

National Coronary Angioplasty Audit Executive Summary

Key Findings from the Angioplasty and Stents to treat Coronary Artery Disease 2008 report of the National Audit of Percutaneous Coronary Intervention in the United Kingdom

Data from Jan 2007 to Dec 2007, Dr Peter F Ludman on behalf of the British Cardiovascular Intervention Society (BCIS)



Prepared in association with:

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 Lead 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 (The IC). This portion of the audit is funded by the Healthcare Quality Improvement Partnership (HQIP).

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 [<http://heartsurgery.healthcarecommission.org.uk>]. The Healthcare Commission also funds audits of heart attacks, heart failure and other aspects of heart disease.

² Percutaneous Coronary Intervention: recommendations of good practice and training. KD Dawkins, T Gershlick, M de Belder, A Chauhan, G Venn, P Schofield, D Smith, J Watkins, HH Gray, Joint Working Group on Percutaneous Coronary Intervention of the British Cardiovascular Intervention Society and the British Cardiac Society. *Heart* 2005; 91 (Suppl VI): 1-27

Key findings include:

- The number of PCIs in the UK was 1,269 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 1031 pmp compared with the highest in Northern Ireland at 1648 pmp.
- For the past 2 years the rate of increase in overall number of PCI procedures performed remains at the lowest level 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 recommendations of the Joint Working Group on PCI of BCIS and the British Cardiovascular Society.² In 2007 the majority of units were performing considerably more than the recommended minimum. Of the 29 units performing less than 400 cases pa, the majority were new units undertaking a gradually increasing volume of work. There are 5 NHS centres however with a persistently low volume of PCI activity over several years.
- 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".³ The great majority of procedures do now involve stent insertion (95 per cent), suggesting that this aspect of good practice is being met.

³ Ischaemic Heart Disease- Coronary Artery Stents (TA 71)

- Following concerns about the safety of drug eluting stents in September 2006, there was a fall in their use to 55 per cent across the UK. These concerns have now been recognised to be mainly invalid and early indications are for a return to higher percentage use. The National Institute for Health and Clinical Excellence (NICE) has produced updated guidelines for the use of these stents, that are largely unchanged from its original guidance.⁴ They again recommended that drug eluting stents should be used if “the target artery to be treated has less than a 3-mm calibre or the lesion is longer than 15 mm.” Research suggests that compliance with the NICE guidance on use of such stents would result in about 70 to 80 per cent of patients being treated with a drug eluting stent,⁵ which is in keeping with the rates observed in this audit prior to the down turn induced by concerns about possible long term safety. Early data from 2008 suggest a return to these sorts of levels now that safety issues are better understood.
- National and International guidelines recommend that in the emergency treatment of patients with ST elevation MI, angioplasty treatment should be performed within 90 minutes of arrival of the patient at the angioplasty site. Modifications to the BCIS-CCAD dataset have been made to allow more detailed analyses of the time delays in treatment by primary PCI. In 2007 the overall median door to balloon times for units delivering primary PCI instead of thrombolysis to treat STEMI was 61.7 minutes. Thirteen of the 21 units achieved this standard in more than three quarters of their patients and, conversely, eight failed to do so.
- The overall rate of death before discharge from hospital following PCI has gradually risen over the past few years. This is due to a change in case mix. There has been no evidence of a change in the outcomes when patients in similar clinical presentations are compared. For patients with unstable angina or NSTEMI, the in hospital mortality 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 2007 all NHS units in England and Wales contributed to CCAD, as did all NHS Scottish units via an electronic link.
- There has been a marked improvement in the quality of data submitted.

The rest of this report contains more details and graphs of the audit findings. The complete set of data from the 2007 audit was presented at the British Cardiovascular Intervention Society’s annual meeting (BCIS) in autumn 2008 and is available for download at the society’s web site www.bcis.org.uk.

4 NICE Guidance TA 152 July 2008

5 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

Data completeness

There has been a big improvement in the completeness of the fields for each of the procedures entered into CCAD for the 2007 data compared with 2006. Healthcare Commission's Healthcheck for 2007/2008 asked trusts to try to achieve more than 90 per cent completeness of the key fields required for risk adjusted outcome. The actual percentage completeness for hospitals in England and Wales is listed in Table 1 below:

	Hospital	Date of Birth	Sex	Medical History	Pre-procedure shock	Procedure urgency	Vessels treated	Renal disease	Diabetes	Discharge date	Discharge status	PCI hospital outcome	NHS number
NHS	CGH. Conquest Hospital	100	100	100	100	100	100	100	100	100	100	100	100
NHS	FRM. Frimley Park Hospital	100	100	100	100	100	100	100	100	100	100	100	100
NHS	SEH. Southend Hospital	100	100	100	100	100	100	100	100	100	100	100	100
NHS	SPH. St Peter's Hospital	100	100	100	100	100	100	100	100	100	100	100	100
NHS	BHR. Royal Berkshire and Battle Hospital	100	100	100	100	100	100	100	100	100	100	100	99.8
NHS	MOR. Morrision Hospital	100	100	100	100	100	100	100	100	100	100	100	99.8
NHS	BHL. Cardiothoracic Centre Liverpool	100	100	99.8	100	100	100	100	100	100	100	100	99.8
NHS	SCM. James Cook University Hospital	100	100	99.6	100	100	100	99.9	99.9	100	100	100	100
NHS	DGE. Eastbourne DGH	100	100	100	100	100	100	100	100	100	100	100	99
NHS	GRL. Glenfield Hospital	100	100	99.9	100	100	100	98.7	99.8	100	100	100	99.7
NHS	CHN. Nottingham City Hospital	100	100	100	100	100	100	100	100	100	98.8	100	99.1
NHS	QEB. Queen Elizabeth Hospital, Edgbaston	100	100	100	100	100	98.6	99.7	99.8	99.7	99.7	99.8	98.9
NHS	CHH. Castle Hill Hospital	100	100	97.4	100	100	100	100	100	100	99.8	99.6	99.3
NHS	NGS. Northern General Hospital	99.9	99.9	99.7	99.9	100	100	99.9	99.7	99.4	99.4	99.5	98.5
NHS	RCH. Royal Cornwall Hospital	100	100	100	100	100	100	96.8	99.5	99.8	99.8	100	99.4
NHS	SAN. Sandwell District General Hospital	100	100	100	100	100	97.7	98.7	99.5	99.5	100	100	99.7
NHS	TOR. Torbay Hospital	100	100	98.7	100	100	100	97.7	99.3	100	100	100	99.3
NHS	DUD. City Hospital	100	100	100	100	100	97.4	98.9	99.3	100	100	99.6	98.5
NHS	AEI. Royal Albert Edward Infirmary	100	100	100	100	100	97.1	97.1	98.6	100	100	100	100
NHS	RFH. Royal Free Hospital	100	100	99.4	100	100	96.2	100	99.7	100	99.8	99.7	97.5
NHS	SGH. Southampton General Hospital	100	99.9	100	100	100	97.8	97.4	98.8	99.1	99.1	99.1	99.9
NHS	RDE. Royal Devon & Exeter Hospital	100	99.4	100	100	100	93.6	98.7	98.8	100	100	100	99.3
NHS	SUN. Sunderland Royal Hospital	100	100	99.3	100	100	100	100	100	96.6	96.6	97	100
NHS	GEO. St George's Hospital	100	100	99.2	100	100	100	99.6	99.8	99.9	99.8	100	90.9

	Hospital	Date of Birth	Sex	Medical History	Pre-procedure shock	Procedure urgency	Vessels treated	Renal disease	Diabetes	Discharge date	Discharge status	PCI hospital outcome	NHS number
NHS	DER. Derby Royal Infirmary	100	97.6	99.1	97.2	100	100	99.4	99.4	97.3	98.8	100	100
NHS	MRI. Manchester Royal Infirmary	100	100	100	100	100	99.4	99.8	99.2	100	100	91.7	98.7
NHS	WRG. Worthing Hospital	100	100	100	100	100	100	97.9	98.2	97.6	97.9	100	94.9
NHS	WAL. Walsgrave Hospital	100	100	94.8	100	100	100	97.9	95.8	100	99.9	99.9	98.1
NHS	FRE. Freeman Hospital	100	99.9	97.8	99.3	100	97.2	97.7	96.9	99.9	100	98.7	98.8
NHS	NHB. Royal Brompton Hospital	100	100	97.5	99.2	100	100	97.7	98.4	99.8	99.8	99.9	90.9
NHS	BRD. Bradford Royal Infirmary	100	100	99.6	100	100	92.3	96.4	97.2	99.6	99.6	99.6	97.6
NHS	LGI. Yorkshire Heart Centre	99.9	99.9	94.2	100	100	99.9	94.9	97	99.5	99.6	97.7	99.1
NHS	RSC. Royal Sussex County Hospital	100	99.8	89.8	100	100	98.6	100	100	100	99.6	96.9	96.4
NHS	QAP. Queen Alexandra Hospital	100	100	91.8	100	100	93	100	99.4	99.8	99.8	94.2	99.8
NHS	EBH. Birmingham Heartlands Hospital	99.4	98.5	99.9	100	100	96	93.5	97.4	98.9	98.5	100	94.9
NHS	NCR. New Cross Hospital	100	99.9	96.3	98.2	100	99.9	97	97.5	97.4	99.2	97.6	93.7
NHS	STH. St Thomas' Hospital	100	100	99.4	100	100	100	90.2	91.3	100	100	100	94.6
NHS	WYT. Wythenshawe Hospital	100	100	100	91.8	99.8	99.5	92.1	92.7	100	99.9	100	99.2
NHS	BRI. Bristol Royal Infirmary	100	100	78.7	100	100	96.8	100	100	100	100	99.9	99.1
NHS	PMS. The Great Western Hospital	100	100	97.9	100	95.5	100	90	94.1	99.6	99.6	97.3	100
NHS	UHW. University Hospital of Wales	100	100	93	97.1	99.9	99.7	95.6	97.3	96.5	98.7	99.4	95.7
NHS	CHG. Cheltenham General Hospital	100	99.8	76.4	100	100	98.6	98.9	99.8	99.8	99.4	100	99.8
NHS	HRI. Hull Royal Infirmary	100	100	91.9	97.1	100	100	94.8	94.8	100	98.2	96.9	97.6
NHS	BAL. Barts and the London	100	100	91.6	99.8	100	99.4	92.4	98.5	92.6	100	98.5	96
NHS	VIC. Victoria Hospital	100	99.2	91.5	100	100	98.9	92.3	92.6	99.2	100	100	94.1
NHS	HH. Harefield Hospital	100	99.8	87.6	97.8	99.9	99.4	87.7	96.7	99.9	99.9	99.9	96.1
NHS	AMG. Wycombe General Hospital	100	99.5	68.9	100	100	100	97.9	89.1	93.3	93.3	100	100
NHS	UCL. University College Hospital	100	100	87	100	100	100	76.5	83.6	98.5	99.5	100	93.6
NHS	WEX. Wexham Park Hospital	100	100	86.1	100	100	94.2	86.9	73	98.4	99.2	100	100
NHS	BOU. Royal Bournemouth General Hospital	100	100	90.2	100	100	100	96.3	96.1	49.3	100	100	99.6

	Hospital	Date of Birth	Sex	Medical History	Pre-procedure shock	Procedure urgency	Vessels treated	Renal disease	Diabetes	Discharge date	Discharge status	PCI hospital outcome	NHS number
NHS	WHC. Whipps Cross University Hospital	100	100	61.1	100	100	100	100	67.9	99.5	100	100	94.8
NHS	STO. North Staffordshire Hospital	99.3	90.7	99.8	100	99.8	97.1	97.6	98.3	98.4	97	45.2	99.8
Private	LBH. London Bridge Hospital	100	100	100	100	100	100	100	100	100	100	100	0
Private	HSC. Harley Street Clinic	100	100	100	100	100	100	98.7	100	100	100	100	0
Private	HHW. Wellington Hospital	100	100	100	100	100	100	99	99	100	100	100	0
Private	PHB. BMI Priory Hospital	100	100	100	100	100	94.9	89.6	100	100	100	100	8.3
NHS	RAD. John Radcliffe Hospital	100	100	100	85.1	100	98.7	37.4	67.6	100	98.9	100	98.9
NHS	HHH. Hemel Hempstead General Hospital	99.6	100	80.5	100	100	93.1	94.1	100	59.4	59	93.5	99.2
NHS	BHH. Rochdale Infirmary	100	100	27.3	66.9	100	99.7	83.8	93.6	100	100	100	99.5
Private	ANT. St Anthony's Hospital	100	99.3	78.3	100	100	99.3	44.1	89.5	99.3	97.9	100	60.8
NHS	MPH. Taunton & Somerset	99.4	99.8	95.9	100	100	98.4	99.6	100	38.4	38.2	98.4	92.7
NHS	KCH. King's College Hospital	100	99.3	97.1	99.1	99.9	96.1	96.3	99.6	28.4	87.4	97.6	58.1
NHS	PLY. Derriford Hospital	100	100	48.3	99.8	100	99.3	99.4	99.9	99.3	99	3.3	99.6
NHS	NOR. Norfolk & Norwich Hospital	100	100	48.9	100	100	100	51.6	53.2	70.6	99.8	92.4	100
NHS	ESU. New East Surrey Hospital	100	96.8	100	64.3	100	100	29	30.6	100	96.8	100	89.5
NHS	NPH. Northwick Park Hospital	100	99.7	94.4	62.5	99.7	92.1	65.6	74.8	98.7	99.3	92.8	25.6
Private	CRO. Cromwell Hospital	100	100	64.7	100	100	100	64.7	100	17.6	88.2	88.2	70.6
NHS	HAM. Hammersmith Hospital	99.9	99.8	100	43.9	100	99.4	35.5	41.8	100	99.2	100	72
NHS	LIS. Lister Hospital	100	99.7	64.9	96.8	100	99.1	87	87	34.8	47	39.6	100
NHS	WHH. William Harvey Hospital	100	100	33.1	70.3	100	96.6	39.9	37.2	74.3	98	99.3	95.9
NHS	NHH. North Hampshire Hospital	100	100	100	3.7	100	100	0.3	21.4	100	100	100	93.7
NHS	BAT. Royal United Hospital Bath	100	100	36.7	100	100	100	96.3	74.3	40.7	42	100	0.3
NHS	MAY. Mayday University Hospital	99.5	99.5	0	100	100	0	92.2	95.1	100	98.1	0	97.8
NHS	PAP. Papworth Hospital	100	100	3.8	4.7	99.9	3.3	66	62.2	100	100	100	97.9
NHS	STM. St Mary's Hospital	100	99.7	77	100	100	0	4.4	100	4.7	100	100	0.1

Table 1: Data completeness for PCI units in England and Wales 2007

Infrastructure

There was a further expansion in the number of sites performing percutaneous coronary intervention, and because this is partly driven by angiography only centres starting PCI, there was a fall in the number of sites performing angiography only. Thus in the United Kingdom there were a total of 98 PCI centres, and 85 angiography only centres in 2007. 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 Cardiovascular Society entitled 'Recommendations for good practice and training'⁶.

The majority of units perform considerably greater numbers than 400 pa. The units performing less than the recommended number of 400 pa are shown in figures 1 and 2 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 1: Centres performing less than 200 PCI procedures in 2007, and the start year of the PCI program.

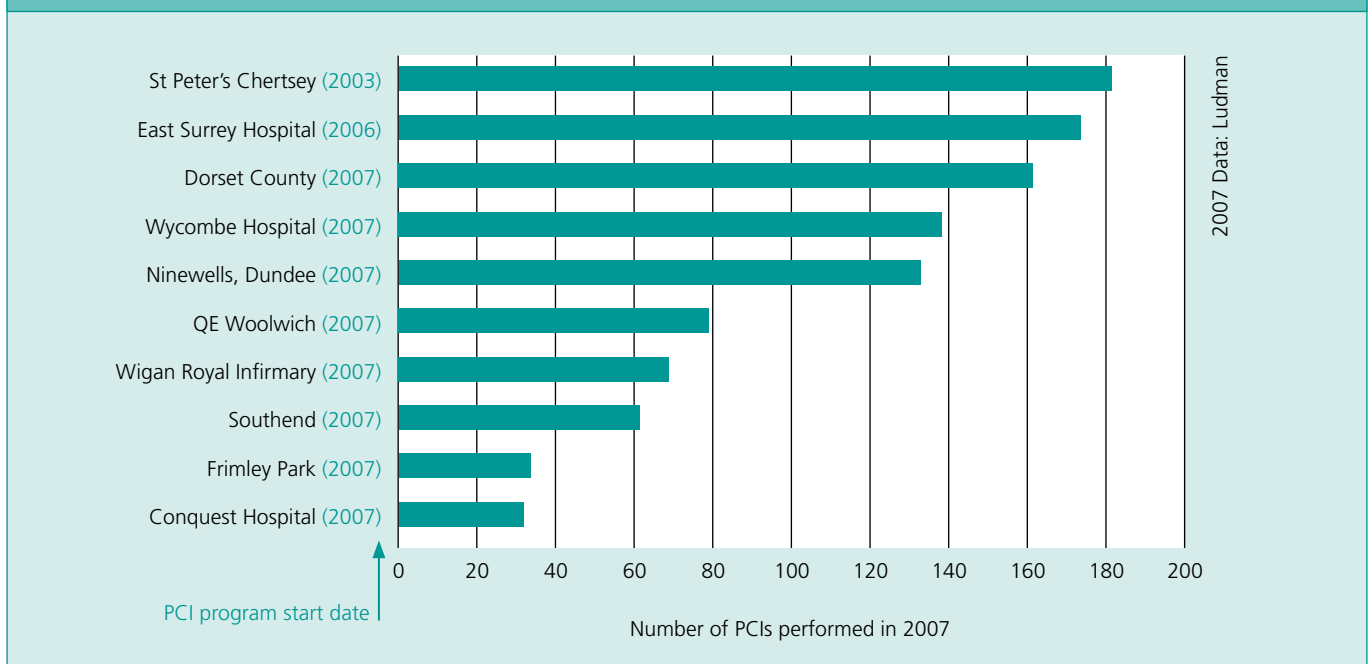
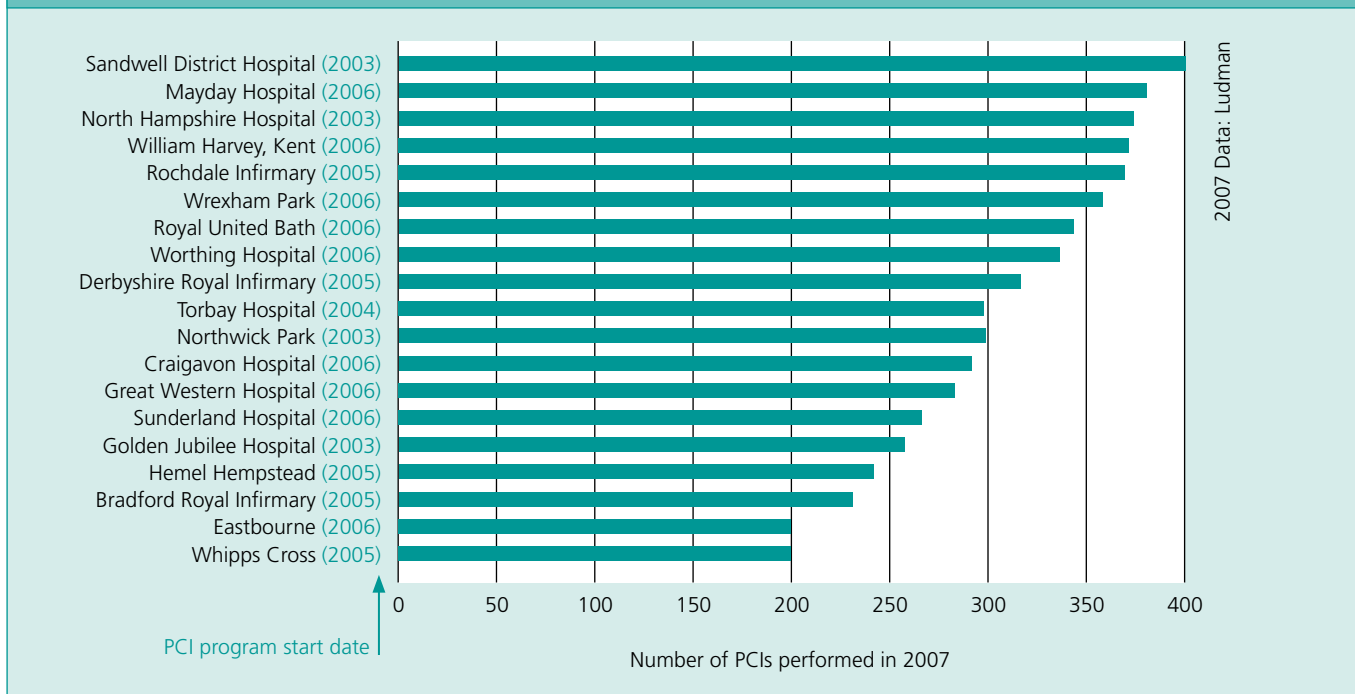


Figure 2: Centres performing 200 to 400 PCI procedures in 2007, and the start year of the PCI program.

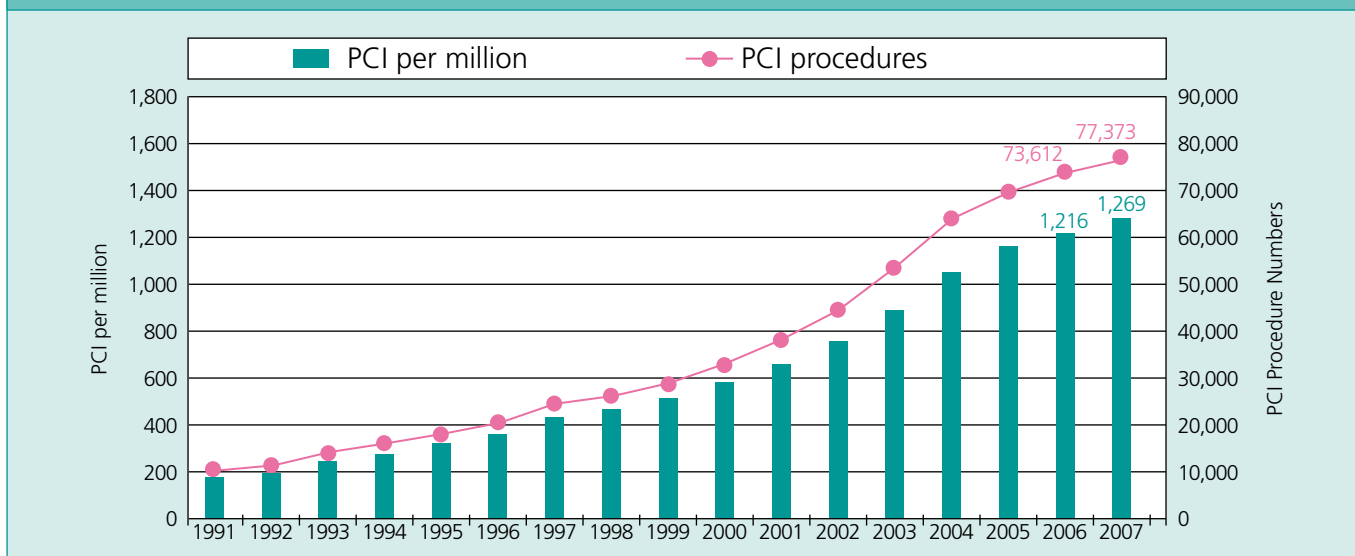


Revascularisation rates in the United Kingdom

Percutaneous coronary angioplasty

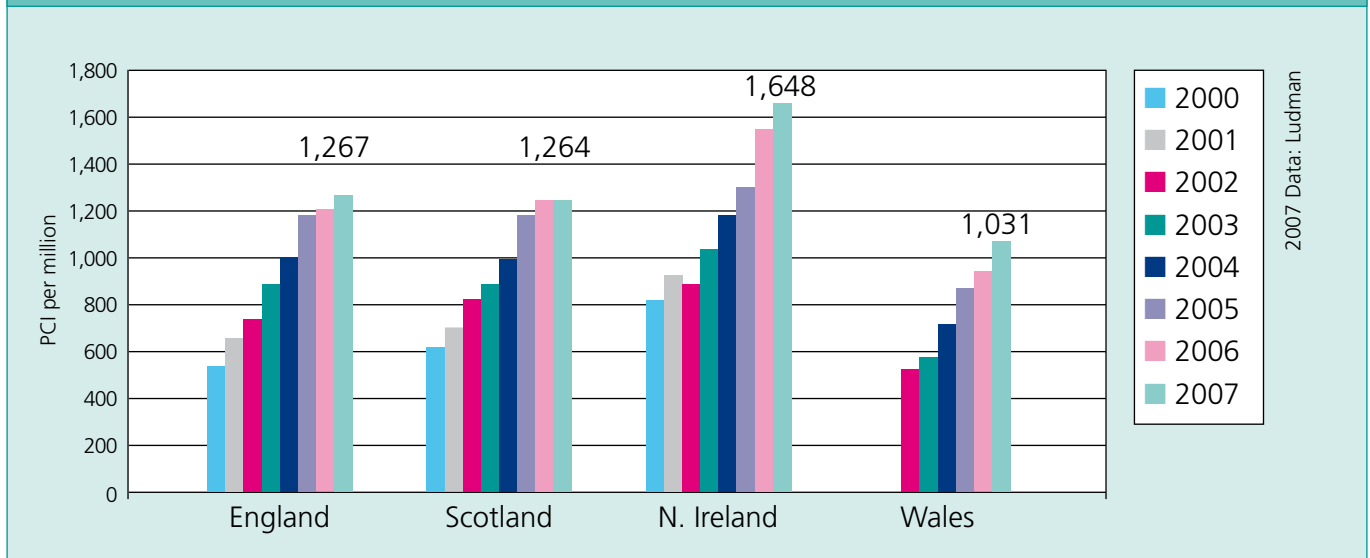
There was a total of 77,373 PCIs performed in the calendar year 2007. With an estimated UK population of 61.0 million in mid 2007, this represents a rate of 1269 PCI pmp.

Figure 3: Graph of absolute number of PCIs and rates pmp.



While the most appropriate rate of PCI pmp is difficult to judge, and will depend on many factors including the varying demographic profiles of populations in different countries, the UK has a lower rate than most of the rest of the developed European countries. In spite of this, the rate of increase in PCI in the UK over the last 2 years remains at its lowest level that at any time since records began in 1992 (Figure 3).

Figure 4: PCI activity per million population in the UK countries.



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 still in Wales at 1031 pmp compared with the highest in Northern Ireland at 1648 pmp. The rates in Scotland have remained virtually unchanged over the last 2 years (Figure 4).

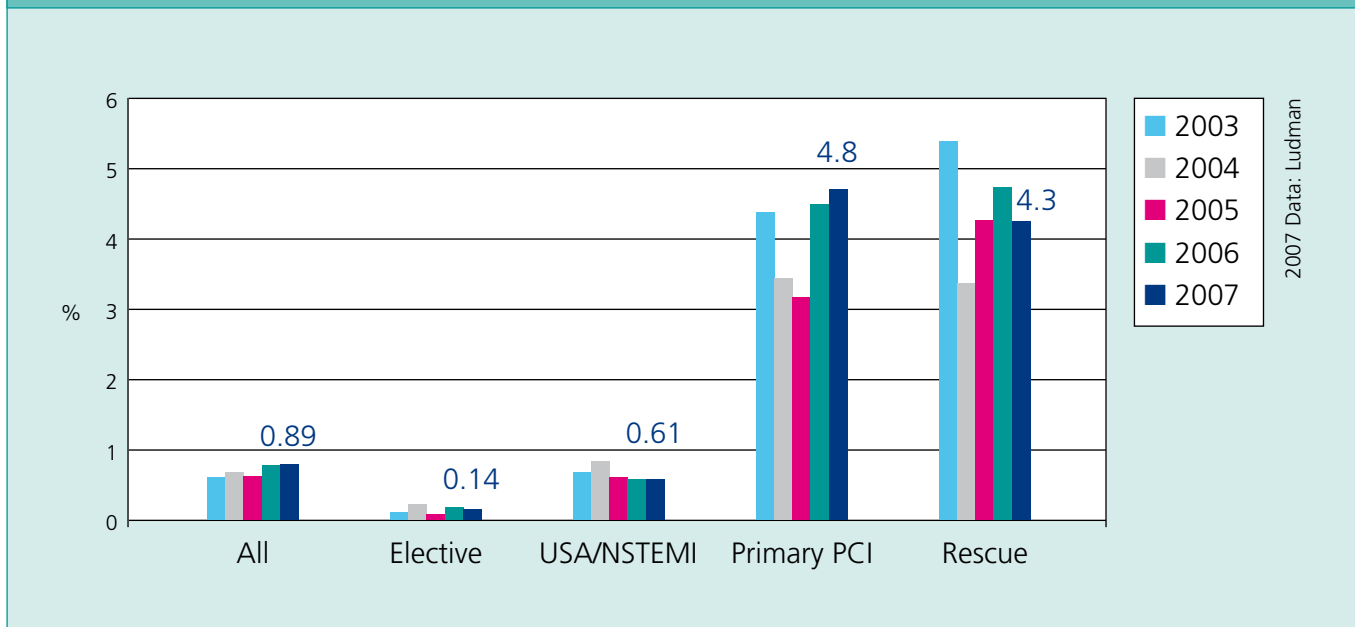
Outcome

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 rate of requirement for emergency CABG remains very

low at less than 1%. The overall rate of death before discharge from hospital following PCI has, however, gradually increased over the past few years.

By looking at mortality for each of the major presenting syndromes it can be seen that the outcomes for each of these groups have remained stable (figure 5). Thus the increase in overall mortality is due to an increasing proportion of sicker patients being treated by PCI, in other words a gradual change in case mix towards treating sicker patients. This change is exemplified by an increase in the number of patients being treated for STEMI.

Figure 5: Mortality (risk stratified by syndrome)



This analysis clearly demonstrates the importance of risk adjustment in the assessment of outcome to help avoid misleading conclusions. To this end we have started to create analyses of each PCI unit's performance, comparing the observed outcomes with those that would be expected using a risk model.

All models have limitations and results must be interpreted with caution. The model we are currently using is that derived from the North West Quality Improvement Program (NQWIP)⁷, which has recently been validated in a contemporary series⁸. Each PCI procedure is assessed and a predicted risk of a major adverse cardiac or cerebrovascular event (MACCE) is calculated. MACCE is defined as in hospital death, Q wave myocardial infarction, stroke or the need for emergency CABG. A cumulative plot is then constructed, with expected MACCE for each successive case, compared with the 2 and 3 sigma probability lines. These lines approximately equate to 95% and 99% confidence intervals. A similar line can

be plotted for the actual (observed) outcomes. If the observed outcomes lie within the 3 sigma confidence lines of the predicted, then the unit's outcomes are in line with the predictions of the model. Conclusions from these plots must be reached with care. If a unit's outcomes are better or worse than predicted, there are a variety of possible explanations. It may be that the unit is performing PCI better or worse than expected. But equally it may be that the model is inaccurate for that unit's population and demographic mix. Clearly the conclusions are also dependant on accurate reporting of demographic and procedural risk factors and of observed outcomes.

7 Multivariate prediction of major adverse cardiac events after 9914 percutaneous coronary interventions in the north west of England A D Grayson, R K Moore, M Jackson, S Rathore, S Sastry, T P Gray, I Schofield, A Chauhan, F F Ordoubadi, B Prendergast, R H Stables, on behalf of the North West Quality Improvement Programme in Cardiac Interventions (NWQIP) Heart 2006;92:658

8 External validation of established risk adjustment models for procedural complications after percutaneous coronary intervention B Kunadian, J Dunning, R Das, A P Roberts, R Morley, A J Turley, D Twomey, J A Hall, R A Wright, A G C Sutton, D F Muir, M A de Belder. Heart 2008;94:1012 - 1018

An example of one unit's activity is shown in figure 6 below:

Figure 6: Percentage actual and predicted MACCE outcome

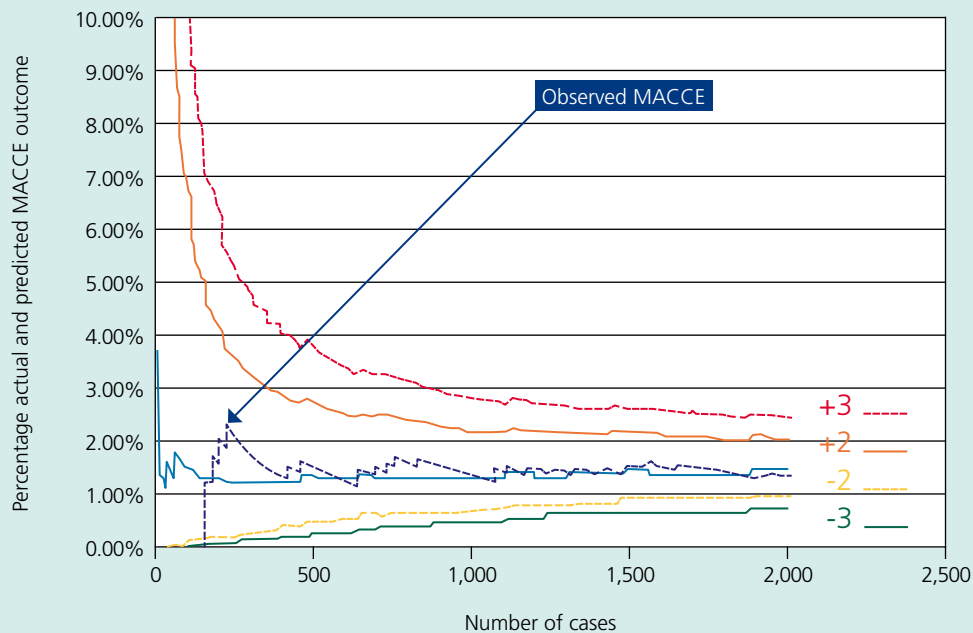


Figure 6: Observed MACCE (dark blue) for successive PCI procedures performed at one unit. Predicted MACCE is plotted in light blue, and the 2 and 3 sigma lines are labelled. It can be seen that this unit's performance is almost exactly as would be predicted from the risk model used, and that the overall risk of in hospital MACCE for that unit is just under 1.5%

The Future

Statistical process control charts will be used to provide units with feedback about their performance. In the first instance we plan to send the cumulative funnel plots of risk adjusted outcomes (as seen in figure 22), and also process control charts of 'door to balloon' times. The plan is to send these reports to all contributing units in a monthly basis.

Other plans include the development of a web browser based interface to integrate the input of data for the BCIS and MINAP datasets. This will help in the linking of these datasets and should reduce duplicate data entry. In addition it may allow data from an admitting hospital to be available to a PCI hospital where they are geographically separate.

The NHS Information Centre for health and social care is working to make information more relevant and accessible to the public, regulators, health and social care professionals and policy makers, leading to improvements in knowledge and efficiency.

The IC is an NHS special health authority that collects, analyses and distributes data to reduce the burden on frontline staff, releasing more time for direct care.

The full report *Angioplasty and Stents to treat Coronary Artery Disease 2008* will compliment this summary and is only available as PDF download from the Clinical section of our website.

For further information please contact our Contact Centre, quoting document reference IC09020209 for the full report or IC09020109 for the executive summary. Printed copies of the summary can be ordered from the NHS Information Centre.

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