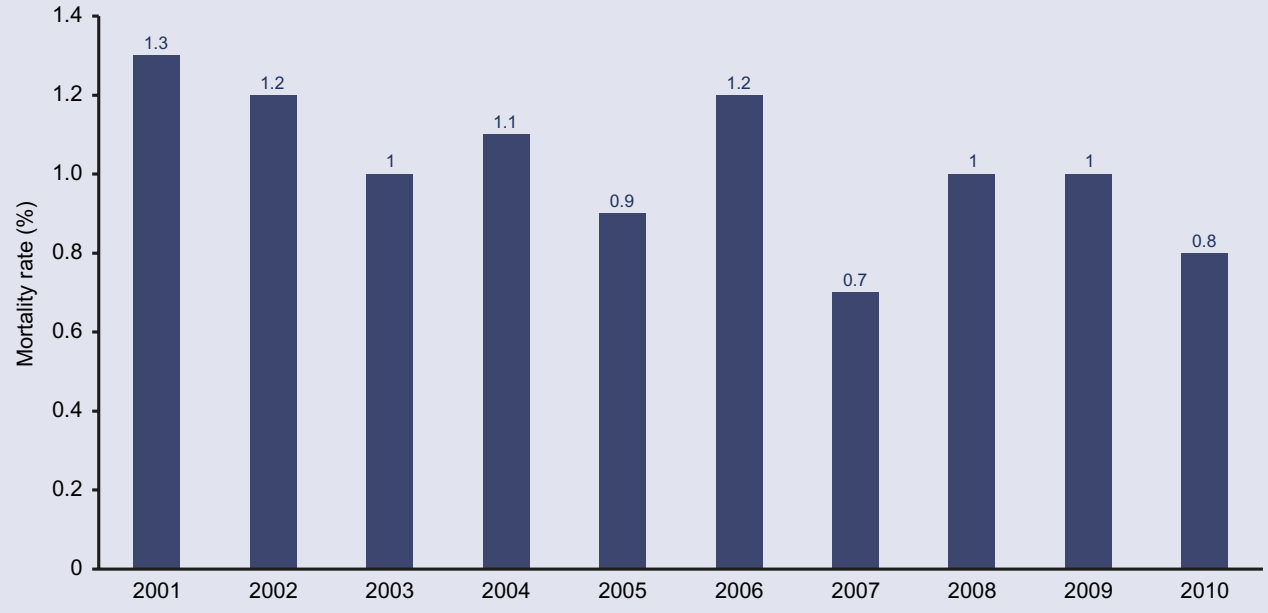

Figure 15
Crude mortality rate for isolated first time CABG (elective procedures)

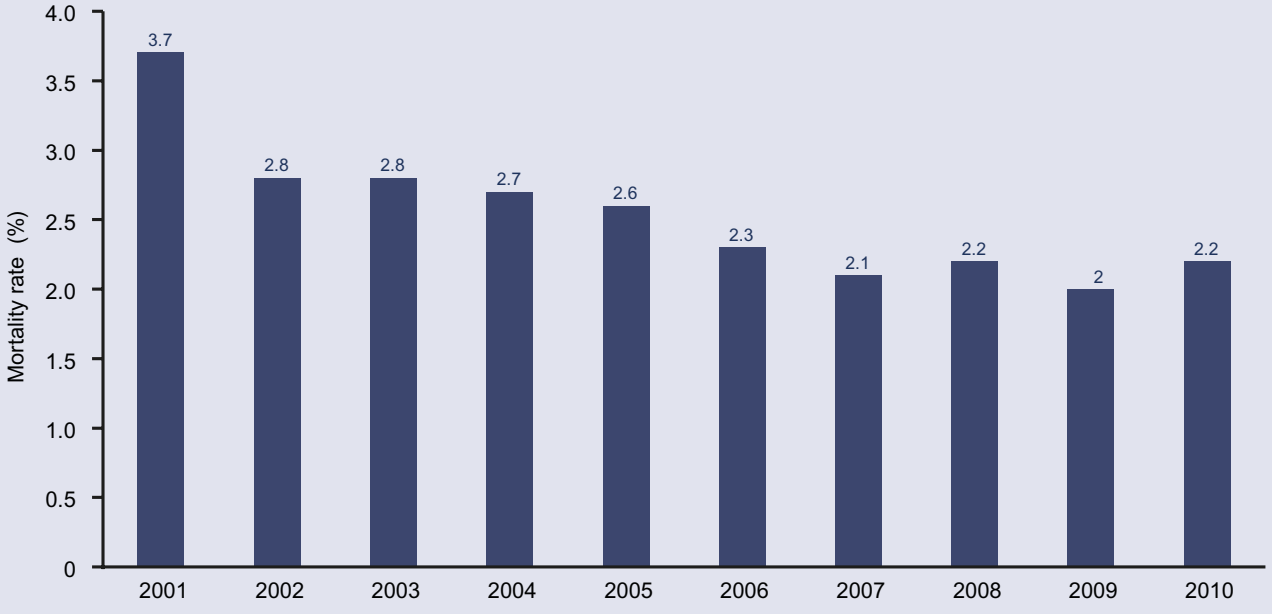

Figure 16
Crude mortality rate for isolated first time CABG (urgent procedures)

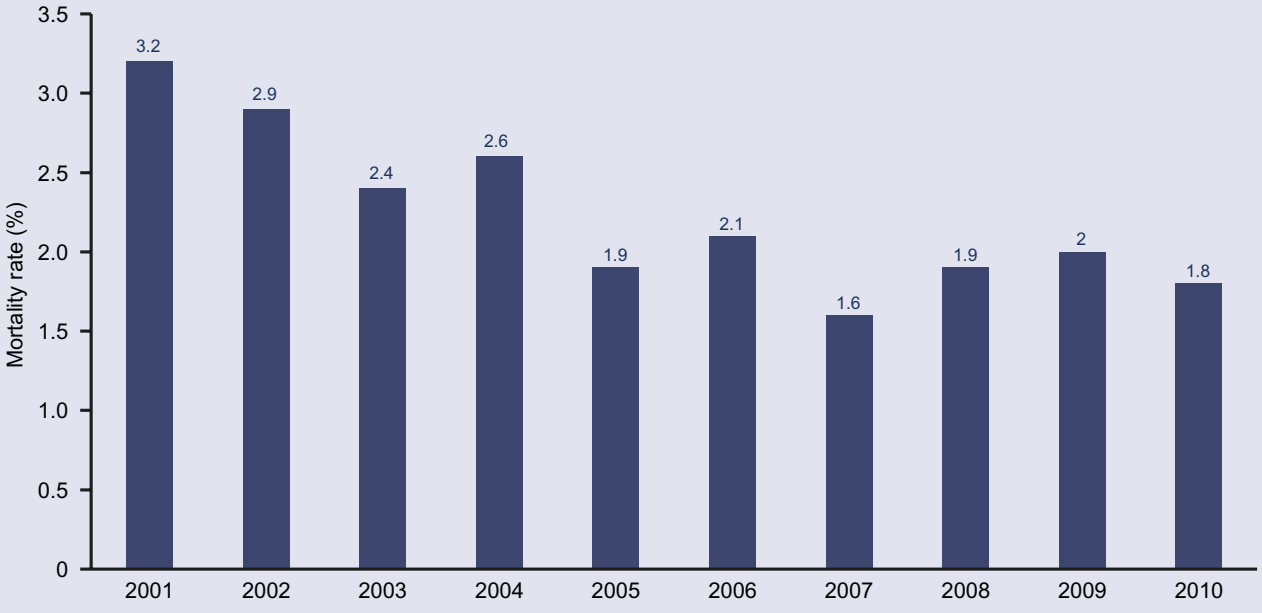

Figure 17
Crude mortality rate for isolated first time aortic valve replacement

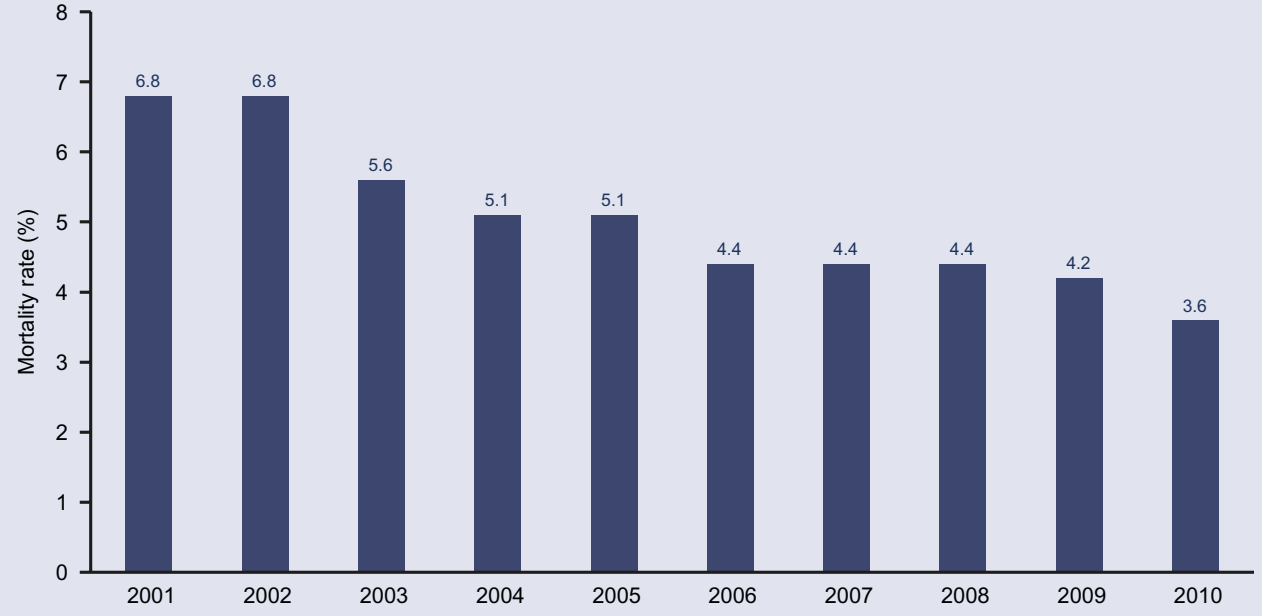

Figure 18
Crude mortality rate for combined aortic valve replacement and CABG

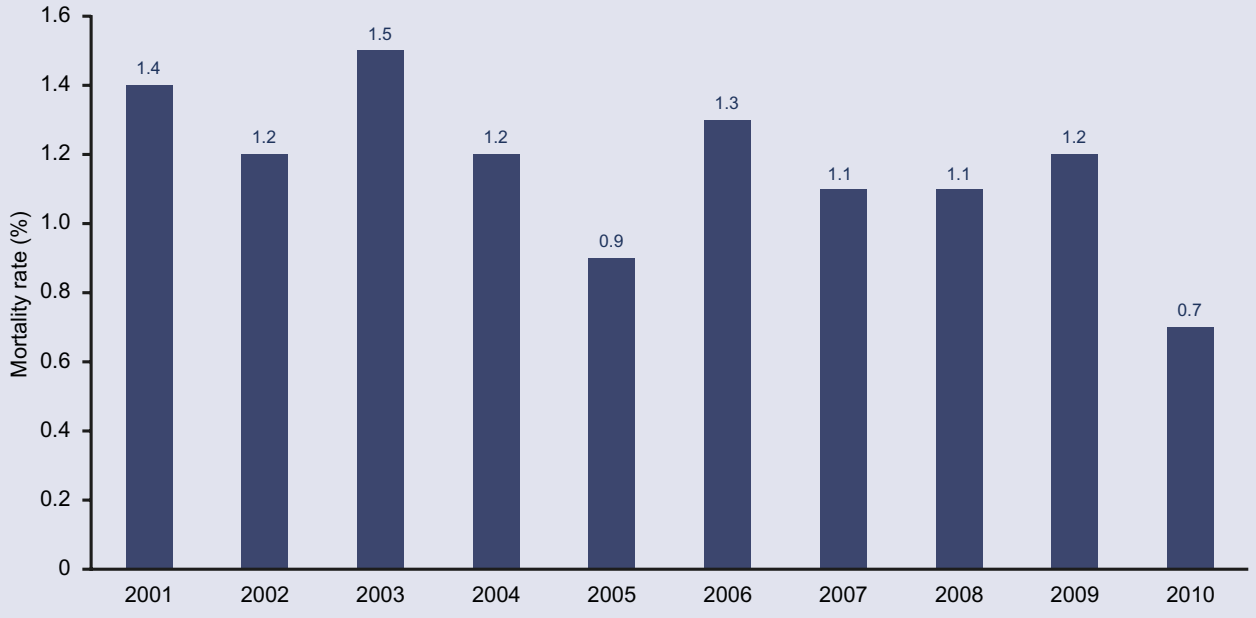

Figure 19
Crude mortality rate for isolated first time mitral valve repair

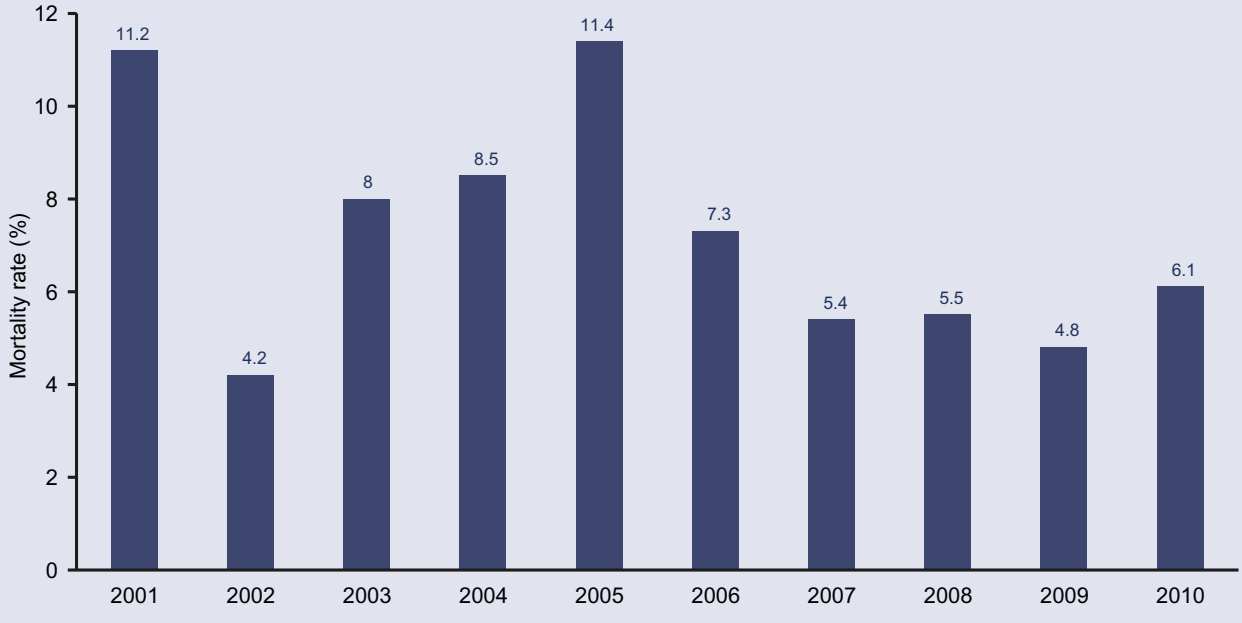

Figure 20
Crude mortality rate for first time combined mitral valve repair and CABG

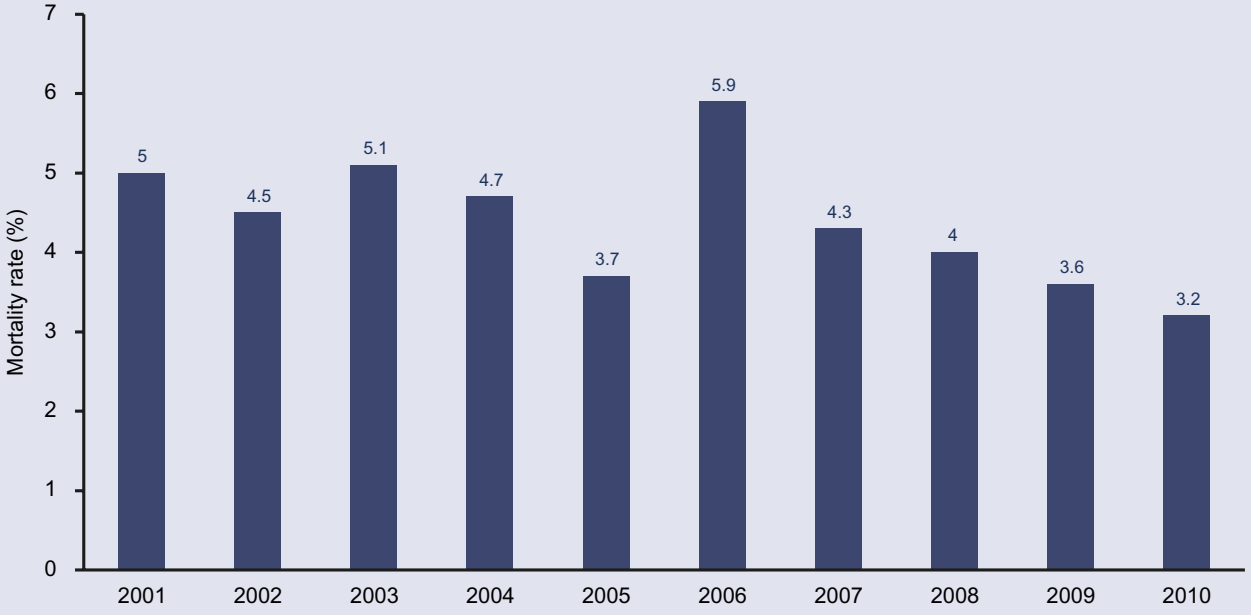

Figure 21
Crude mortality rate for isolated first time mitral valve replacement

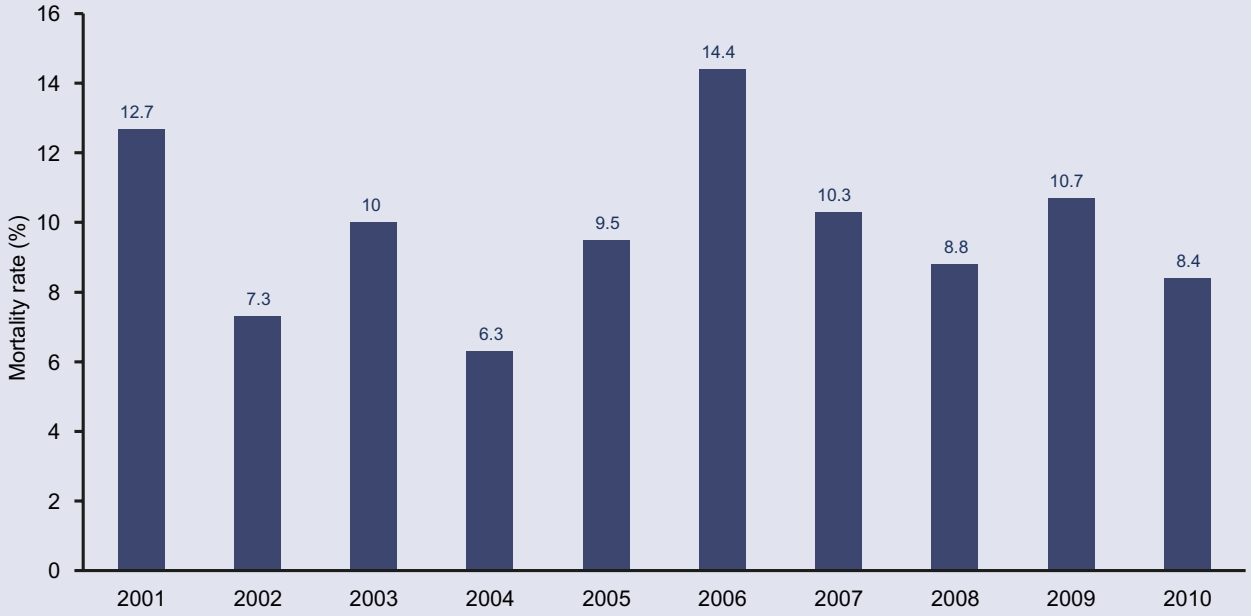

Figure 22
Crude mortality rate for combined mitral valve replacement and CABG

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Urgent surgery

More patients are undergoing cardiac surgery having been admitted with acute chest pain or other manifestations of heart disease (urgent surgery), rather than being admitted from home for their operations (elective surgery). This is largely due to changing methods of diagnosis and management for patients with heart attacks. Many patients who suffer minor heart attacks are being admitted to hospital and treated using 'routine invasive strategies' whereby they proceed directly to angiography to look for evidence of significant abnormalities in their coronary arteries. If a significant abnormality is found they are then treated thereafter by percutaneous coronary intervention (angioplasty) or surgery as determined by the nature of the coronary artery disease, the preferences of the patient, and to some extent the preference of the cardiologist who is responsible for performing the angiogram. It has been shown that routine invasive strategies for patients gives a lower mortality than allowing patients to recover from the heart attack, and then investigating them further only if they have symptoms or features of on-going ischaemic heart disease on further investigation.

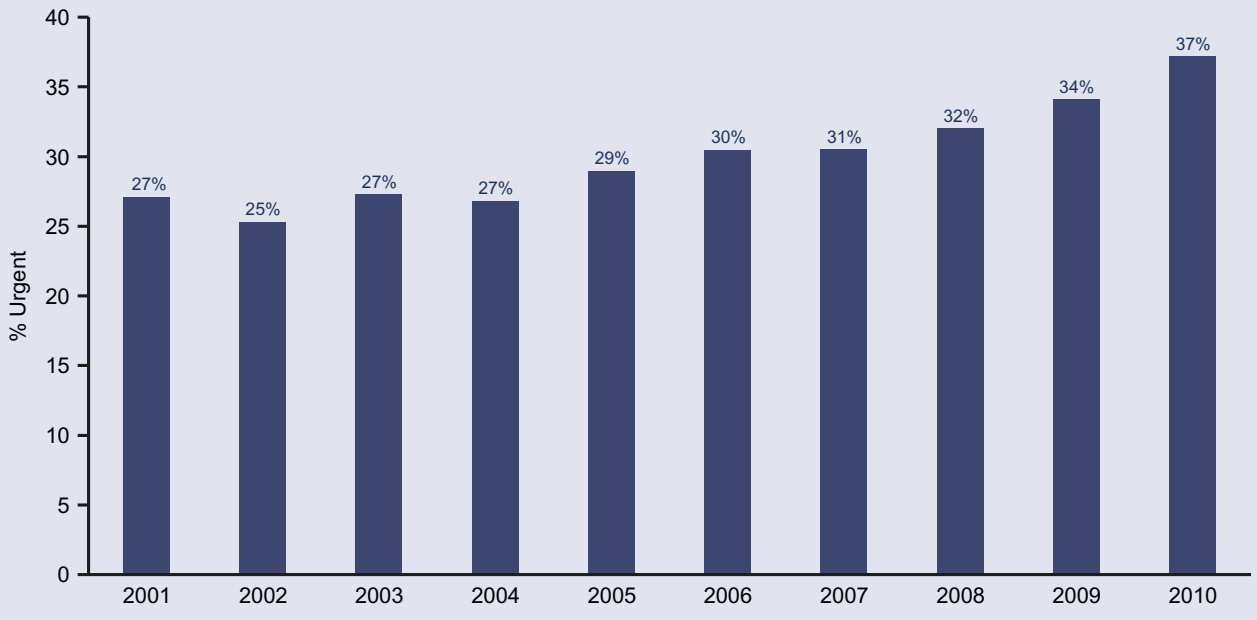

Figure 23
Proportion of urgent isolated first time CABG procedures

In hospital mortality outcomes

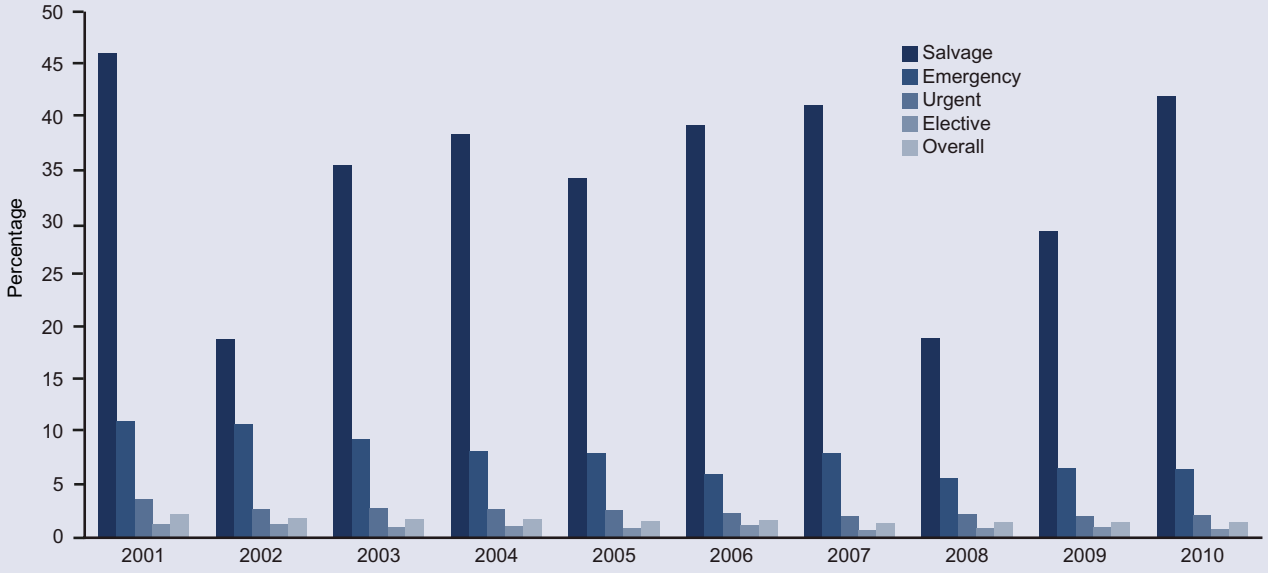

Figure 24
Crude mortality rates for isolated first time CABG by operative urgency

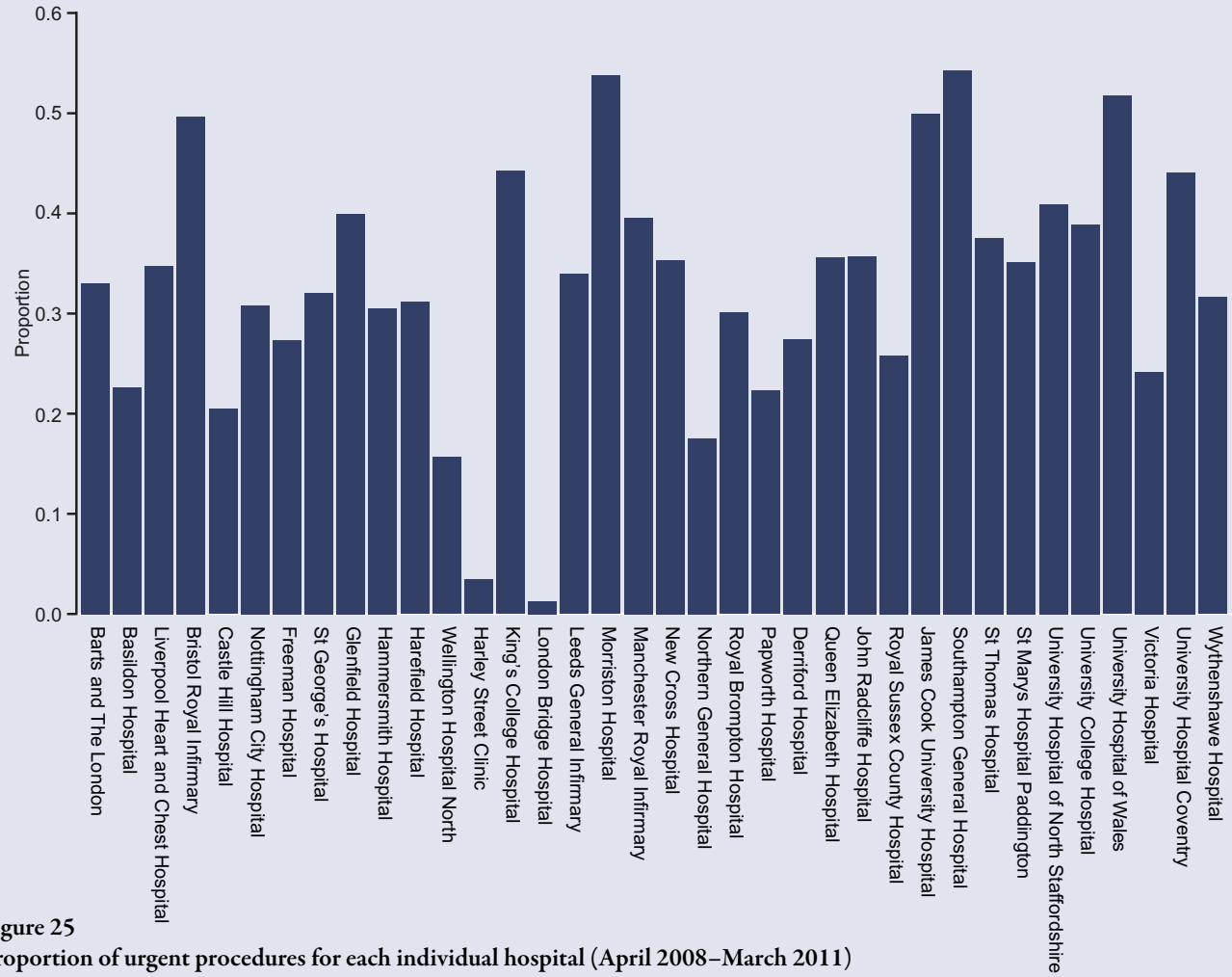

Figure 25
Proportion of urgent procedures for each individual hospital (April 2008–March 2011)

Risk factors for patients receiving urgent CABG

Patients receiving urgent CABG are more likely to be older, female, have pulmonary disease, extra cardiac arteriopathy, neurological dysfunction, renal disease and left ventricular dysfunction.

Table 2
Risk factors for patients receiving urgent isolated first time CABG

Group	Elective	Urgent	Emergency	Salvage
Age	65.6	66.7	67	65.7
Female	17.80%	21.70%	28.10%	30.60%
Pulmonary disease	11.60%	13.50%	12.90%	14.60%
Extracardiac arteriopathy	12.10%	13.90%	15.10%	18.50%
Neurological dysfunction disease	1.60%	2.10%	2.60%	3.60%
Creatinine> 200 µmols/l	1.50%	2.40%	3.80%	6.80%
Critical preoperative state	1.50%	6.30%	46.80%	100.00%
Unstable angina	0.60%	13.30%	56.50%	52.30%
LV dysfunction (moderate)	23.40%	30.60%	37.60%	24.20%
LV dysfunction (poor)	4.40%	8.20%	14.80%	42.00%
Recent myocardial infarction	9.40%	47.60%	55.70%	61.60%
Pulmonary hypertension	19.0%	0.4%	0.4%	0.7%

Mortality rates by centre

The mortality of any given cardiac operation depends on a number of factors. These factors include the exact type of operation performed, the patient's age, presence of other risk factors, and the quality of surgery and post-operative care. It has been shown that different hospitals and surgeons operate on different types of patients with quite different risk profiles. Unless these variations are accounted for, it is possible to draw incorrect conclusions from comparing hospital mortality rates.

The risk adjustment technique most commonly used in Europe is based on the EuroSCORE. This model attributes scores to various operative and patient risk factors, to enable comparisons to be made between hospitals with different patient risk profiles. The EuroSCORE was originally published in 1999, and because the quality of surgical care has improved over time, the predictions made by the EuroSCORE are no longer accurate and the model now significantly over estimates the actual risk. If you compare a hospital's contemporary mortality with that predicted by the EuroSCORE, all hospitals will perform much better than expected.

The European Association for Cardiothoracic Surgery (EACTS) published a suggested recalibration of the EuroSCORE for isolated CABG based on a large cohort of patients from around Europe. Currently mortality rates were found to be 36% lower than predicted using the original EuroSCORE meaning the recalibration by a factor of 0.73 of the original EuroSCORE was required.

Comparison of all units in England and Wales against this standard is shown in figure 26.

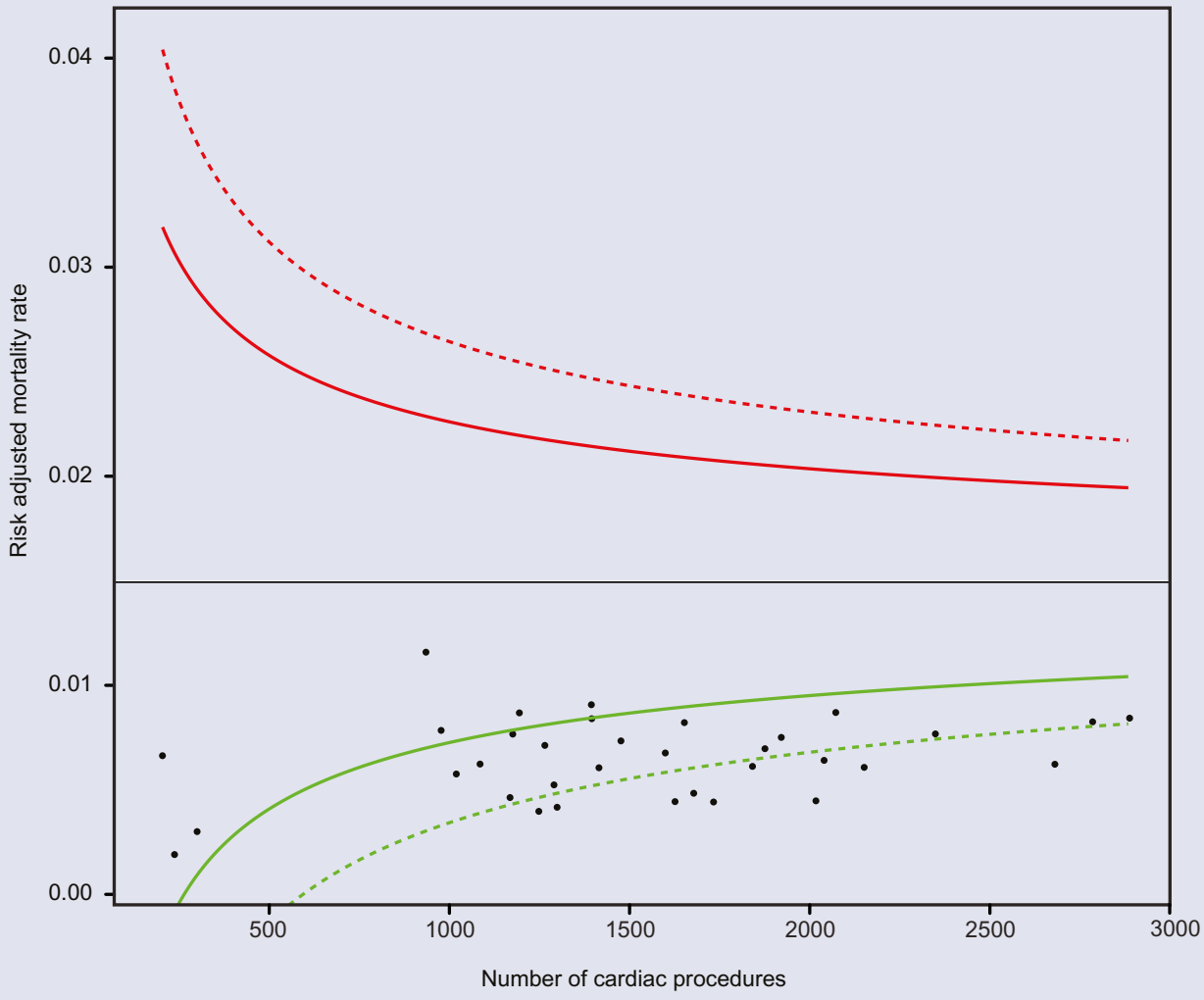

Figure 26
Risk adjusted mortality rates for isolated first time CABG procedures by hospitals (EACTS standard)

There are also some concerns about the ability of the EuroSCORE to accurately adjust for the highest risk patients. This is a particular concern as it is felt that close scrutiny of results in cardiac surgery can potentially encourage surgeons to turn down high risk patients, to protect the quality of their results, and it is these patients who potentially have the most to gain from successful surgery.

We have responded to these issues in two ways for this report;

- We have excluded all emergency patients (those who need to go directly to surgery without delay) and salvage patients (who require cardiopulmonary resuscitation immediately prior to surgery) from the comparative risk adjusted analyses. We do however present these data separately.
- We have compared the outcomes for the units to a modification of the original EuroSCORE model.
- We have used a recalibration based on the data cohort from 2004–2007. This was the decision made by our professional society in 2010 about the appropriate benchmark for subsequent governance analyses This is the data presented in the following analyses.
- However we recognise that data are most meaningful when compared to a true contemporary standard. The SCTS wishes to move towards this standard and we are due to discuss these issues further with our membership at the forthcoming annual business meeting in 2012.

Further details of the methodologies are available at **www.scts.org**

The activity and mortality rates for emergency and salvage cardiac surgery cases are provided in table 26 and figure 29. It should be noted that the EuroSCORE model does not have an adequate predictive ability for this group of patients, and as such crude mortality data only is presented.

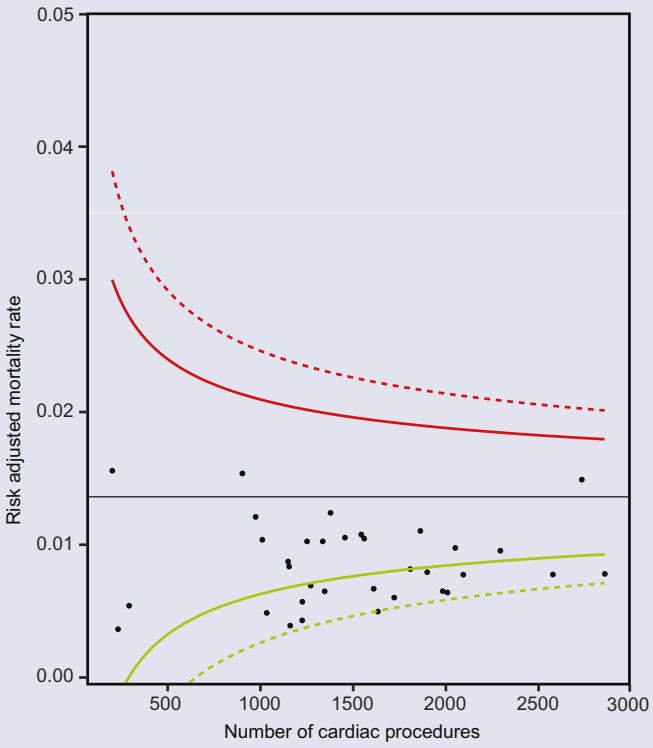

Figure 27
Funnel plot showing the mEuroSCORE for isolated first-time CABG procedures by hospital (April 2008 – March 2011)

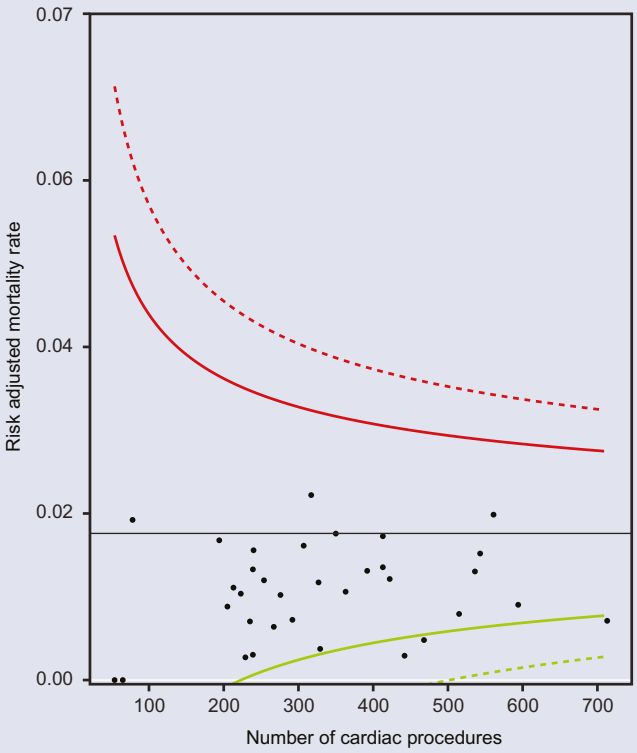

Figure 28
Funnel plot showing EuroSCORE for isolated first-time aortic valve replacement procedures by hospital

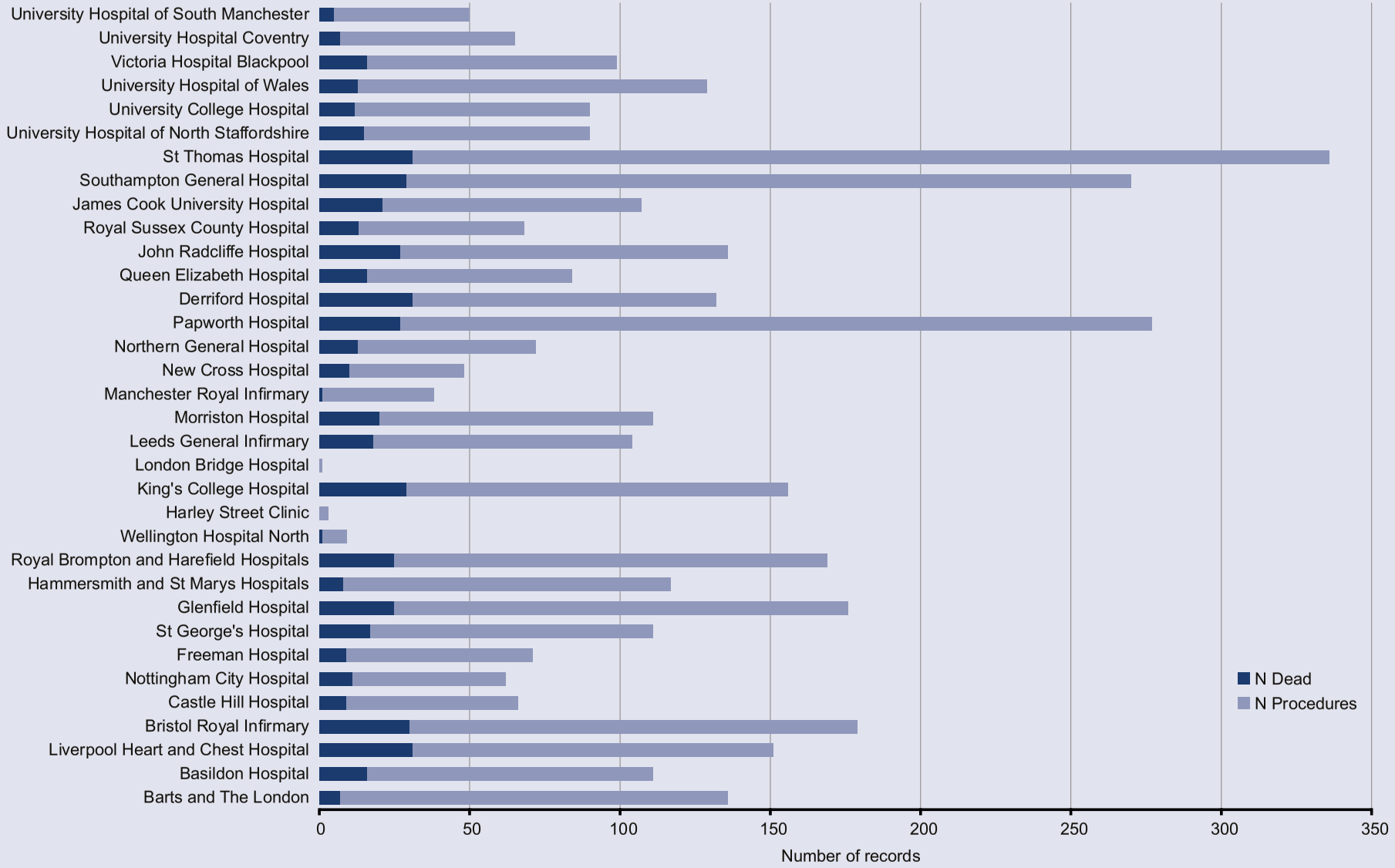

Figure 29
Activity rates and mortality for emergency and salvage cases by hospital

17

The Future

The adult cardiac surgery audit of the Society for Cardiothoracic Surgery in GB and Ireland is one the longest established national audits anywhere in the world. Our initiatives on collecting data, providing analyses for surgeons and feeding back to the public has led to marked improvement in the quality of clinical outcomes. The accessibility of our data has been praised by politicians, health care observers, patients and the public. We intend to continue to develop our programme to enhance the benefits that it can achieve.

Whilst we believe there are strengths in our current programme, we also feel that we should develop the way we feedback data to clinical teams and optimise the opportunities for quality improvement.

We must develop better information for patients, to help them in the process of shared decision making and to enable them to come to cardiac surgery as fully informed as possible.

The way that the medical profession is regulated is changing with the introduction of professional revalidation. Clinical outcome data will play an important part in this, and we have described some thoughts around these issues in our recent publication, - Maintaining patients' trust which is available from the SCTS website. However, we see a role for the national Cardiac Surgery Audit in refining the methods for including 'performance' data in judgements about clinicians 'fitness to practise', in a way that can be cascaded widely through both medicine and surgery.

Finally we believe that the Adult Cardiac Surgery Database of GB and Ireland is potentially a major resource for clinical research. We are committed to working with other stakeholders to produce high quality outputs from the database; both from the cardiac surgery data, and of probably greater importance from data which is linked across the national cardiac audits including congenital heart disease surgery, percutaneous coronary intervention, and myocardial infarction. In that way we believe we will better understand how to improve outcomes for patients.

APPENDIX 1 – Data information and definitions

Data

All adult cardiac surgery records between 1st April 2001 and 31st March 2011 (inclusive) were extracted from the CCAD database. Records originating from Scotland and Ireland were removed from the data, as well as from unknown hospitals. Finally, transplant, trauma and primary ventricular assist device procedures were removed from the database. The total number of records remaining is 318,086

Definitions and Information

Single or first time procedure in an admission spell

Mortality data was assessed on either a patients only cardiac procedure for a given admission spell, or the first cardiac procedure in an admission spell requiring further cardiac surgery. The rationale behind this is to not inflate mortality or survival for patients undergoing multiple operations in a single admission window. Records were identified as being single episode if for any given patient, the record corresponded to the first in a single or multiple set. Rules were developed for situations involving missing admission, procedure or discharge dates.

First time procedure

A first time cardiac procedure is defined as any patient who has had a previous cardiac operation (CABG, valve, congenital, other, ascending or arch aortic procedures); the number of previous heart operations is zero and have not had another procedure in a given admission spell. Note, other vascular procedures were not included in this definition.

Years

All annual information is given as the calendar start year of a financial year. For example, a procedure occurring on 13/02/2011 would be classified as occurring in the 2010 financial year.

Isolated CABG

An isolated CABG is defined as a patient for whom the default CABG indicator field is recorded as '1. Yes' and the default valve, major aortic and other cardiac procedure indicator fields are recorded as '0. No'.

Isolated mitral and aortic valve procedures

An isolated mitral valve procedure is defined as a patient for whom the default CABG, major aortic and other cardiac procedures indicator fields are recorded as '0. No', the default valve indicator field is recorded as '1. Yes' and there exists evidence (determined via the explant, pathology, replacement reason, procedure type and implant type fields) of a mitral valve procedure but no evidence of an aortic, pulmonary or tricuspid valve procedure exists. The same method was applied for identifying isolated aortic valve procedures.

Population data

Population statistics for England and Wales were obtained through numerous sources, including Wikipedia; Welsh Assembly; the Office of National Statistics. Statistics for England 2011 and Wales 2006-2008 and 2011 were estimated by linear extrapolation.

Procedural specific measures

A LIMA was identified as being used if the graft conduit field was recorded as missing or contained the word 'LIMA'. Overall 3,700 missing conduit records were assigned to LIMA. This is based on expert opinion that missing coronary bypass graft information is likely to be equivalent to the most common conduit type.

An LAD graft site was identified if the graft site was recorded as missing or contained the word 'LAD'. Overall 13,772 missing graft site records were assigned to LAD.

An off-pump procedure was identified if use of cardiopulmonary bypass was recorded as missing or '0. No'. Overall 4,800 missing cardiopulmonary bypass records were recorded as on-pump.

APPENDIX 2 – Data tables

Table 3
Missing in-hospital mortality data for individual hospitals (April 2008–March 2011)

Hospital	Count
St Anthony's Hospital	0
Barts and The London	41
Basildon Hospital	0
Liverpool Heart and Chest Hospital	0
Bristol Royal Infirmary	0
Castle Hill Hospital	1
Nottingham City Hospital	49
Freeman Hospital	0
St George's Hospital	0
Glenfield Hospital	84
Hammersmith Hospital	26
Harefield Hospital	2
Wellington Hospital North	1
Harley Street Clinic	0
King's College Hospital	13
London Bridge Hospital	1
Leeds General Infirmary	3
Morriston Hospital	0
Manchester Royal Infirmary	0
New Cross Hospital	2
Northern General Hospital	3
Royal Brompton Hospital	3
Papworth Hospital	0
Derriford Hospital	3
Queen Elizabeth Hospital	0
John Radcliffe Hospital	58
Royal Sussex County Hospital	6
James Cook University Hospital	0
Southampton General Hospital	0
St Thomas Hospital	0
St Marys Hospital Paddington	0
University Hospital of North Staffordshire	1
University College Hospital	0
University Hospital of Wales	3
Victoria Hospital Blackpool	0
University Hospital Coventry	2
University Hospital of South Manchester	0

Table 4 (Figure 2) Activity levels and procedures per million population for all cardiac surgery		
Year	**Count**	**ppm**
2001	24258	466.1
2002	30339	577.1
2003	32245	610.7
2004	32803	618.3
2005	31409	588.0
2006	32526	605.5
2007	34953	646.4
2008	35162	645.8
2009	32778	598.0
2010	31613	571.3

Table 5 (Figure 3) Activity levels and procedures per million population for isolated CABG		
Year	**Count**	**ppm**
2001	15535	298.5
2002	20312	386.4
2003	20883	395.5
2004	20743	391.0
2005	18670	349.5
2006	18883	351.5
2007	20236	374.3
2008	19268	353.9
2009	17509	319.4
2010	16408	296.5

Table 6 (Figure 4) Activity levels and procedures per million population for all valve surgery		
Year	**Count**	**ppm**
2001	6593	126.7
2002	8633	164.2
2003	9734	184.4
2004	10387	195.8
2005	11018	206.3
2006	11848	220.6
2007	12834	237.4
2008	13878	254.9
2009	13314	242.9
2010	13226	239.0

Table 7 (Figure 5)
Activity levels procedure per million population for all cardiac surgery (England and Wales)

Country	Year	Count	ppm
England	2001	23499	478.2
England	2002	28798	580.0
England	2003	30599	613.6
England	2004	31187	622.4
England	2005	29806	590.6
England	2006	30951	609.8
England	2007	33337	652.5
England	2008	33321	647.5
England	2009	31227	602.7
England	2010	30231	578.0
Wales	2001	759	260.8
Wales	2002	1541	527.7
Wales	2003	1646	561.8
Wales	2004	1616	549.7
Wales	2005	1603	543.4
Wales	2006	1575	532.1
Wales	2007	1616	542.3
Wales	2008	1841	615.7
Wales	2009	1551	517.0
Wales	2010	1382	455.6

Table 8 (Figure 6)
Activity levels and procedures per million population for isolated CABG (England and Wales)

Country	Year	Count	ppm
England	2001	15077	306.8
England	2002	19310	388.9
England	2003	19840	397.8
England	2004	19734	393.8
England	2005	17711	350.9
England	2006	18011	354.8
England	2007	19381	379.4
England	2008	18347	356.5
England	2009	16694	322.2
England	2010	15721	300.6
Wales	2001	458	157.4
Wales	2002	1002	343.2
Wales	2003	1043	356.0
Wales	2004	1009	343.2
Wales	2005	959	325.1
Wales	2006	872	294.6
Wales	2007	855	286.9
Wales	2008	921	308.0
Wales	2009	815	271.7
Wales	2010	687	226.5

Table 9 (Figure 7)
Activity levels and procedures per million population for valve surgery (England and Wales)

Country	Year	Count	ppm
England	2001	6338	129.0
England	2002	8177	164.7
England	2003	9215	184.8
England	2004	9865	196.9
England	2005	10443	206.9
England	2006	11241	221.5
England	2007	12168	238.2
England	2008	13075	254.1
England	2009	12657	244.3
England	2010	12609	241.1
Wales	2001	255	87.6
Wales	2002	456	156.2
Wales	2003	519	177.1
Wales	2004	522	177.6
Wales	2005	575	194.9
Wales	2006	607	205.1
Wales	2007	666	223.5
Wales	2008	803	268.6
Wales	2009	657	219.0
Wales	2010	617	203.4

Table 10 (Figure 10)
Percentage of LIMA use in isolated first time CABG

Year	Percentage
2001	92.4
2002	92.3
2003	93.4
2004	93.5
2005	93.9
2006	93.8
2007	94.4
2008	94.5
2009	94.9
2010	95.4

Table 11 (Figure 11)
Percentage of isolated first time CABG procedures performed using off-pump surgery

Year	Percentage
2001	17.5
2002	16.5
2003	18.2
2004	18.3
2005	16.7
2006	17.3
2007	17.1
2008	20.2
2009	18.7
2010	19.1

Table 12 (Figure 12)
Mitral valve replacement and repair rates for individual hospitals (April 2008 – March 2011)

Hospital name	Replacement	Repair	Total	Repair Rate
Barts and The London	92	119	211	56%
Basildon Hospital	122	38	160	24%
Liverpool Heart and Chest Hospital	35	86	121	71%
Bristol Royal Infirmary	57	235	292	80%
Castle Hill Hospital	56	52	108	48%
Nottingham City Hospital	99	16	115	14%
Freeman Hospital	111	77	188	41%
St George's Hospital	85	155	240	65%
Glenfield Hospital	67	228	295	77%
Hammersmith Hospital	40	70	110	64%
Harefield Hospital	34	86	120	72%
Wellington Hospital North	16	45	61	74%
Harley Street Clinic	23	17	40	43%
King's College Hospital	32	120	152	79%
London Bridge Hospital	34	27	61	44%
Leeds General Infirmary	78	73	151	48%
Morriston Hospital	78	72	150	48%
Manchester Royal Infirmary	16	84	100	84%
New Cross Hospital	31	210	241	87%
Northern General Hospital	87	144	231	62%
Royal Brompton Hospital	35	210	245	86%
Papworth Hospital	92	182	274	66%
Derriford Hospital	71	134	205	65%
Queen Elizabeth Hospital	29	140	169	83%
John Radcliffe Hospital	13	75	88	85%
Royal Sussex County Hospital	26	81	107	76%
James Cook University Hospital	34	146	180	81%
Southampton General Hospital	35	15	50	30%
St Thomas Hospital	98	179	277	65%
St Marys Hospital Paddington	12	31	43	72%
University Hospital of North Staffordshire	25	70	95	74%
University College Hospital	64	72	136	53%
University Hospital of Wales	77	95	172	55%
Victoria Hospital	73	104	177	59%
University Hospital Coventry	4	185	189	98%
University Hospital of South Manchester	27	130	157	83%

Table 13 (Figure 13)
Crude mortality rates by year for all cardiac surgery

Year	Mortality rate
2001	4.0
2002	3.5
2003	3.6
2004	3.4
2005	3.5
2006	3.5
2007	3.0
2008	3.2
2009	3.1
2010	3.1

Table 14 (Figure 14)
Crude mortality rates for isolated first time CABG

Year	Mortality rate
2001	2.3
2002	1.8
2003	1.7
2004	1.7
2005	1.6
2006	1.7
2007	1.4
2008	1.5
2009	1.5
2010	1.5

Table 15 (Figure 15)
Crude mortality rate for isolated first time CABG (elective procedures)

Year	Mortality rate
2001	1.3
2002	1.2
2003	1.0
2004	1.1
2005	0.9
2006	1.2
2007	0.7
2008	1.0
2009	1.0
2010	0.8

Table 16 (Figure 16)
Crude mortality rate for isolated first time CABG (urgent procedures)

Year	Mortality rate
2001	3.7
2002	2.8
2003	2.8
2004	2.7
2005	2.6
2006	2.3
2007	2.1
2008	2.2
2009	2.0
2010	2.2

Table 17 (Figure 17)
Crude mortality rate for isolated first time aortic valve replacement

Year	Mortality rate
2001	3.2
2002	2.9
2003	2.4
2004	2.6
2005	1.9
2006	2.1
2007	1.6
2008	1.9
2009	2.0
2010	1.8

Table 18 (Figure 18)
Crude mortality rate for combined aortic valve replacement and CABG

Year	Mortality rate
2001	6.8
2002	6.8
2003	5.6
2004	5.1
2005	5.1
2006	4.4
2007	4.4
2008	4.4
2009	4.2
2010	3.6

Table 19 (Figure 19) Crude mortality rate for isolated first time mitral valve repair	
Year	**Mortality rate**
2001	1.4
2002	1.2
2003	1.5
2004	1.2
2005	0.9
2006	1.3
2007	1.1
2008	1.1
2009	1.2
2010	0.7

Table 20 (Figure 20) Crude mortality rate for first time combined mitral valve repair and CABG	
Year	**Mortality rate**
2001	11.2
2002	4.2
2003	8.0
2004	8.5
2005	11.4
2006	7.3
2007	5.4
2008	5.5
2009	4.8
2010	6.1

Table 21 (Figure 21) Crude mortality rate for isolated first time mitral valve replacement	
Year	**Mortality rate**
2001	5.0
2002	4.5
2003	5.1
2004	4.7
2005	3.7
2006	5.9
2007	4.3
2008	4.0
2009	3.6
2010	3.2

Table 22 (Figure 22) Crude mortality rate for combined mitral valve replacement and CABG	
Year	**Mortality rate**
2001	12.7
2002	7.3
2003	10.0
2004	6.3
2005	9.5
2006	14.4
2007	10.3
2008	8.8
2009	10.7
2010	8.4

Table 23
Number of patients undergoing isolated first time CABG according to operative urgency

Year	Elective	Urgent	Emergency	Salvage	Total
2001	10555	4069	353	26	15014
2002	14193	4983	370	38	19684
2003	14134	5533	459	32	20282
2004	14256	5420	437	26	20203
2005	12523	5282	361	35	18225
2006	12402	5625	381	28	18446
2007	13246	6037	459	34	19786
2008	12422	6030	338	21	18828
2009	10960	5845	287	24	17141
2010	9629	5954	323	20	16016

Elective = patients admitted from home for their operations

Urgent = patients undergoing surgery as an inpatient

Emergency = patients who need to go directly to surgery without any delay

Salvage = patients who require cardio pulmonary resuscitation immediately prior to surgery

Table 24 (Figure 25)
Crude mortality rates for patients receiving isolated first time CABG by operative urgency

Operative urgency	2001 (%)	2002 (%)	2003 (%)	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
Salvage	46.15	18.92	35.48	38.46	34.29	39.29	41.18	19.05	29.17	42.11
Emergency	11.08	10.81	9.37	8.24	8.03	6.04	8.06	5.65	6.62	6.56
Urgent	3.67	2.75	2.80	2.70	2.59	2.33	2.09	2.19	2.04	2.17
Elective	1.32	1.23	1.00	1.10	0.94	1.15	0.71	0.97	1.01	0.83
Overall	2.26	1.82	1.74	1.75%	1.63	1.67	1.38	1.47	1.51	1.50

Table 25
Percentage of patients undergoing isolated first time CABG by operative urgency (April 2008–March 2011)

Hospital	Missing	Elective	Urgent	Emergency	Salvage	Total
Barts and The London	0.0%	64.3%	33.0%	2.4%	0.2%	2151
Basildon Hospital	0.0%	74.7%	22.7%	2.6%	0.1%	1678
Liverpool Heart and Chest Hospital	0.0%	64.2%	34.8%	0.9%	0.2%	2888
Bristol Royal Infirmary	0.6%	48.0%	49.7%	1.7%	0.1%	2349
Castle Hill Hospital	0.0%	78.2%	20.5%	1.4%	0.0%	1476
Nottingham City Hospital	0.0%	68.6%	30.8%	0.4%	0.2%	1168
Freeman Hospital	0.0%	71.6%	27.4%	1.0%	0.1%	1265
St George's Hospital	0.0%	65.4%	32.1%	2.4%	0.1%	1599
Glenfield Hospital	0.1%	55.9%	40.0%	3.5%	0.5%	1394
Hammersmith Hospital	3.8%	62.5%	30.5%	3.1%	0.1%	1225
Harefield Hospital	0.1%	67.6%	31.1%	1.1%	0.2%	1523
Wellington Hospital North	1.0%	81.7%	15.7%	1.7%	0.0%	300
Harley Street Clinic	0.0%	95.1%	3.4%	1.5%	0.0%	204
King's College Hospital	0.0%	52.5%	44.2%	3.1%	0.2%	1194
London Bridge Hospital	1.7%	96.6%	1.3%	0.4%	0.0%	237
Leeds General Infirmary	0.0%	64.3%	34.0%	1.7%	0.1%	1841
Morriston Hospital	0.0%	41.6%	53.7%	3.8%	0.9%	1085
Manchester Royal Infirmary	0.0%	59.2%	39.6%	1.2%	0.1%	1395
New Cross Hospital	0.0%	64.0%	35.3%	0.6%	0.1%	1733
Royal Brompton Hospital	0.0%	67.4%	30.1%	2.4%	0.2%	1262
Papworth Hospital	0.0%	73.9%	22.3%	3.8%	0.0%	2680
Derriford Hospital	0.5%	71.5%	27.5%	0.5%	0.0%	2072
Queen Elizabeth Hospital	0.0%	64.1%	35.6%	0.2%	0.1%	977
John Radcliffe Hospital	0.1%	60.9%	35.7%	3.1%	0.2%	935
Royal Sussex County Hospital	0.0%	73.3%	25.8%	0.9%	0.0%	1019
James Cook University Hospital	0.0%	48.5%	50.0%	1.4%	0.1%	2040
Southampton General Hospital	0.5%	40.9%	54.3%	4.0%	0.3%	1415
St Thomas Hospital	0.0%	61.4%	37.5%	1.0%	0.1%	1921
St Marys Hospital Paddington	0.0%	59.5%	35.1%	5.2%	0.2%	427
University Hospital of North Staffordshire	0.1%	56.8%	40.9%	2.2%	0.0%	1176
University College Hospital	0.0%	59.6%	38.9%	1.2%	0.2%	1290
University Hospital of Wales	2.5%	42.6%	51.7%	3.1%	0.1%	1299
Victoria Hospital	0.1%	74.1%	24.2%	1.5%	0.1%	2017
University Hospital Coventry	0.0%	54.2%	44.1%	1.7%	0.1%	1248
University Hospital of South Manchester	0.4%	67.5%	31.6%	0.5%	0.0%	1626

Table 26 (Figure 29)
Activity rates and crude mortality rate for emergency and salvage cardiac surgery

Hospital	Number of deaths	Number of procedures	Crude mortality
Barts and The London	7	129	5.4%
Basildon Hospital	16	95	16.8%
Liverpool Heart and Chest Hospital	31	120	25.8%
Bristol Royal Infirmary	30	149	20.1%
Castle Hill Hospital	9	57	15.8%
Nottingham City Hospital	11	51	21.6%
Freeman Hospital	9	62	14.5%
St George's Hospital	17	94	18.1%
Glenfield Hospital	25	151	16.6%
Hammersmith and St Marys Hospitals	8	109	7.3%
Royal Brompton and Harefield Hospitals	25	144	17.4%
Wellington Hospital North	1	8	12.5%
Harley Street Clinic	0	3	0.0%
King's College Hospital	29	127	22.8%
London Bridge Hospital	0	1	0.0%
Leeds General Infirmary	18	86	20.9%
Morriston Hospital	20	91	22.0%
Manchester Royal Infirmary	1	37	2.7%
New Cross Hospital	10	38	26.3%
Northern General Hospital	13	59	22.0%
Papworth Hospital	27	250	10.8%
Derriford Hospital	31	101	30.7%
Queen Elizabeth Hospital	16	68	23.5%
John Radcliffe Hospital	27	109	24.8%
Royal Sussex County Hospital	13	55	23.6%
SCM. James Cook University Hospital	21	86	24.4%
Southampton General Hospital	29	241	12.0%
St Thomas Hospital	31	105	29.5%
University Hospital of North Staffordshire	15	75	20.0%
University College Hospital	12	78	15.4%
University Hospital of Wales	13	116	11.2%
Victoria Hospital Blackpool	16	83	19.3%
University Hospital Coventry	7	58	12.1%
University Hospital of South Manchester	5	45	11.1%