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National Coronary Angioplasty Audit

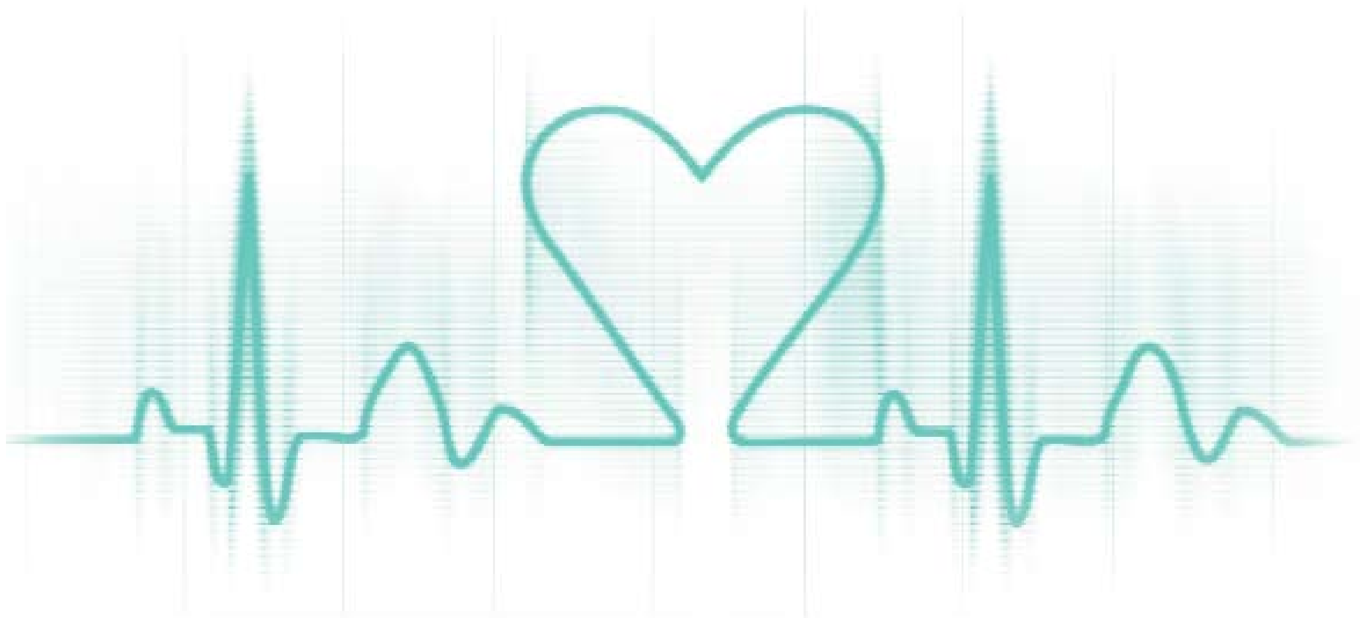
Angioplasty and Stents to treat Heart Disease 2007 report of the National Audit of Percutaneous Coronary Intervention in the United Kingdom

Data from January 2006 to December 2006, Peter F Ludman on behalf of the British Cardiovascular Intervention Society

Prepared in association with:

Healthcare Commission

BCIS



This report presents the main findings from the National Coronary Angioplasty Audit. The main objective of this audit is to improve the care of patients who undergo Percutaneous Coronary Intervention (PCI) procedures in the UK. The audit provides a mechanism to collect procedure-specific data based on the current minimum British Cardiovascular Interventional Society dataset. This audit project is being delivered in collaboration with the British Cardiovascular Interventional Society (BCIS) and The NHS Information Centre for health and social care.

The audit described here allows clinicians to assess key aspects of the quality of their care when performing coronary angiogram and Percutaneous Coronary Intervention. This is a United Kingdom wide audit performed by the Audit Officer of the BCIS with participation from hospitals performing PCI procedures.

The executive summary, presents the key findings from the Angioplasty and Stents to treat Heart Disease 2007 report of the National Audit of Percutaneous Coronary Intervention in the United Kingdom and will compliment this report.

It is available to download from the improving patient care section of our website. Printed copies can be ordered through our Contact Centre, quoting document reference 12020108.

This full report is available as a PDF download only. For further information contact our Contact Centre, quoting document reference 28010308.

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Foreword

The evidence base for the practice of coronary angioplasty (now referred to as percutaneous coronary intervention [PCI]) continues to expand, especially for patients presenting with acute coronary syndromes. When PCI was first introduced it was for the treatment of patients with stable angina. It remains a very useful treatment for this indication especially as we now have the use of drug-eluting stents (DES), which have made a major impact on reducing the requirement for additional revascularisation procedures following an initial procedure. In addition, the availability of DES have allowed doctors to treat more patients with PCI rather than having to treat them with coronary artery bypass grafting (CABG) operations. More and more however, PCI is being used in the context of patients with unstable symptoms or small or large heart attacks. After small heart attacks there is evidence that PCI helps to reduce the morbidity and mortality associated with these events, and to reduce the frequency of future attacks. Larger heart attacks have traditionally been treated with thrombolytic ("clot-busting") drugs but now there is an increasing use of angioplasty to restore blood flow to the heart (in this context it is referred to as "primary angioplasty"). This treatment has a number of advantages over clot-busters, but it is a logistic challenge to provide this treatment across the UK. Initial results from the National Infarct Angioplasty Project address many of the issues to be addressed in setting up a primary angioplasty service.[1]

The growth has been possible because of government investment in new cardiac catheter laboratories, and there has been a significant increase in the number of doctors performing PCI. Although there has been an increase in the indications for PCI, this investment has been associated with a major drop in the waiting times for both PCI and CABG procedures. This report provides an overview of the growth of PCI over the last few years. However, the report identifies a significant discrepancy about the delivery of care in different parts of the UK, and Wales in particular appears to have a major under-provision in treatment. We must push for these inequalities to be abolished.

Part of the expansion in activity has come because more hospitals have started a PCI programme. The British Cardiovascular Intervention Society (BCIS) provides a site visit to all centres wishing to start, to ensure that they have the appropriate infrastructure to provide a good quality service to their patients. Of course, patients want a service to be provided locally if at all possible, but there is also evidence to suggest that outcomes for patients are better if performed in centres doing a reasonably large number of cases every year (400 or more), with experienced operators working together with a good support team. There are some concerns that some of the new centres do not appear to be increasing their activity to the level that they expected, and this aspect needs to be carefully monitored.

Wherever PCI is performed, it needs to be performed to a high standard. BCIS has been performing an evaluation of overall outcomes across the country, but by collecting information on every patient via the Central Cardiac Audit Database, we will soon be in a position to report on the outcomes for patients at every unit. This is a very important part of quality control, so that we can assure patients that a good service is provided. There are some units that are very good at collecting information but there are some that are poor. We are working to improve this situation so that all centres collect appropriate information to allow their results to be reviewed.

BCIS is working together with the Department of Health and the Health Commission to ensure that this audit process develops and provides us with important information regarding the quality of the practice of this important treatment. The project would not be possible without the tireless energy of Dr Peter Ludman who spearheads the Society's efforts. The support we get from Dr David Cunningham and Nadeem Fazal and the entire CCAD team is immense. As we get to grips with coronary artery disease and its treatments, we are also mindful of the development of new treatments for valve and other diseases of the heart. BCIS will be developing programmes to collect information on all aspects of the treatments now on offer. We hope this report demonstrates some of the strides being made.

Mark de Belder
President, BCIS

1 National Infarct Angioplasty Project (NIAP). Interim report. Department of Health Publication 286108. www.dh.gov.uk/publications

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Acknowledgements

The National Percutaneous Coronary Intervention Audit has been developed and run by the British Cardiovascular Intervention Society (BCIS) since 1988 and more recently has received support from The NHS Information Centre for health and social care and The Healthcare Commission. The analysis on which this report is based was undertaken by the BCIS Audit Officer, Dr Peter Ludman.

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1.0 Executive Summary

Coronary heart disease accounts for about one in five deaths in men and one in six deaths in women. In addition, the British Heart Foundation estimate that there are over 1 million men living in the UK who have or have had angina (heart-related chest pain), and over 840,000 women.

Percutaneous Coronary Intervention (PCI) is a rapidly evolving technique used to treat patients whose coronary arteries – which supply the heart with blood - are narrowed or blocked. The procedure works by mechanically improving blood flow to the heart. First, the doctor uses x-ray images of the heart arteries to make the position and shape of any narrowing or blockages visible (a 'coronary angiogram'). If the clinical circumstances and the angiogram findings suggest that something needs to be done to physically modify the blood flow to the heart, then the majority of patients are treated by PCI[1]. A small balloon is inserted which, when inflated, squashes the fatty tissue out of the way and widens the artery. In most cases a 'stent' is then implanted - a stainless steel mesh tube that stays permanently in place to keep the artery wall open. Treatment thus aims to prevent the arteries blocking (which might cause a heart attack) and improve flow to the heart muscle to alleviate the symptoms of angina.

The audit described here allows clinicians to assess key aspects of the quality of their care when performing coronary angiogram and PCI. This is a United Kingdom wide audit performed by the Audit Officer of the British Cardiovascular Intervention Society (BCIS). This audit has recently been enhanced by the Central Cardiac Audit Database (CCAD) which allows electronic transfer of much more detailed information. This data collection and analysis for centres in England and Wales has project management and specialist IT support provided by the National Clinical Audit Support Programme (NCASP), which is part of The NHS Information Centre for health and social care. This portion of the audit is funded by the Healthcare Commission.

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Key findings include:

- The number of PCIs in the UK was 1,216 per million population (pmp). These numbers are less than in most other developed European countries. The number of angiograms and PCI procedures are also less than that recommended by the British Cardiovascular Society (BCS), but both exceed the numbers expected by the National Service Framework (NSF) for Coronary Heart Disease. For PCIs, the NSF target in 2000 was 750 (pmp), and the BCS 2003 target was 1,400 pmp, with expectations that the level might need to be 2-3,000 pmp.

- Although there has again been an increase in PCI activity in all the UK countries, there remain large differences between these countries, with the poorest provision in Wales at 943 pmp compared with the highest in Northern Ireland at 1559 pmp.

- The rate of increase in overall number of PCI procedures performed has fallen, and was the lowest increase since records began in 1992.

- Centre size: there is evidence that suggests improved outcomes for patients being treated in higher volume PCI centres, particularly those that perform at least 400 procedures pa. This forms part of the Joint Working Group on PCI of BCIS and the British Cardiac Society recommendations. In 2006, the majority of units were performing considerably more than the recommended minimum. Of the 23 units performing less than 400 cases pa, the majority were new units undertaking a gradually increasing volume of work.

- The National Institute for Health and Clinical Excellence (NICE) recommend that "Stents should be used routinely where PCI is the clinically appropriate procedure for patients with either stable or unstable angina or with acute myocardial infarction[2]". The great majority of procedures do now involve stent insertion (94 per cent), suggesting that this aspect of good practice is being met.

- 61 per cent of the stents inserted in England, and 80 per cent of those in Wales, were coated with a drug designed to pass into the wall of the artery to improve the longer term success rates of the procedure (these coated stents are called drug-eluting stents). The National Institute for Health and Clinical Excellence (NICE) recommend that "A drug-eluting stent should be used if the person has angina, and the inside diameter of the artery is less than 3 mm across, or the narrowed area is more than 15 mm long[3]." Research suggests that compliance with the NICE guidance on use of such stents would result in about 76 per cent of patients being treated with a drug eluting stent[4], which is in keeping with the rates observed in this audit and suggests that recommended practice is being followed.

- National and International guidelines recommend that in the emergency treatment of patients with ST elevation myocardial infarction (STEMI), angioplasty treatment should be performed within 90 minutes of arrival of the patient at the angioplasty site. For the first time the CCAD data were used to measure unit's ability to deliver treatment in this time frame. For almost every unit providing a full time service, the median door to balloon times less than 90 minutes. More detailed analysis will occur next year.

- The overall rate of death before discharge from hospital following PCI has remained fairly stable over recent years at around 0.5-1 per cent, and there has been a marked fall in the need for emergency coronary artery bypass surgery to try to solve a PCI complication (in 2006, this occurred in less than 0.1 per cent of all procedures).

- The risk of in-hospital death for emergency patients varies according to clinical syndrome. For patients with unstable angina or non ST elevation myocardial infarction (NSTEMI), the in hospital mortlity is less than 1 per cent. For patients with STEMI, the mortality is higher at about 5 per cent.

- There has been a huge improvement in the number of centres sending data to CCAD for electronic collection and analysis. In 2006, 95.4 per cent of all NHS units in England and Wales contributed to CCAD, with only 3 English units failing to do so.

- There remains a need to improve data quality, with only about one third of centres providing more than 90 per cent data completeness for key fields of the dataset.

The rest of this report contains more details and graphs of the audit findings. The complete set of data from the 2006 audit was presented at the British Cardiovascular Intervention Society's annual meeting in autumn 2007 and is available for download at the Society's website www.bcis.org.uk

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2.0 Introduction

The heart is a muscular pump which moves blood around the body, which contains the oxygen and food your body's organs need to function. To pump properly the heart muscle needs its own blood supply, and this is provided by vessels called the coronary arteries. If these arteries get narrowed or blocked, and the supply to a region of heart muscle is reduced, then this region may start to contract less well, and ultimately this region may die.

The sensation that many people experience when their heart muscle does not get enough blood supply is called angina, which is usually felt as a tight constricting feeling across the chest. If a region of heart muscle dies, this is called a 'heart attack' or 'myocardial infarction'.

Coronary Heart Disease (CHD), causes over 117,000 deaths a year in the United Kingdom, accounting for approximately one in five deaths in men and one in six deaths in women (www.heartstats.org). While death rates for CHD have been falling rapidly in the UK since the late 1970s they are still amongst the highest in Western Europe.

There is considerable variation in mortality from CHD across the UK. Death rates are higher in Scotland than the South of England, in manual workers than in non-manual workers and in certain ethnic groups.

In addition to being a leading cause of mortality, a large number of people suffer symptoms as a result coronary artery disease. The British Heart Foundation estimate that there are over 1 million men living in the UK who have or have had angina and over 840,000 women giving a total of just under 2 million.

Treatment of narrowed coronary arteries has two aims. The first is to try to prevent the coronary arteries blocking which might cause a myocardial infarction and lead to heart failure or death. The second is to improve flow to the heart muscle to alleviate symptoms of angina.

There are three aspects to most people's treatment. Medication is required in all cases. In addition many patients benefit from either:

a) percutaneous coronary intervention (PCI) or
b) coronary artery bypass surgery (CABG)

Both these procedures are ways of mechanically improving blood flow to the heart muscle, and are called 'revascularisation procedures'. There are many facts used to decide firstly whether either is necessary, and if they are which is most appropriate for an individual patient.

If either of these 2 procedures might be required, then it is first necessary to visualise the coronary arteries so that it is possible to see where the narrowings and blockages are. This is done by performing a 'coronary angiogram' which is essentially a special x-ray test.

2.1 The Coronary Angiogram procedure

During this procedure, x-ray images are made of the heart arteries, while a special liquid is injected into them to make them visible. The procedure can be performed from the artery at the top of the leg, or in the wrist, and is performed under local anaesthetic. The area of skin is made numb using local anaesthetic and through this area a long thin tube (called a catheter) is fed into the artery. It is then guided under x-ray imaging control until the tip reaches the heart.

When the tip of the catheter is in position a special liquid is injected into the heart arteries so that they show up on the x-ray machine. The position and shape of any narrowings in these arteries can therefore be identified. This part of the procedure is called an angiogram, and usually takes about 30 minutes. It can be performed as a day case procedure, or as a prelude to a percutaneous coronary intervention (PCI), which would then occur immediately after the images are obtained.

As can be seen from the graphs below, if the clinical circumstances and the angiogram findings suggest that something needs to be done to physically modify the blood flow to the heart, then out of every 4 patients, 3 will need a PCI, and 1 will need a coronary artery bypass operation (CABG) (Figure 8).

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2.2 Percutaneous Coronary Intervention

A percutaneous coronary intervention (PCI) starts just like an angiogram. Then, once the images have been taken, a very thin wire is steered under x-ray image control, across the narrowed part of coronary artery. Once in place, a balloon is fed over this wire and so tracked across the narrowing. Inflating the balloon squashes the fatty tissue out of the way and widens the artery. This may need to be done several times to be successful in fully widening the artery. In most cases a stent is then implanted. A stent is a small stainless steel mesh in the shape of a tube which can be used to scaffold the artery wall in order to keep it open. The stent is crimped over the balloon, which is used to deploy it against the inner wall of the artery. As the balloon inflates, so the stent is expanded, pressing out against the arterial wall, so helping to hold open the newly widened artery. The balloon is then deflated and withdrawn, leaving the stent in place. In the last few years we have seen the development of special stents called 'drug eluting' stents, which have a drug on their surface. This drug passes into the wall of the artery it is scaffolding to try to improve the longer term success rates of the procedure.

Following a PCI, most patients return home the next day. Generally, this is a very safe form of treatment. The potential complications can be broadly split into those that occur during or very shortly after angioplasty, and those that occur weeks or months later.

Early complications: At the time of PCI it is sometimes not possible to successfully open up the blocked vessel. Generally if the vessel was narrowed the success rates are very high (see Section 3), but if the vessel was completely blocked before the procedure, the chances of re-opening it are rather lower. In addition, but very rarely it is sometimes necessary to resort to emergency coronary artery bypass surgery to treat a complication. This occurred in less than 0.1 per cent of cases in 2006. Any treatments involving the coronary arteries may, rarely, be associated with complications such as stroke, heart attack or death (the risk is less than 1 per cent). As can be seen from the audit below, some patients are at higher risk of developing complications than others. For example, the treatment of a patient in a stable situation is associated with complication rates of less than 1 per cent, but in the context of an acute heart attack, this may rise to 10 per cent or more.

Potential later complications: After PCI, the symptoms of angina are usually much improved. There follows a period when the walls of the newly stretched arteries heal. If a simple metal stent has been deployed, then over the course of the first six months cells grow over this part of the artery wall, and form a new lining, embedding the stent within the artery wall. If the healing process is over exuberant this can lead to re-narrowing of the artery, and a recurrence of angina (so called 'restenosis'). If this is going to occur it usually does so within the first six months. If a drug eluting stent has been implanted, there is much less proliferation of cells around the stented site. This means that the chance of recurrent symptoms in the first few months is much lower. After both types of stent there is a small risk (less than 1 per cent per year) of the treated vessel blocking abruptly, usually due to clot formation. This risk is slightly higher for simple metal stents early after the angioplasty, and slightly higher for drug eluting stents later after the angioplasty.

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3.0 Audit background

From 1988, PCI activity across the UK has been gathered by the Audit Officer of the British Cardiovascular Intervention Society (BCIS) and presented to the society annually. Early data were published in the British Heart Journal, but data from 1992 onwards are available on the Society's website (www.bcis.org.uk).

These audits have addressed a number of issues for the provision of care, to the outcome following procedures. The data have been gathered by asking all units that perform PCI to complete paper forms that summarised their year's activity.

3.1 Central Cardiac Audit Database

In order to improve a number of aspects of this audit, particularly to increase the amount of detailed information about each PCI procedure that can be collected and analysed, BCIS have been working with Central Cardiac Audit Database (CCAD) to role out electronic data collection for England and Wales. The CCAD project sits within the National Clinical Audit Support Programme, which is part of The NHS Information Centre.

In brief, this project is funded by the Healthcare Commission, and infrastructure provided by the National Clinical Audit Support Programme (NCASP). The audits that concern PCI are under the clinical lead of the BCIS audit secretary, Dr Peter Ludman.

Since 2005, the audit analysis has made extensive use of data that had been uploaded to CCAD, with the analyses presented being a combination of data from the usual paper forms (for all the United Kingdom), and also from the electronic data available on CCAD central servers. In 2006, 95.4 per cent of all NHS units in England and Wales contributed to CCAD, with only 3 English units failing to do so. It is planned combine the data with that already collected electronically by the Scottish PCI units, and so work towards a United Kingdom wide electronic system.

Having made big strides in encouraging participation in this electronic data collection, the focus must now shift to data quality. If we examine each PCI record, and measure how completely key data fields are entered, we find some units perform extremely well, while others have some way to go to achieve satisfactory data collection performance. The initial aim, encapsulated by the Healthcare Commission's annual health check for 2006-2007, is to achieve more than 90 per cent completeness of these key fields. What was actually achieved in 2006 is shown in the figures overleaf.

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Figure 1: Data completeness (as %) for the key data fields, for each individual PCI centre in England and Wales

	Date of Birth	Sex	MH	Pre-proc shock	Proc urgency	Vessels treated	Renal disease	DM	Dx date	Dx status	PCI hospital outcome	NHS number
SUN. Sunderland Royal Hospital	100	100	100	100	100	100	100	100	100	100	100	100
TOR. Torbay Hospital	100	100	100	99.6	100	100	100	100	100	100	100	99.2
SCM. James Cook University Hospital	100	100	99.5	100	100	100	99.6	99.9	100	100	100	100
HSC. Harley Street Clinic	100	100	99.3	100	100	100	100	99.7	100	100	100	0
HHW. Wellington Hospital	100	100	99.4	100	100	100	98.4	100	100	100	100	0
SEH. Southend Hospital	100	100	100	98.7	100	100	99.3	99.3	100	100	100	100
QEB. Queen Elizabeth Hospital, Edgbaston	100	100	100	100	100	98.8	99.9	99.9	99.5	99.5	99.5	97.5
SAN. Sandwell District General Hospital	100	99.5	100	100	100	99.5	98.8	100	98.3	100	100	99.8
DUD. City Hospital	100	99.8	100	100	100	98.6	98.6	99.1	99.5	99.5	100	98.6
EBH. Birmingham Heartlands Hospital	100	99.9	99.6	100	100	97.6	98.8	98.9	99.7	99.5	100	98.4
SPH. St Peter's Hospital	100	100	98.3	95.6	100	100	100	99.4	100	100	100	98.3
DGE. Eastbourne DGH	100	100	94.7	100	100	98	95.4	99.3	100	100	100	98.7
GEO. St George's Hospital	100	100	99.9	86.5	100	100	99.5	99.5	99.8	99.8	99.9	75.3
GRL. Glenfield Hospital	100	100	98.3	99.7	100	100	86.1	98.7	100	100	99.7	99.8
CRO. Cromwell Hospital	100	100	97.5	100	100	95	100	92.5	95	100	100	2.5
CHG. Cheltenham General Hospital	100	100	85.6	99.5	100	98.4	98.8	97.2	100	100	100	99.8
FRE. Freeman Hospital	100	100	97.3	98.8	100	97.6	98.7	95.2	100	100	91.3	99.5
WHC. Whipps Cross University Hospital	100	100	89	100	100	100	99.4	76.9	99.4	100	100	91.9

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	Date of Birth	Sex	MH	Pre-proc shock	Proc urgency	Vessels treated	Renal disease	DM	Dx date	Dx status	PCI hospital outcome	NHS number
PHB. BMI Priory Hospital	96.4	98.2	100	100	100	92.2	96.4	98.2	91.1	91.1	100	7.1
LGI. Yorkshire Heart Centre	100	99.5	88.2	100	100	99.5	88	89.8	98.9	98.3	97.8	97.7
CHH. Castle Hill Hospital	100	100	94	74.6	99.5	100	96.6	96.8	99.5	99.8	98.5	94.8
DER. Derby Royal Infimary	100	100	76.4	100	100	100	94.6	94.9	92.6	97.6	97.6	96
WAL. Walsgrave Hospital	100	100	82.6	95.4	100	99.6	90.6	95.1	99.1	90.5	99.9	93.8
QAP. Queen Alexandra Hospital	97.2	99.2	100	100	100	95.8	97.4	96.6	69.5	73.6	100	64.3
MAY. Mayday University Hospital	98.2	98.2	100	100	99.6	97.5	58.3	76.3	100	100	100	99.3
MRI. Manchester Royal Infirmary	100	100	64.7	100	100	99.4	99.1	96.8	100	100	60.6	97.7
NHB. Royal Brompton Hospital	100	100	95.7	29.9	100	99.8	96.9	98	99.9	99.9	99.9	61.8
NCR. New Cross Hospital	100	100	84.7	65.8	99.8	99.8	84.7	87.8	99.5	99.8	96.9	74.3
STH. St Thomas' Hospital	100	94	99.7	100	100	96.5	57	90.8	100	77.4	100	92.3
BRI. Bristol Royal Infirmary	100	100	69.4	94.5	100	98.7	99.1	100	99.4	100	51.5	99.2
HHH. Hemel Hempstead General Hospital	100	99.6	100	100	100	93	70.8	96.4	75.9	76.7	100	83.4
KES. King Edward Seventh Hospital	100	100	99.1	54.5	100	100	97.3	100	51.8	99.1	99.1	4.5
BOU. Royal Bournemouth Hospital	100	100	92.6	100	100	100	95.1	95	8.2	99.9	100	99.8
WRG. Worthing Hospital	100	100	99.2	100	100	100	98.4	78	56.1	58.5	100	100
RAD. John Radcliffe Hospital	100	100	100	75.6	100	95.7	49.4	71.7	100	96.6	100	98.4
UHW. University Hospital of Wales	100	100	67.3	83.5	100	99.6	74.1	75.2	94.1	95.7	98.4	97.8
CHN. Nottingham City Hospital	100	99.9	0	100	100	100	85.1	100	100	100	100	99.5

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	Date of Birth	Sex	MH	Pre-proc shock	Proc urgency	Vessels treated	Renal disease	DM	Dx date	Dx status	PCI hospital outcome	NHS number
BAL. Barts and the London	100	100	75.3	92	100	97.2	79.7	90.6	55.7	100	85.8	90.7
MPH. Taunton & Somerset	100	99.3	100	100	100	99	100	99.8	38.5	35.4	100	91.4
RSC. Royal Sussex County Hospital	100	99.9	81.4	100	99.4	91	100	100	14.1	99.8	78.1	65.8
BRD. Bradford Royal Infirmary	99.6	99.6	100	100	100	99.6	96.9	96	31.4	33.6	99.6	97.8
KCH. King's College Hospital	100	98.6	81.9	99.3	99.9	97.3	91.9	99	5.6	86.4	91.1	44.8
HH. Harefield Hospital	100	99.7	56.9	35.6	100	99.6	65.9	80.3	100	100	100	54.8
PMS. The Great Western Hospital	100	100	67.5	92.1	82.9	100	90.9	100	97.4	98.7	6.6	94.8
WEX. Wexham Park Hospital	100	100	86.4	100	100	100	100	86.4	18.2	36.4	100	100
ANT. St Anthony's Hospital	100	98.8	74.5	3.3	100	99.3	59	95.7	98.1	98.1	100	17.4
BAT. Royal United Hospital Bath	100	100	80.3	100	100	100	97.5	69.5	36.5	37.9	100	1.5
RCH. Royal Cornwall Hospital	100	100	99.5	100	99.8	100	92.3	21	43.2	45.8	100	99.5
BHL. Cardiothoracic Centre Liverpool	100	100	92.7	100	100	100	100	100	0	100	3.5	97.9
UCL. University College Hospital	100	100	96.6	99.7	99.8	97.5	75.5	60.4	20.9	40.6	100	90
WYT. Wythenshawe Hospital	100	100	100	39.7	100	99.9	6	31.5	100	98.9	100	98.7
BHH. Rochdale Infirmary	100	86.1	3.6	16.3	99.8	100	74.2	85.9	99.8	99.8	100	54.1
ESU. New East Surrey Hospital	100	87.5	100	42.9	100	100	6.2	37.5	100	87.5	100	100
BHR. Royal Berkshire and Battle Hospital	100	93.5	98.2	89.6	100	89.6	76.4	65.4	17.1	28.3	100	98.4
LIS. Lister Hospital	100	97.6	58.1	32.9	99.4	98.8	88	79.6	64.1	65.3	69.6	70.7
PAP. Papworth Hospital	100	100	64.9	20.9	100	90.7	0.3	63.8	100	100	100	97.3

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	Date of Birth	Sex	MH	Pre-proc shock	Proc urgency	Vessels treated	Renal disease	DM	Dx date	Dx status	PCI hospital outcome	NHS number
WHH. William Harvey Hospital	100	96.3	26.2	52.4	100	98.8	41.7	36.9	87.2	97.9	99.4	95.2
HAM. Hammersmith Hospital	99.7	99.7	100	9.5	100	100	0.4	11.9	100	96.6	100	71.3
NHH. North Hampshire Hospital	100	100	100	1.3	100	100	0.3	14.4	100	99.5	100	94.8
PLY. Derriford Hospital	100	100	47.9	25.9	99.9	98.3	1.3	47.1	100	96.5	97.1	98.2
STM. St Mary's Hospital	100	98.5	75.2	100	100	0	6.5	100	12.1	100	100	0
MOR. Morriston Hospital	100	99.9	0.3	98.4	0	98.6	1.6	87.8	99.9	99.9	94.9	99.4
VIC. Victoria Hospital	100	98.4	28.1	100	100	75.8	0.4	7.4	67.6	100	100	77.6
NGS. Northern General Hospital	100	100	18.9	17.8	99.9	99.7	40.1	47.7	67.7	68.2	8.9	98.4
NOR. Norfolk & Norwich Hospital	100	100	49.8	99.5	0	99.5	54.1	52.7	0	0	0	99
RFH. Royal Free Hospital	100	100	0	99.3	99.5	98.3	0	0	0	0	39.4	88.8
RDE. Royal Devon & Exeter Hospital	100	99.9	0	0	100	100	0.1	0.1	0.4	1.6	25.7	0

Key: DM=diabetes mellitus, Dx=Discharge, MH=medical History, Proc=procedure

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3.2 Audit data

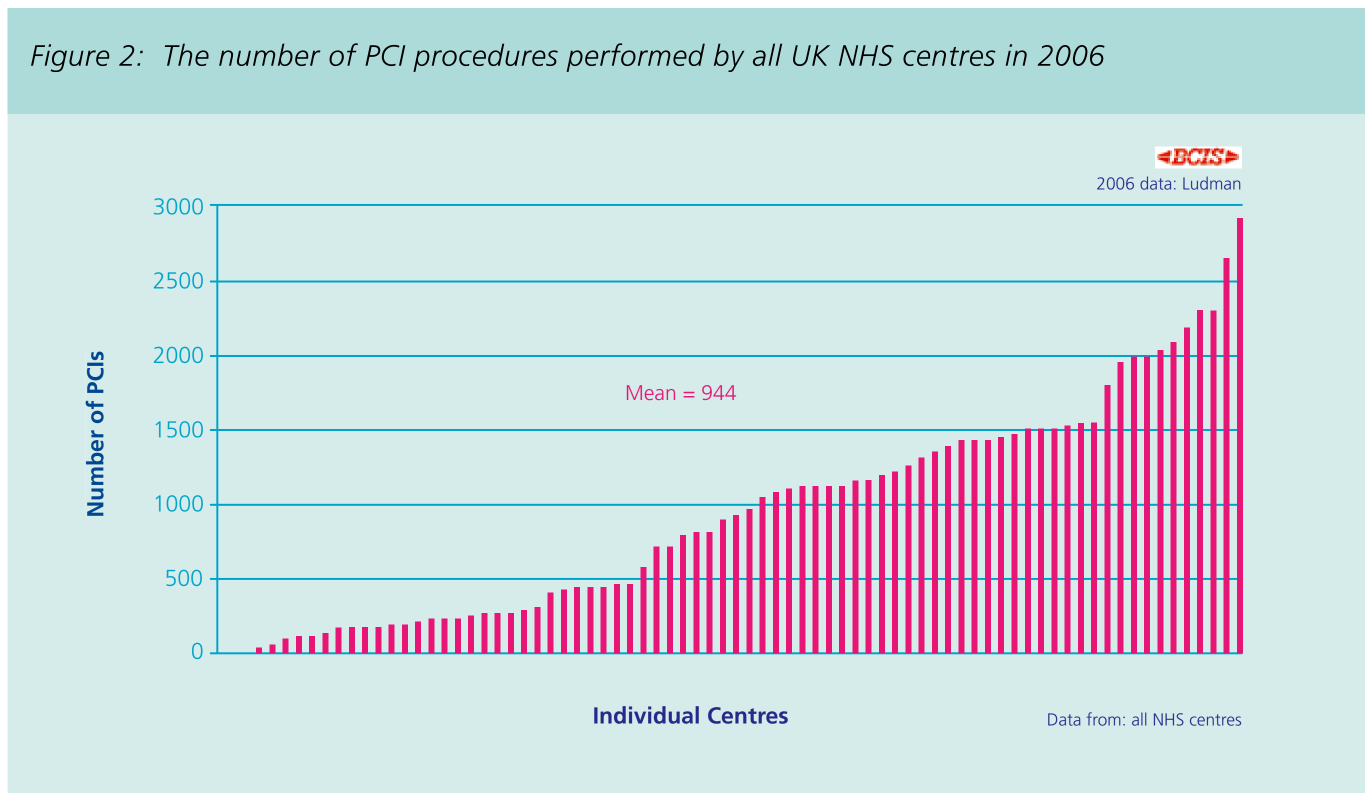
Below is an overview of some of the key features of the 2006 audit, and how they pertain to national targets and the evolution of the provision of PCI.

3.2.1 Infrastructure

There was a further expansion in the number of sites performing both angiography and percutaneous coronary intervention in the United Kingdom, with a total of 90 angiography only centres, and 91 interventional centres in 2006. There are data from many countries that suggest improved outcomes for patients being treated in higher volume centres, particularly those that perform at least 400 procedures per annum. This recommendation therefore forms part of the report by the Joint Working Group on Percutaneous Coronary Intervention of the British Cardiovascular Intervention Society and the British Cardiac Society entitled 'Recommendations for good practice and Training' (Dawkins KD Heart 2005;91(Suppl VI):vi1–vi27).

The majority of units perform considerable greater numbers that 400 pa (Figure 2).

Figure 2: The number of PCI procedures performed by all UK NHS centres in 2006



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The units performing less than the recommended number of 400 pa are shown in figures 3 and 4 below. In the majority of cases this is because the unit is new, and undertaking a gradually increasing volume of work. The start date for the unit's PCI program can be seen in the figures.

Figure 3: Centres performing less than 200 PCI procedures in 2006, and the start year of the PCI program

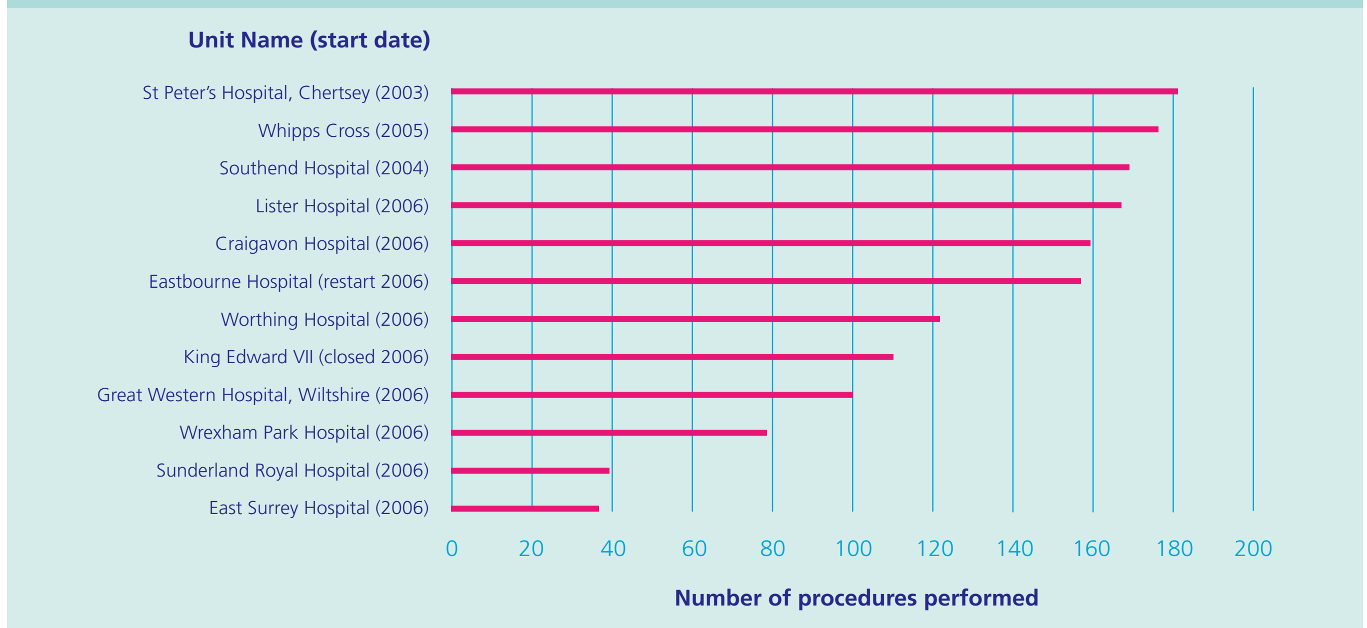
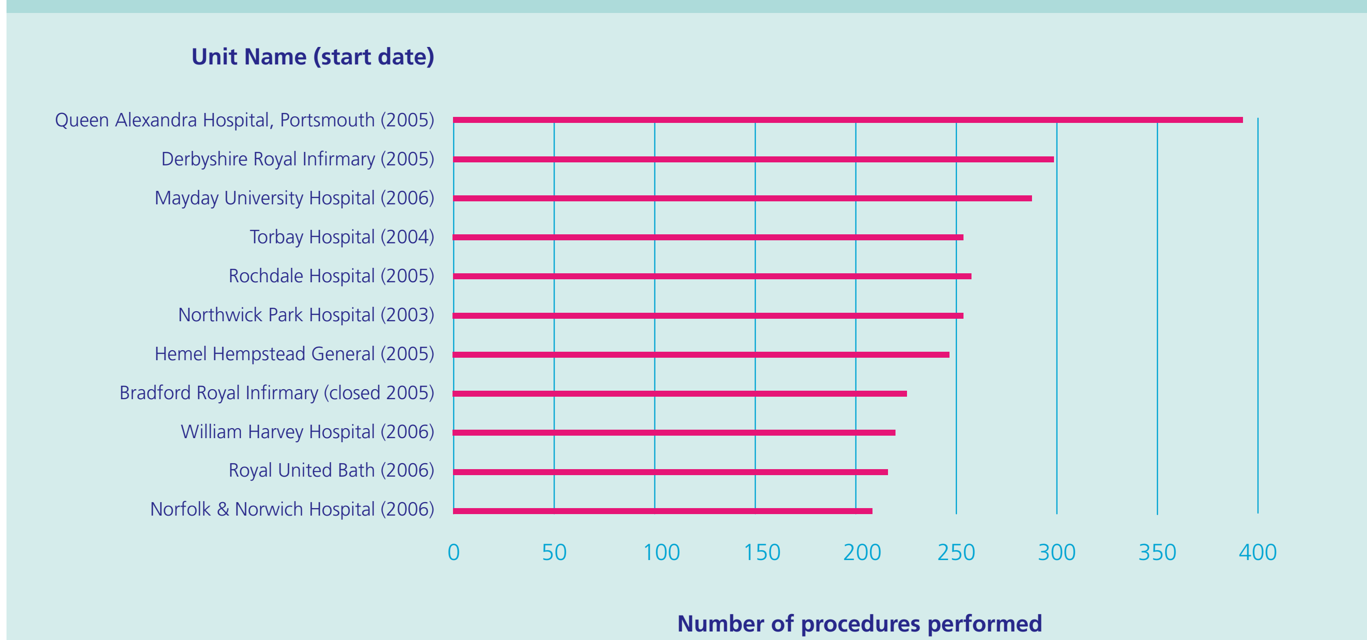


Figure 4: Centres performing 200 to 400 PCI procedures in 2006, and the start year of the PCI program



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3.3 Revascularisation rates in the United Kingdom

3.3.1 Coronary angiography

In 2006, 215,575 diagnostic coronary angiograms were performed. This represents a rate of 3540 angiograms pmp. There is no government target for coronary angiograms, but the National Service Framework (NSF) for Coronary Heart Disease targets for revascularisation (published in 2000) would be expected to lead to a rate of about 3000 angiograms pmp. The British Cardiovascular Society made recommendations in 2002 that would be expected to lead to over 5000 angiograms pmp (Hackett D, BCS Working Group on Cardiology Workforce Requirements 2003).

3.3.2 Percutaneous coronary angioplasty

There were a total of 73,612 PCIs performed in the calendar year 2006. With an estimated UK population of 60.9 million in mid 2006, this represents a rate of 1216 PCI pmp. The National Service Framework (NSF) for Coronary Heart Disease, published in 2000 set a number of targets. While this document is now 7 years old, it gives an idea of how the service provision in the UK has improved. The NSF target for PCI was 750 pmp. The British Cardiac Society published a workforce planning document in 2003 suggesting an immediate increase in the target to 1400 pmp, but with expectations that the required level might be 2000 to 3000 pmp. Comparisons with provision in Europe remain interesting. In Germany and Belgium for example, the 2006 rate of PCI pmp was 3614 and 2235 respectively. Yet in the UK, the rate of increase in PCI was the slowest in 2006 that at any time since records began in 1992 (Figure 5). The cause of this reduction in rate of increase is not clear at this time.

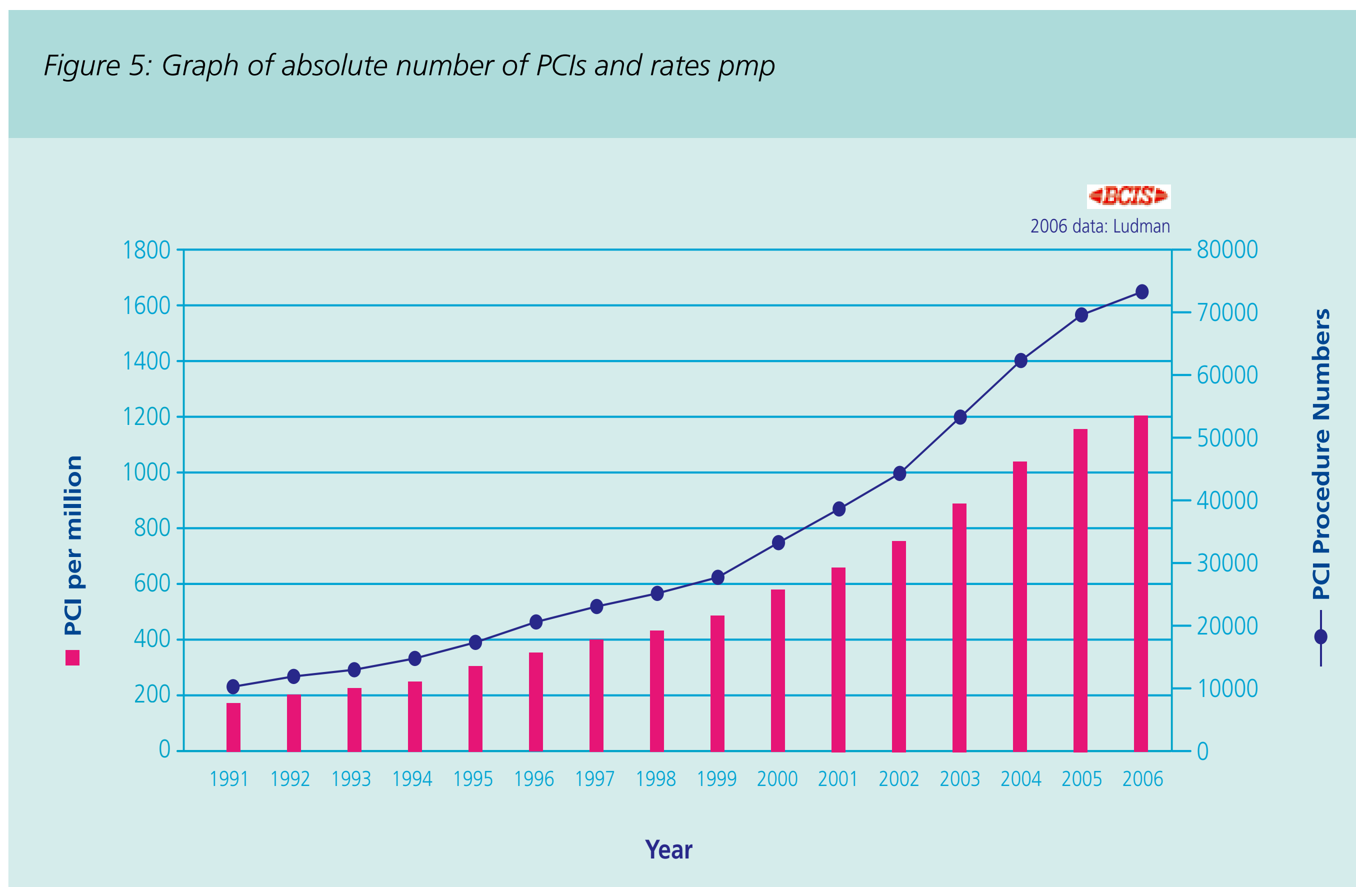

Figure 5: Graph of absolute number of PCIs and rates pmp

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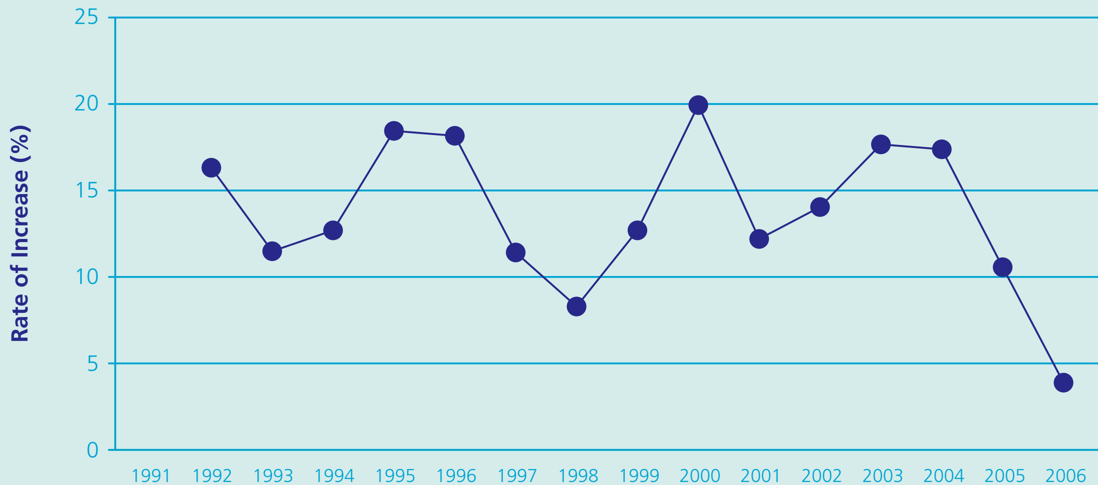
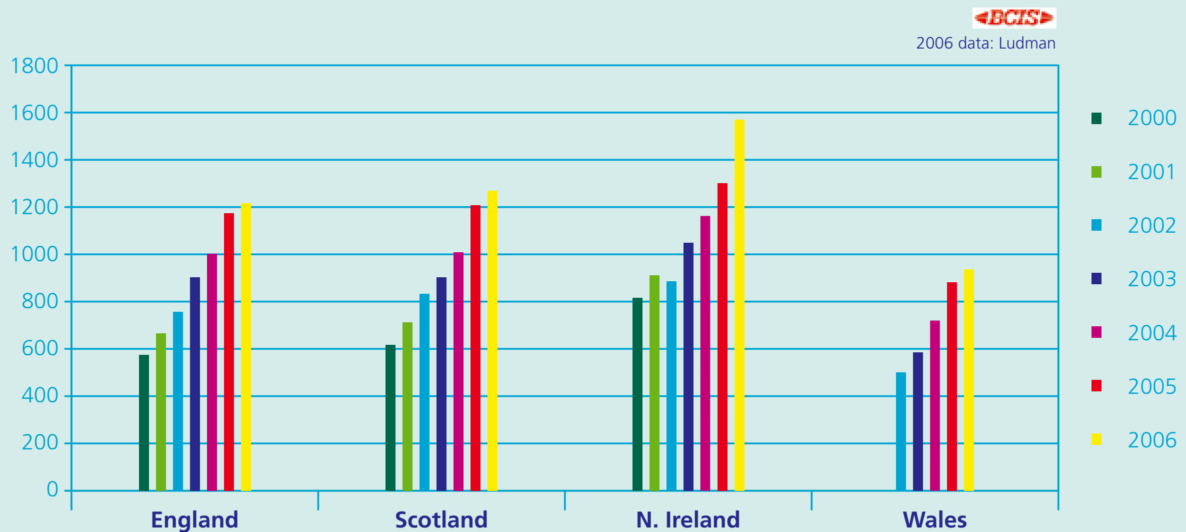
Figure 6: Rate of increase in PCI numbers pmp in the UK since 1992



While the increase in PCI activity has occurred in all the countries in the UK, there remain large differences between these countries, with the poorest provision in Wales at 943 pmp compared with the highest in Northern Ireland at 1559 pmp (Figure 7).

Figure 7: PCI activity per million population in the UK countries



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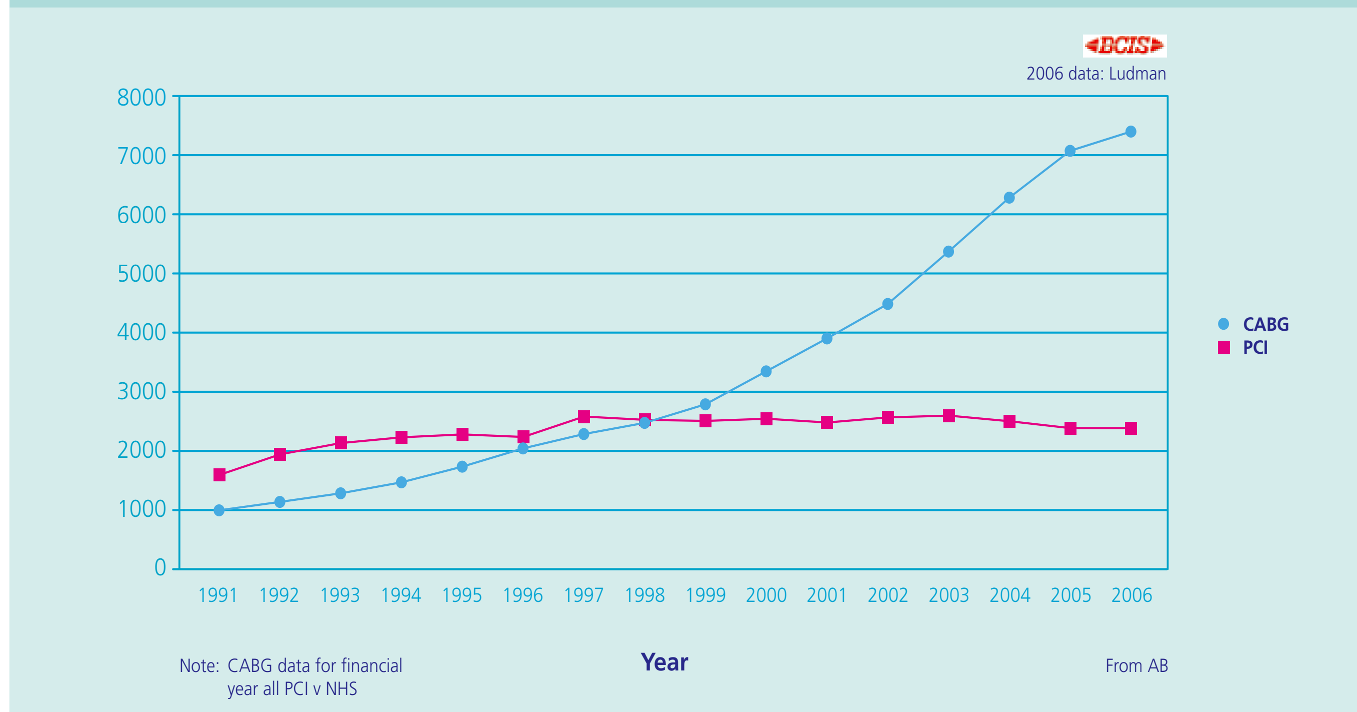
While PCI activity has risen above 1000 pmp in England, Scotland and Northern Ireland, the provision in Wales only exceeded NSF targets for the first time in 2005, showing a marked under provision of healthcare compared with the rest of the UK.

The majority of patients who need mechanical revascularisation can be treated by PCI rather than requiring bypass surgery. In 2006, there was not much change in this ratio, which is running at about 3:1 (Figure 8).

Figure 8: PCI vs Isolated CABG Numbers (UK) 1991 to 2006



3.4 Clinical Presentation

Patients can develop symptoms of coronary disease in a number of ways. They may for example notice a gradual onset of chest pain on exertion. If they are being treated as an outpatient, then such a patient is usually described as having 'stable angina'. Alternatively a patient may present with sudden onset of symptoms that leads to a hospital admission. Such a presentation would be described as being an acute coronary syndrome, which may include unstable angina or a myocardial infarction. Myocardial infarction is further subdivided into two different electrocardiographic presentations – ST elevation myocardial infarction (STEMI) and non ST elevation myocardial infarction (NSTEMI).

It can be seen that there is a fairly even split between those being treated for stable symptoms and for acute coronary syndromes, but with quite a lot of individual variation between different units (Figure 9).

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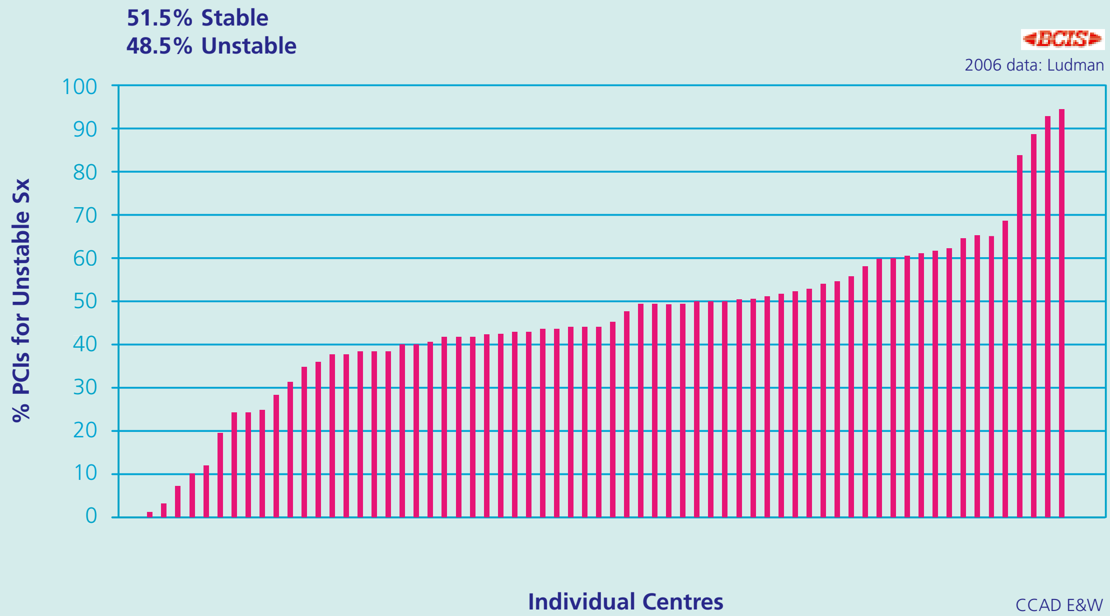
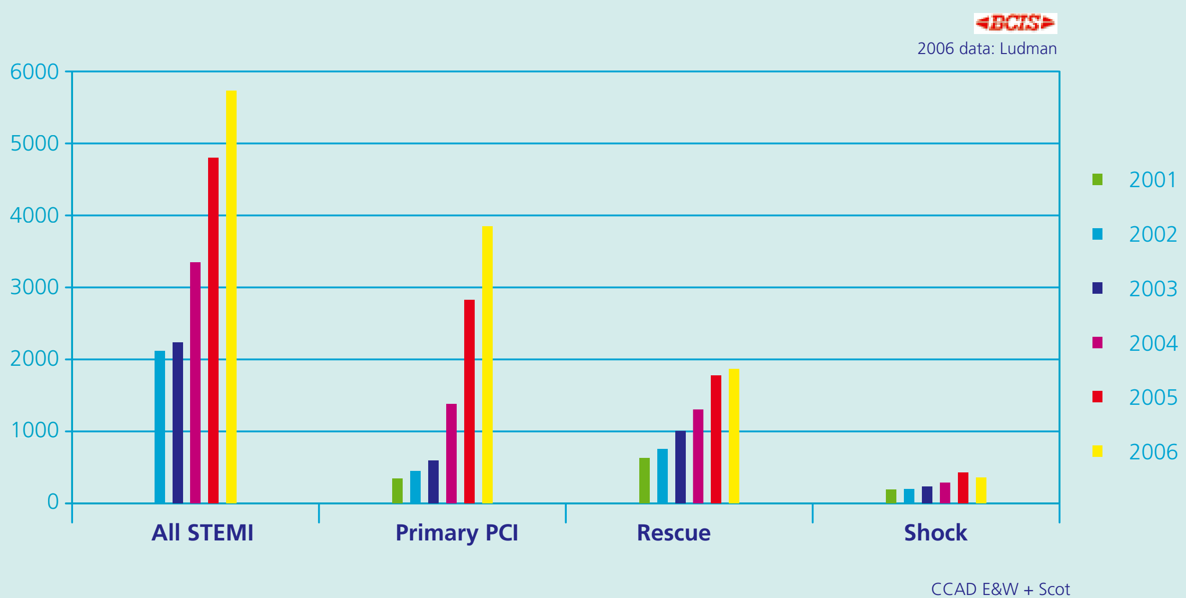
Figure 9: Clinical Syndrome



Currently the commonest treatment for STEMI is thrombolysis, and this therapy, which must be delivered very quickly, is the subject of the Myocardial Infarction National Audit Project (MINAP).

There has been an increase in the use of PCI in place of thrombolysis, so called primary PCI, and also the use of PCI where thrombolysis has been used, but has failed to work (so called rescue PCI). The increasing use of these treatments is shown in Figure 10.

Figure 10: PCI for STEMI



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3.5 Process

3.5.1 Stents

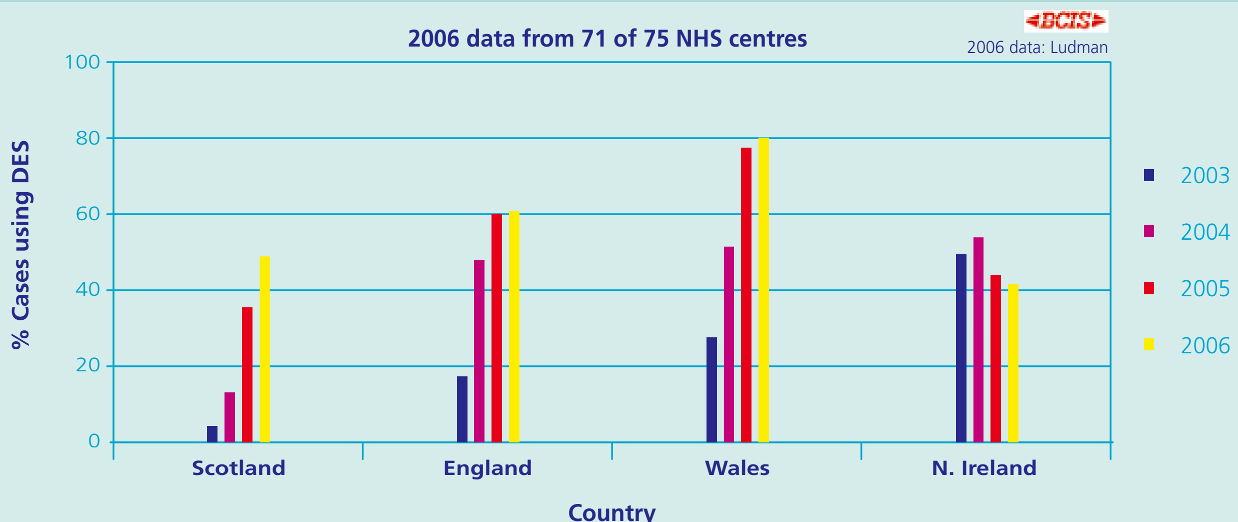
During angioplasty, after the vessel has been dilated, there is increasing evidence that where possible, a stent should be inserted, as it is associated with a better outcome. There are technical reasons why this is not always possible, but the issue of stent implantation has been the subject of the National Institute of Clinic Excellence recommendation "Stents should be used routinely where PCI is the clinically appropriate procedure for patients with either stable or unstable angina or with acute myocardial infarction"[5].

It can be seen that the use of stents has increased in line with these recommendations, so that stents are now used in more than 90 per cent of procedures (Figure 11).

Figure 11: Procedures using Stents

An over-exuberant healing process following stent implantation can lead to renarrowing of the vessel, usually 4 to 6 months after the procedure. Drug eluting stents have been developed to reduce this problem. The increasing use of these stents in the UK countries is shown in Figure 12.

Figure 12: Drug Eluting Stent cases - NHS



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The National Institute for Health and Clinical Excellence (NICE) recommend that "A drug-eluting stent should be used if the person has angina, and the inside diameter of the artery is less than 3 mm across, or the narrowed area is more than 15 mm long[3]." Research suggests that compliance with the NICE guidance on use of such stents would result in about 76 per cent of patients being treated with a drug eluting stent[4], which is in keeping with the rates observed in this audit and suggests that recommended practice is being followed.

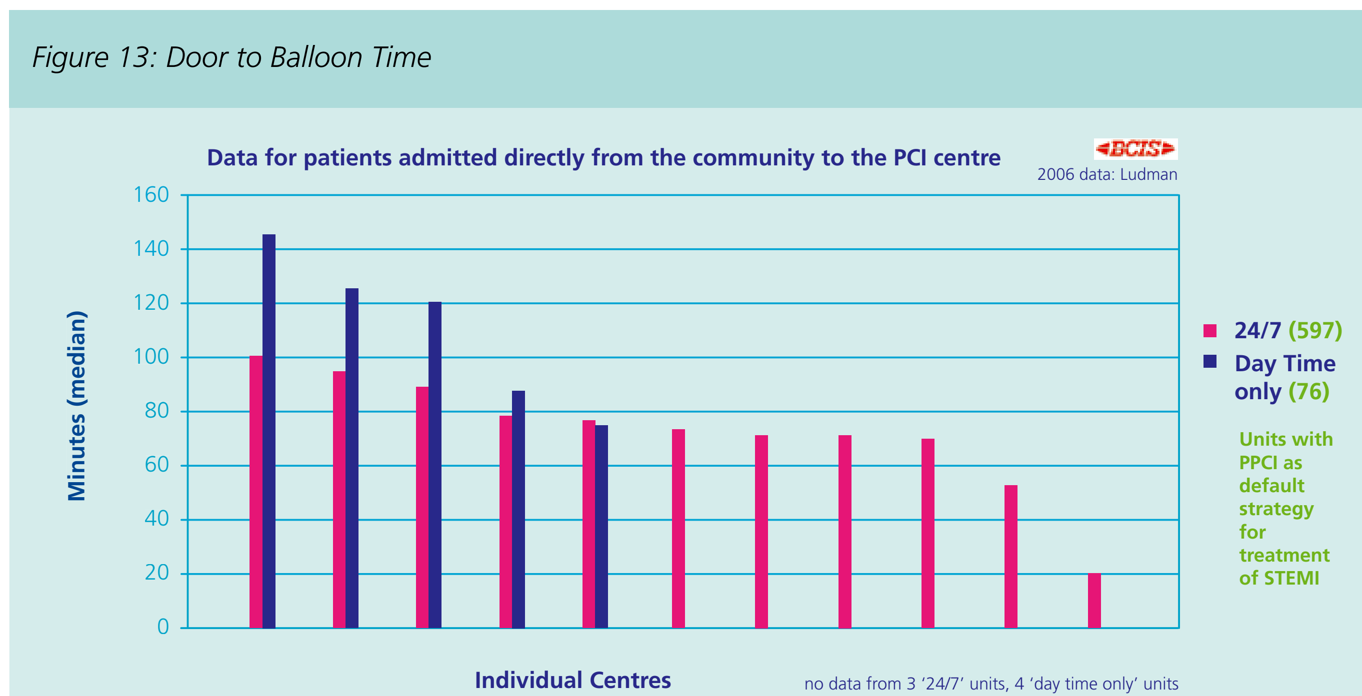
3.5.2 Time Delays to Treatment

In the treament of STEMI, speed is of the essence, because delays increase the risk of a patient not surviving the heart attack. When treatment is with thrombolytic therapy, the time delay between a patient presenting with chest pain, and being given the correct intravenous drug treatment is measured (known as the 'door to needle' time). The Myocardial Infaction National Audit Project (MINAP), was set up to help measure and minimise these time delays, and so improve patient outcome. MINAP is supported by The NHS Information Centre's National Clinical Audit Support Programme (NCASP) and CCAD. The MINAP report can be downloaded as a PDF or found on the The NHS Information Centre's website.

When PCI is used instead of drug treatment, speed is also essential in maximising patient benefit. For PCI, the key time delay is the time between a patient presenting to a hospital with chest pain, and the time the first device is used to re-open the blocked coronary artery. This is known as the 'door to balloon' time. Guidelines from the both the European Cardiology Society and the American College of Cardiology[5]- recommend that this delay is less than 90 minutes. In 2006, for the first time the BCIS-CCAD data collection tool was used to assess this time delay. Though the data are far from complete, this represents the start of an audit process that is being developed with the aim of much more complete data available for next year.

Figure 13 below examines only those units whose default strategy for the treatment of STEMI is PCI rather than thrombolysis. It also looks only at those patients who were admitted directly to the PCI centre (not those who were transferred to the centre from another hospital). It shows that the median door to balloon times compare favourably to the audit standard, with better performance from those units whose treatment is offered twenty four seven, seven days a week rather than during working hours only.

Figure 13: Door to Balloon Time



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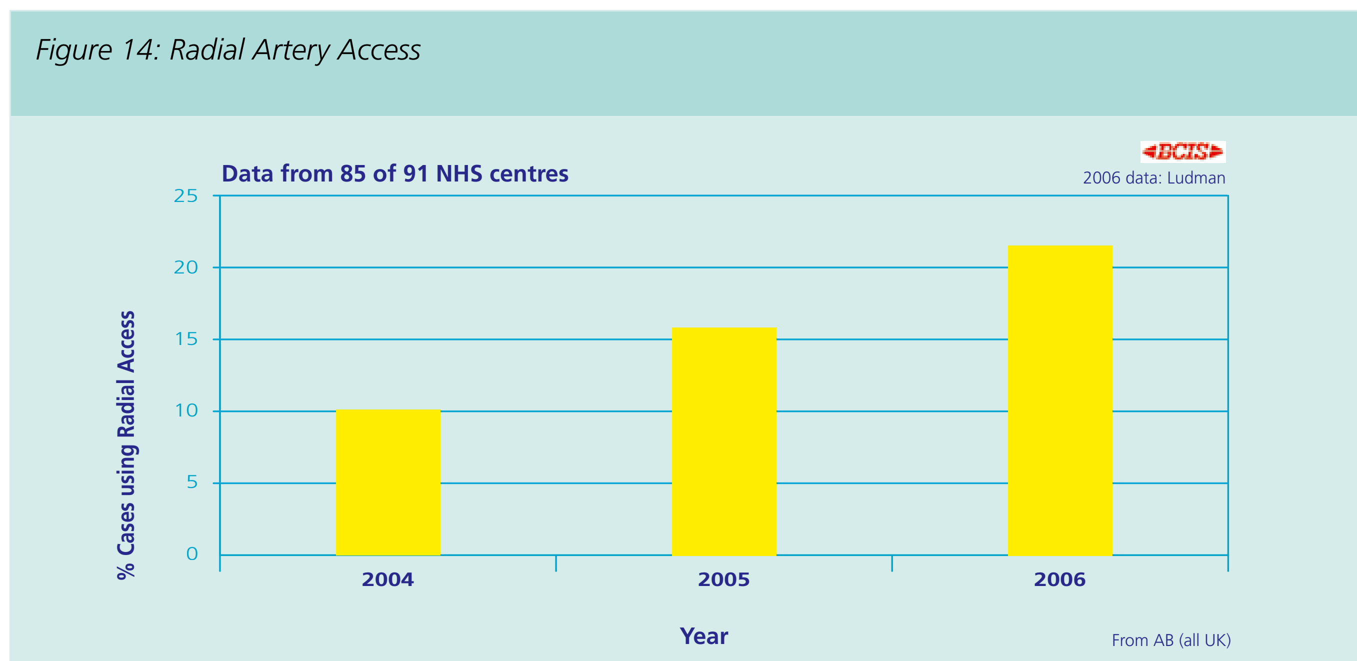
3.5.3 Arterial Access

Traditionally, the femoral artery has been used to gain access to the circulation, and so PCI has involved inserting tubes into this artery at the top of the leg. There has been increasing interest in the use of the radial artery (at the wrist) as this approach can be associated with fewer complications at the puncture site. The increasing interest in using this approach can be seen in Figure 14.

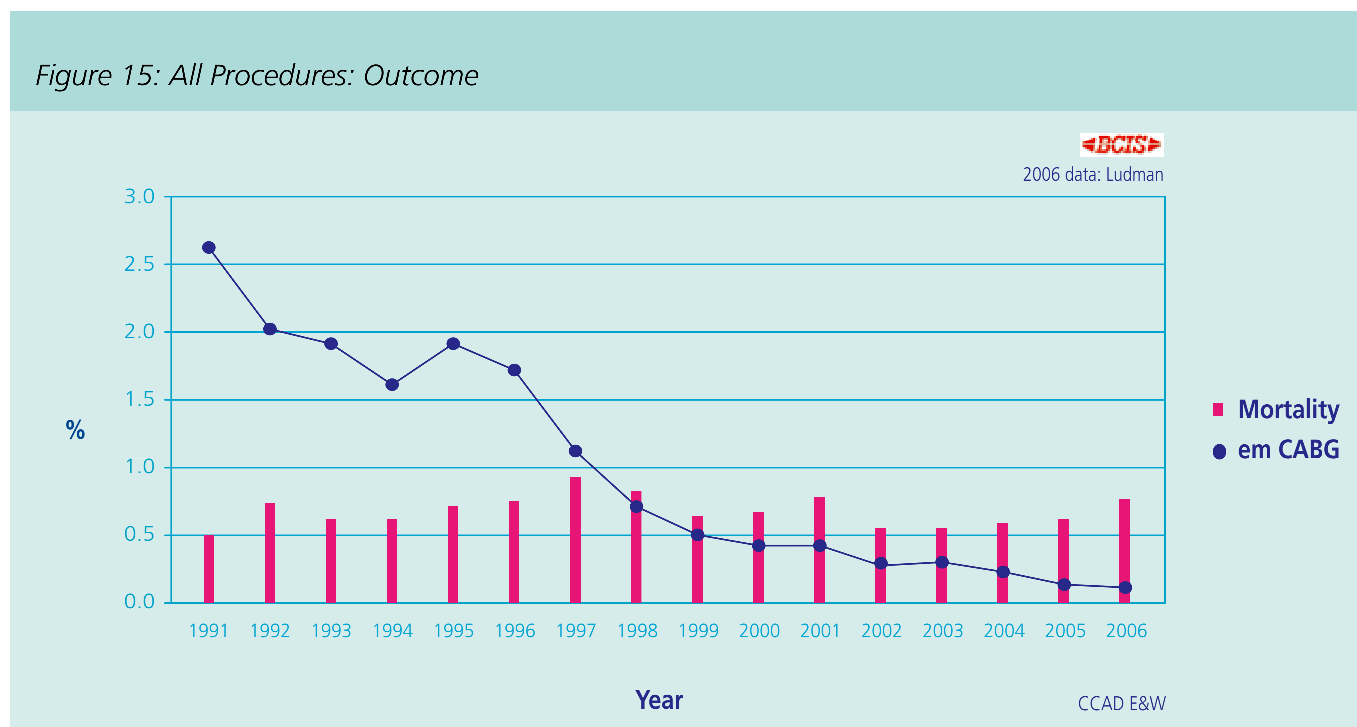
Figure 14: Radial Artery Access



3.6 Outcome

The complications from PCI have fallen progressively as techniques have evolved. Nevertheless this has also meant that the procedure can be offered to patients who are considerably sicker, and in whom a higher risk of complications is expected. The overall rate of death before discharge from hospital following PCI has remained fairly stable over recent years at around 0.5 to 0.7 per cent, but there has been a marked fall in the need for emergency coronary artery bypass surgery to try to solve a PCI complication, so that in 2006, this occurred in less than 0.1 per cent of all procedures (Figure 15).

Figure 15: All Procedures: Outcome



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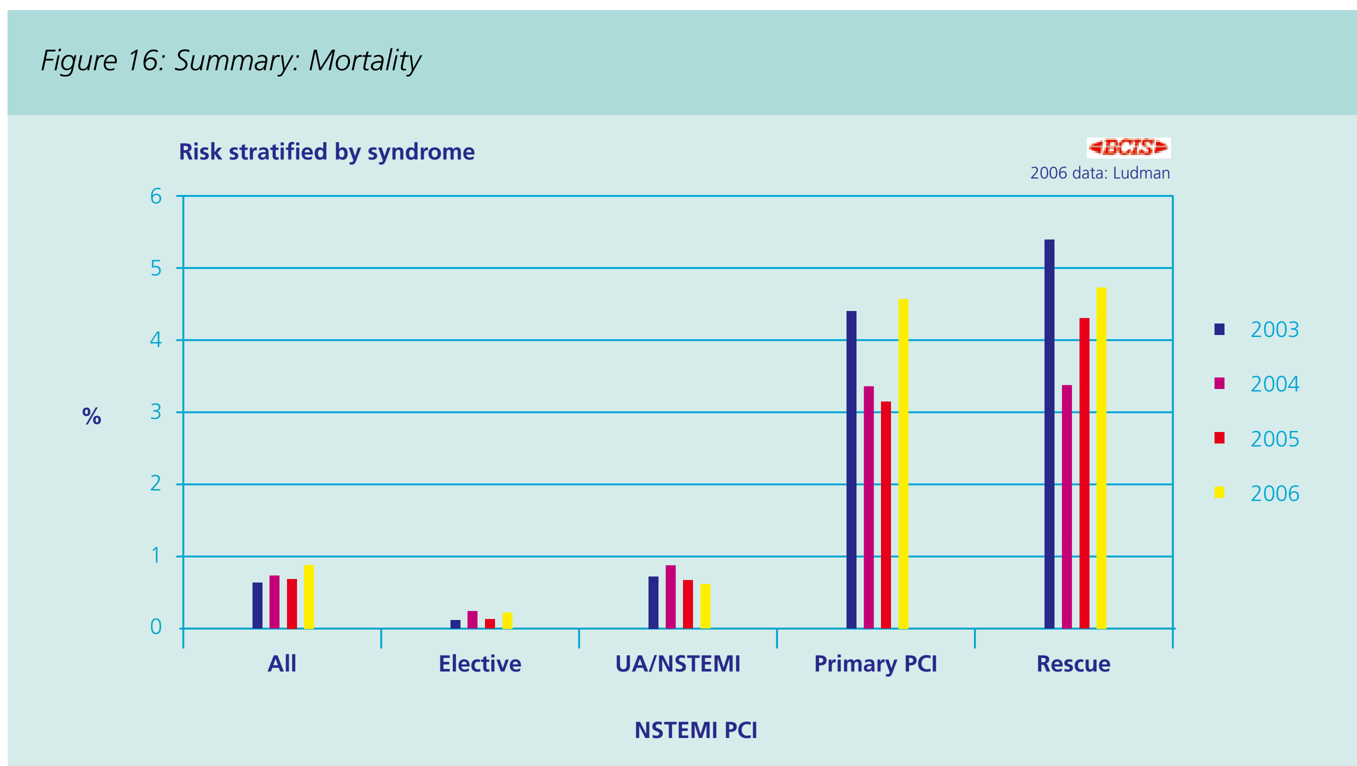
It is important to understand that the risk of dying when presenting with coronary disease is largely dependent on the clinical scenario. Some patients have a very high risk of dying from their disease (whether or not a PCI is performed). A coronary angioplasty may well offer them a big reduction in that risk, but nevertheless the overall mortality risk will be higher than patients who have little chance of succumbing to their disease in the first place.

It is often those at highest risk who have the most to gain from a PCI procedure. The risks in some broadly different groups of patient are shown below (Figure 16), and can be seen to have not altered much over the past few years.

Figure 16: Summary: Mortality



'Elective' describes patients who are placed on a waiting list and are therefore admitted routinely from home. The remainder have all been treated during an emergency admission to hospital brought about by unexpected angina.

Those with 'UA / NSTEMI' are usually treated urgently, within a few days of admission. Those presenting and treated for primary PCI or Rescue, are much sicker, and need to be treated much more quickly.

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4.0 The Future

Almost all units in England and Wales now submit their data to CCAD. The Scottish centres have been collecting data in an electronic format for some time, and we are in the process of trying to combine these data so that we can have a much more complete view of PCI as it is performed across all the countires in the United Kingdom. There will be further drives to encourage better data completeness.

More detailed analyses are planned that will address differences between various patients subgroups. Other analyses will include measurement of risk adjusted outcomes, and also a much more detailed analysis of the time delays patient experience for the urgent and emergency treatment by angioplasty.

The electronic interface for BCIS-CCAD is to be re-written so that Lotus Notes software will not need to be installed. The interface will instead operate through a web browser, making appropriate access to the data gathering and analysis programmes more widely available across trusts.

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Glossary

A number of terms are essentially synonymous and used to describe the same procedure: thus a coronary angioplasty is also called a percutaneous coronary intervention, abbreviated to PCI. Coronary artery bypass surgery, sometimes abbreviated to bypass surgery or CABG.

Other abbreviations in alphabetical order:

BCIS: British Cardiovascular Intervention Society

CCAD: Central Cardiac Audit Database

DES: Drug eluting stent

MINAP: Myocardial Infarction National Audit Project

NCASP: National Clinical Audit Support Programme

NSTEMI: Non ST elevation myocardial infarction

STEMI: ST elevation myocardial infarction

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References

1 Some patients are treated with a coronary artery bypass operation (CABG). Another audit describes outcomes for these patients, and a 'public portal' website allows patients to see the results for their local heart surgery centre. The Healthcare Commission also funds audits of heart attacks, heart failure and other aspects of heart disease.

2 Ischaemic Heart Disease - Coronary Artery Stents (TA 71).

3 Ischaemic heart disease - Coronary Artery Stents (review) (TA071).

4 S. N. Doshi, P. F. Ludman, J. N. Townend, N. P. Buller. Estimated annual requirement for drug eluting stents in a large tertiary referral centre, according to new NICE criteria. (Heart 2004:90; suppl II A41).

5 2007 Focused Update of the ACC/AHA 2004 Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: Circulation, Jan 2008; 117: 296 – 329.

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