



Modern Standards and Service Models

Coronary Heart Disease

**national
service
frameworks**

Chapter Five
Revascularisation

5

Chapter Five: Revascularisation

	contents	page
A	Aim	2
B	Standards	2
C	Rationale	2
D	Effective interventions	4
E	Service models	7
	Fair access to angiography and revascularisation	10
	Clinical audit	13
F	Immediate priorities	16
G	Milestones and goals	17
H	Holding the NHS to account	19
I	Summary	20
	References	21
	Appendices	
	A Coronary revascularisation in the management of stable angina pectoris	23
	B National adult cardiac surgical database	24
	C British Cardiovascular Intervention Society (BCIS) dataset	41

contents

5.0 Revascularisation

Introduction

This National Service Framework (NSF) for Coronary Heart Disease (CHD) establishes clear standards for prevention and treatment of CHD that will lead to major improvements in quality and access.

There are seven clinical chapters in this NSF, of which this is the fifth. They cover the following areas:

- 1 Reducing heart disease in the population (standards one and two)
- 2 Preventing CHD in high risk patients (standards three and four)
- 3 Heart attack and other acute coronary syndromes (standards five, six, and seven)
- 4 Stable angina (standard eight)
- 5 Revascularisation (standards nine and ten)
- 6 Heart failure (standard eleven)
- 7 Cardiac rehabilitation (standard twelve)

They each set out:

- the aim
- the relevant standards
- the rationale
- effective interventions
- service models (structuring care and clinical audit)
- immediate priorities
- milestones and goals
- holding the NHS to account – performance indicators

This chapter includes details about the increase in the total number of revascularisation procedures to be achieved by April 2002, and the early milestones relating to revascularisation – these are the immediate priorities in which rapid improvement is expected in this area.

All the chapters are summarised in section 2 of this NSF.

[A] **Aim**

- 1 This chapter sets out how specialist teams led by cardiologists and cardiac surgeons can best help people with proven coronary heart disease (CHD) reduce their risks and/or relieve their symptoms by identifying and treating those who will benefit from revascularisation of their coronary arteries.

[B] **Standards**

- 2 The standards of care that the NHS will aim for are that:

Standard nine

People with angina that is increasing in frequency or severity should be referred to a cardiologist urgently or, for those at greatest risk, as an emergency.

Standard ten

NHS Trusts should put in place hospital-wide systems of care so that patients with suspected or confirmed coronary heart disease receive timely and appropriate investigation and treatment to relieve their symptoms and reduce their risk of subsequent coronary events.

[C] **Rationale**

- 3 The symptoms of CHD are usually caused either by:
 - the gradual and progressive narrowing of the arteries supplying the heart (coronary arteries) by atheromatous plaques, or
 - sudden/rapid occlusion of coronary arteries following thrombus formation (blood clots) caused by the rupture of atheromatous plaquesⁱ.
- 4 There is good evidence that many people with atheromatous plaques and narrowed coronary arteries can have their symptoms relieved and/or their risks of dying reduced by restoring blood flow through blocked coronary arteries (revascularisation)ⁱ. The two most widely used techniques for restoring blood flow are coronary artery bypass surgeryⁱⁱ (CABG) and percutaneous transluminal coronary angioplastyⁱⁱⁱ (PTCA).

ⁱ The sudden occlusion of coronary arteries typically presents as a) sudden death/cardiac arrest b) acute myocardial infarction or c) unstable/rapidly progressive angina. Standards of care for these presentations of coronary heart disease have been addressed in Chapter 3.

ⁱⁱ Coronary artery bypass surgery (CABG) is surgery in which a narrowing in a coronary artery is by-passed with a vein or artery taken from elsewhere in the patient's body – typically the leg or the chest.

ⁱⁱⁱ Percutaneous transluminal coronary angioplasty (PTCA) is a procedure in which a narrow tube (a cardiac catheter) is passed through the skin of the groin or elbow into an artery. The tube is threaded into the coronary arteries. The position of the tip of the catheter can be followed with an X-ray cine camera. When the tip of the catheter is in the narrowed section(s) of the coronary artery a small balloon at the tip of the catheter is inflated dilating the narrowed section of the coronary artery. A tubular mesh splint – a stent – is often inserted into the dilated artery to act as scaffolding to help keep it open.

- 5 Much of the relevant investigation and treatment requires complex equipment and specialised skills that can be provided only in hospitals. Although the equipment is expensive and the treatment intensive, these treatments can be more cost-effective than many other treatments currently provided by the NHS.
- 6 By international standards the UK has high rates of CHD but low rates of coronary artery revascularisation^{2,3}. This does not appear to be because most other countries are over-using revascularisation but rather because there has been under-provision of revascularisation in the UK. Another major difference between the UK and most other developed countries is that people in the UK wait considerably longer for investigation and treatment than people elsewhere.
- 7 Not only are the overall rates of coronary revascularisation in the UK low, but people's access to that care is very unequal. There are marked geographical⁴, gender⁵ and racial⁶ variations in revascularisation rates, which are not closely correlated with measures of the level of heart disease in the community⁷.
- 8 There are various interdependent causes for these undesirable variations. It is thought that there are variations in the likelihood of people being referred to cardiologists and cardiac surgeons, and variations in the thresholds for investigation and treatment used by specialists. There are also marked variations in the level of NHS investment in specialist cardiac services including revascularisation⁷.
- 9 On several occasions, and in several fields of clinical practice, inadequate monitoring of the quality of care has meant that problems have not been identified and, as a consequence, action to improve quality has not been taken as early as it could and should have been. The public rightly expects the NHS to improve the quantity, quality and timeliness of information about the quality of care it provides and to take steps to ensure that quality is reliably and dependably high.
- 10 The evidence shows that there is considerable scope for improving access to secondary care and to interventions of proven clinical and cost effectiveness. There is equal scope for improving the consistency in the way patients are investigated and in the delivery of the care they receive. The standards in this chapter of the NSF will lead to an increase in the overall rate of revascularisation in England, and to more equitable access to services, and will allow patients and the public to know more about and have greater confidence in the quality of care that is available to them.

[D] Key effective interventions and investigations

- 11 People who have CHD may have narrowings in their coronary arteries which, if identified and treated, would improve their symptoms and, sometimes, reduce their risks of death or further cardiac events.
- 12 Not everyone with CHD will be a candidate for revascularisation. For example, if someone has other serious illness (co-morbidity) or is very frail, the risks of treatment may outweigh the benefits.
- 13 The key investigations and interventions that should be offered to people who are potential candidates for revascularisation and have
- *angina (Chapter 4),*
 - *unstable coronary artery disease, (Chapter 3) or*
 - *who have survived a myocardial infarction (Chapter 3) are:*
-

A Angiography^{iv} for those with

- evidence of continuing extensive ischaemia* (e.g. a strongly positive exercise test) and/or
 - angina that persists despite optimal medical therapy and lifestyle advice
- followed by

B Quantitative assessment of urgency⁸/risk^{9,10}/priority¹¹ using a published stratification system^{iv} for patients accepting an offer of revascularisation to inform the judgement about the balance of risks and benefits and to help determine each patient's relative priority for treatment (immediate, urgent, soon).

followed by

C Revascularisation

EITHER

- **Coronary artery bypass surgery (CABG)** for those who meet the criteria for angiography, in whom the risks are judged to be outweighed by the benefits in terms of either
 - a *prognosis*¹² i.e. the angiogram has shown significant narrowing of:
 - left main coronary artery, or
 - three coronary arteries, or
 - two coronary arteries including the proximal left anterior descending coronary artery
 - or
 - b *symptom relief*¹³ i.e. with suitable coronary anatomy where severe angina persists despite optimal medical therapy

^{iv} Angiography involves using cine X-ray equipment to follow the flow of injected radio-opaque fluids through the coronary arteries to demonstrate the extent and position of narrowings in the major coronary arteries.

^v There are several ways in which severe ongoing ischaemia can be recognised. These include a) a resting ECG with ST depression in multiple leads in someone who has recently had unstable angina, b) a strongly positive stress test e.g. widespread ST depression in the first two stages of the Bruce protocol (< 6 minutes) and c) strongly positive myocardial perfusion scan e.g. a large or multiple reversible perfusion defects.

^{vi} The Ontario scoring system is designed to assess the urgency of intervention, the PARSONNET and EUROSCORE are designed to estimate the risk of in-hospital operative mortality and the New Zealand priority score which is intended to rank people by 'ability to benefit'. The Society of Cardiothoracic Surgeons of Great Britain and Ireland is developing its own risk stratification system which may be a better predictor of operative mortality in the UK than other published scores.

OR

- **Percutaneous transluminal coronary angioplasty (PTCA)¹⁴ with or without stenting¹⁵** for those who have continuing symptoms, in whom the benefits are judged to outweigh the risks and who have operable narrowings of one vessel or two coronary arteries without significant narrowing of the left main stem.

D Effective secondary prevention and rehabilitation (see Chapters 2 and 7)

Special considerations

14 Coronary revascularisation is a major intervention with risks as well as benefits. It is never undertaken lightly. Each and every patient requires careful consideration.

15 A number of important factors influence the likely balance of risks and benefits. These include¹⁶:

Smoking

Smoking is associated with poorer long-term survival after CABG, and those who stop smoking are less likely to undergo repeat surgery or to have a heart attack.

Diabetes mellitus

People with diabetes have poorer long-term survival after revascularisation than those who do not. Good diabetic and hypertension control reduces the rate of progression of vascular disease in people with diabetes.

Impaired left ventricular function

People with impaired left ventricular function and CHD have a poorer long-term survival than those with normal left ventricular function. But, despite a higher operative mortality, they also obtain greater long-term survival benefit from revascularisation than people without impaired left ventricular function.

Advanced age

Elderly people who survive revascularisation can experience a great improvement in their symptoms. However, procedure-associated risk rises rapidly with age.

Gender

Women may have a higher procedure-associated mortality than men. The extent and reasons for this remain uncertain.

Recent myocardial infarction or episode of unstable angina

Recent coronary events increase procedural risk.

Unfavourable coronary anatomy

Extensive disease in the distal parts of coronary arteries reduces the likely benefits of intervention.

Inequalities

There is evidence that the most deprived in society, including people from minority ethnic groups, have worse access to care than those better off.

Minority ethnic groups

Services should provide for the particular needs of people from different ethnic groups. This includes assessing and meeting people's needs in ways that are culturally, religiously and linguistically appropriate. Where possible, clinical and managerial staff should be aware of and make use of available practical help (e.g. bilingual support workers), and relevant staff training programmes (e.g. those that promote understanding of how cultural and religious differences affect people's lifestyles and the way they use health services).

Other considerations

- 16 In recent years new medicines (e.g. glycoprotein IIb/IIIa receptor blocking drugs) and new equipment (e.g. intra-coronary stents) have been developed that may improve the outcomes of PTCA. Although widely used, these technologies are still developing and their precise place in clinical practice is still to be determined.
- 17 Emergency PTCA following AMI is practised in some centres and may offer benefits to some patients, especially those unsuitable for thrombolysis. However, the resource implications are significant and the cost-effectiveness of this form of treatment needs further assessment.
- 18 Another new development is the recognition that people with heart failure caused by CHD may benefit from revascularisation even if they do not have angina. However, more evidence of effectiveness is required before revascularisation can be recommended as a routine treatment for ischaemic heart failure.
- 19 The incidence of CHD and the need for revascularisation in a community depend on the ethnic composition and the relative poverty of the population. These factors are reflected in financial allocations to HAs and should be reflected in the PCGs'/PCTs' levels of investment in services for the prevention and treatment of CHD.

[E]

Service models

Hospitals

- 20 Over many years, the NHS has not invested sufficiently in coronary revascularisation. Revascularisation rates in England are low compared to many other countries and waits for diagnosis and treatment are long. This suggests that currently many people who might benefit are not offered revascularisation and those that do have often waited longer than is acceptable. At present there is insufficient coronary revascularisation capacity in England and there is scope to improve every step on the pathway from presentation to revascularisation.
- 21 The NSF addresses these challenges, first with the immediate target of increasing the numbers of revascularisations by 3,000. This will be achieved by April 2002 by investing funds so that more effective use can be made of facilities and the skills and experience of existing staff. In order to reach the level of activity to meet the needs of patients, a further increase in capacity will be required. This must be a longer term objective because of the time needed to train new surgeons, cardiologists and other skilled staff. This area of the service will be developed so that all those needing revascularisation are investigated and treated promptly. Further details of the immediate priorities and milestones are set out below.
- 22 Further targets will be set as these intermediate aims are achieved and the results of the re-engineering work come through, with the ultimate aim that patients should experience waits of weeks rather than months for their diagnosis and treatment. The NSF goal in this area and the waiting times goals are shown below.
- 23 There are marked geographical variations in coronary revascularisation rates. The communities that have the highest prevalence of CHD do not necessarily have the highest rates of coronary revascularisation. This implies that the NHS does not offer people with heart disease an equal chance of receiving the appropriate treatment. This NSF will help to correct this unfairness.
- 24 The reasons that people have unequal access to care can include:
- variations among general practitioners and hospital physicians in rates of referral to cardiologists with access to angiography
 - variations among cardiologists in their methods of and thresholds for investigation
 - variations among cardiologists and cardiac surgeons in their selection of patients for revascularisation
 - variations among local commissioners of health services in their investment in coronary revascularisation and associated investigations.

25 Hospitals, PCGs/PCTs, practices and HAs should put in place models of care so that they:

Use a systematic approach for:

- identifying people who may benefit from angiography and for referring them to specialists with access to appropriate facilities
 - determining who should be offered angiography
 - determining who should be offered revascularisation
 - assessing and improving the quality of care
 - determining the level of investment in coronary revascularisation based on the CHD needs of their local community.
-

26 Systematic care implies that the relevant organisations should agree, implement and audit a detailed plan and protocol for the referral, investigation and treatment of people who may benefit from coronary revascularisation. These plans and protocols should be consistent with the criteria set out above in section D.

27 The method for determining the level of local investment in coronary revascularisation should be included in the local Health Improvement Programme (HImp).

Local networks of cardiac care

28 The usual model for delivering systematic specialist care will be a 'hub and spoke' model that links tertiary referral cardiac centres, cardiac units in district hospitals and primary care to form local networks of cardiac care. Typically the geographical boundaries of a local network of cardiac care will match those of the PCGs/PCTs whose populations are served by the relevant tertiary referral centre(s).

29 The tertiary referral centres, the relevant district general hospitals and primary care groups that together form local networks of cardiac care should agree common referral criteria, treatment protocols, and quality improvement methods.

Facility and operator standards for angiography, PTCA and CABG

30 Angiography, PTCA and CABG all require high degrees of technical skill. However, the quality of the procedure depends not just on the skill and experience of the individual operator, but also on the skill and experience of the whole team involved in caring for the patient. This includes nurses, technicians, and ancillary staff as well as other medical staff.

31 These procedures all carry risks of serious complications. For example, PTCA may sometimes precipitate a sudden coronary artery obstruction that may need to be treated with an emergency CABG and so pre-arranged cardiac surgical cover is essential.

- 32 Studies in other countries have suggested that the best results are obtained when both individual operators and individual institutions undertake a sufficient number of procedures each year to maintain the skills of individuals and teams. For example, in New York State, the patients of surgeons who performed more than 50 CABGs per year appeared to have lower risk-adjusted mortality rates than patients operated upon by surgeons who performed fewer than 50 operations per year^{17,18,19}.
- 33 Preliminary work in the UK has not confirmed these conclusions. However, pending further work on surgical audit, the Society of Cardiothoracic Surgeons has agreed that normally surgeons should perform a minimum of 50 CABGs per year and cardiac surgical units should perform a total of at least 400 CABGs per year. The Joint Working Group on Coronary Angioplasty of the British Cardiac Society and the British Cardiovascular Intervention Society concluded that an independent angioplasty operator should undertake a minimum of 75 coronary procedures annually²⁰.
- 34 It is also financially more efficient to make intensive use of expensive resources, rather than to leave equipment unused for large parts of the day. So, for reasons of both quality of care and financial efficiency, the following standards should be used *as the basis* for agreeing locally where patients' needs will be met and by whom.

Facility and operator standards for angiography, PTCA and CABG

Angiography

- in any single institution undertaking coronary angiography, a minimum of 500 cardiac catheterisation procedures per year should be carried out by a minimum of two operators
- each individual trained operator (consultant level) should perform a minimum of 100 cardiac catheterisations per year.

Coronary angioplasty (PTCA)

- in any single institution undertaking coronary angioplasty (PTCA), a minimum of 200 procedures per year should be carried out by a minimum of two trained operators (consultant level)
- each individual trained operator (consultant level) should perform a minimum of 75 angioplasties per year
- PTCA should be performed only with pre-arranged cardiac surgical cover and in institutions where emergency cardio-pulmonary bypass can be established within 90 minutes of the decision to refer the patient for emergency CABG. If inter-hospital transfer is required, the journey time between hospitals should not exceed 30 minutes.

Coronary artery bypass grafting (CABG)

- in any single institution undertaking coronary artery surgery, a minimum of 400 CABGs per year should be carried out by a minimum of three trained surgeons
 - each individual trained surgeon (consultant level) should perform a minimum of 50 CABGs per year.
-

- 35 In some parts of the country, these standards will encourage the beneficial development of services and possibly lead to some centralisation – notwithstanding the fact that centralisation can sometimes reduce access to services.
- 36 An initial aim is to ensure that all units have a minimum of four surgeons so that they can provide a safe 24 hour service. In the longer term all major units will require at least five surgeons to meet training requirements.
- 37 All clinicians are expected to participate in clinical audit (see pages 13-16). If a decision is taken locally to offer services to people from individuals or institutions with lower workloads than those listed above, then locally collected audit data must demonstrate that the quality of care provided is consistently comparable to that provided elsewhere in the country.
- 38 HAs will also be expected to collect and report data about the fairness of access to invasive cardiac services (see audit criteria on page 15).

Fair access to high-quality angiography and revascularisation

Assuring fair access

- 39 If the NHS is to offer people fair and equal access to high-quality coronary revascularisation, a first step is to develop robust systems of care so that people with equal need have an equal chance of referral, investigation and treatment.

Local systems for assuring fair access should comprise:

- protocols for referral, investigation, treatment and follow-up
 - an annual review of age-sex standardised angiography and revascularisation rates by PCG/PCT by the boards of the relevant PCGs/PCTs and Trusts that together form a local network of cardiac care
 - a regular review of access rates by ethnic group
 - a regular review of local investment in coronary revascularisation to achieve satisfactory rates of investigation and treatment and to meet the relevant waiting time targets
 - the triggering of a focused and detailed audit/review of recent practice if access rates are substantially lower than expected.
-

Improving quality of care

- 40 It is not enough just to have access to care. When care is received people should have justifiable confidence in the quality of that care. This NSF sets out systems for continuously improving the quality of NHS care.

Local systems for improving quality of care should include:

- protocols for referral, investigation, treatment and follow-up
 - regular clinical audit
 - annual review of quality of care indicators (clinical audit criteria on page 15) by the boards of the organisations that together form a local network of cardiac care
 - the triggering of a focused and detailed audit /review of recent practice if quality indicators are substantially worse than expected.
-

- 41 An example of a protocol and dataset that can be used to develop local protocols are set out in the appendices. These are provided as examples only and are not intended to be prescriptive. However, hospitals and primary care groups may find it easier to modify a protocol developed elsewhere than to begin from scratch.

Regular review of local investment in coronary revascularisation and associated investigations

- 42 In commissioning coronary revascularisation and its associated investigations, PCGs/PCTs, HAs and NHS Trusts should review their investment in these services regularly.^{vii} These reviews should take into account a number of factors including:

- local incidence and prevalence of disease
- local angiography and revascularisation rates
- comparison of costs of relevant providers
- waiting time targets and local performance.

^{vii} The highly specialised cardiac services that are commissioned regionally or centrally are: a) complex electrophysiology including the implantation of defibrillators, b) cardiac transplantation which can only be performed in nationally designated centres.

43 The first and second stage waiting time aims are:

- from referral by GP to specialist assessment of those with new onset chest pain thought to be angina: 2 weeks maximum (national roll-out from 2002-03)
- from referral by GP to consultant appointment:
 - first stage aim: 13 weeks maximum
 - second stage aim: 4 weeks maximum
- from decision to investigate to angiography:
 - first stage aim: 6 months maximum
 - second stage aim: 3 months maximum
- from decision to operate to angioplasty:
 - first stage aim: 12 months maximum
 - second stage aim: 3 months maximum
- from decision to operate to CABG:
 - first stage aims:
 - emergency/urgent: not to leave hospital before procedure
 - high-risk priority cases: within 3 months maximum
 - all others: 12 months maximum
 - second stage aims:
 - emergency/urgent: not to leave hospital before procedure
 - high risk priority cases: within 3 months maximum
 - all others: 6 months

44 The second stage aims above indicate the direction of travel towards longer term goals. In the case of CABGs, for example, the goal is to treat within 3 months of the decision to operate. Progress will be made towards the aims and goals as resources and capacity become available and the results of re-engineering of services take effect. The NSF goal in this area and the waiting times goals are shown on page 18. Prioritisation must ultimately remain a matter of individual clinical judgement. However, many clinicians find it useful to use a formal scoring system to inform their judgement.

- 45 There is no one national target for revascularisation rates. Application of the clinical criteria set out in section D is intended to increase revascularisation rates in England but local rates should reflect local need. In communities with high levels of CHD there will be more people who need revascularisation. Once the criteria are fairly and equally applied the rates of revascularisation will be greatest in the communities in greatest need.
- 46 The average rates of revascularisation in the 20 HAs in 1996/7 with the highest rates of commissioning are equivalent to 550 CABGs and 550 PTCAs per million population (pmp), which is a total revascularisation rate of 1100 pmp. This NSF aims to reduce inequalities and increase all HAs to an equivalent rate, relative to the local burden of disease. The NSF is expected to lead to an increase in the national rate beyond 750 CABGs and 750 PTCAs pmp.
- 47 There is currently no agreed method of estimating the local need for revascularisation. However, mortality rates for CHD under 75 vary two-fold between HAs. The rates for revascularisation may vary similarly.
- 48 While the NHS adjusts so that it can deliver the standards set out in this NSF, the priority should be to ensure that those with most to gain receive care when they need it. This principle should underpin the local management of waiting lists within the maximum waiting times standards.

Overcoming bottlenecks

- 49 It is important that NHS facilities should be used to their maximum potential. Hospitals should identify and tackle any bottlenecks in the pathways of care for patients undergoing revascularisation.
- 50 One of the commonest bottlenecks is a lack of critical care beds in which patients can be nursed immediately after the operation. Several hospitals have developed innovative approaches to this problem. For example, St Thomas' Hospital, London has developed the concept of Overnight Intensive Recovery. They have found that providing overnight intensive care for post-operative patients in the surgical recovery unit substantially reduces the numbers of surgical patients who need to be admitted to the intensive care unit and the numbers of cancelled operations²¹. (Contact Dr Chris Aps, Guys and St Thomas' NHS Trust, Tel: 020 7928 9292).

Clinical audit

- 51 Clinical audit – the systematic assessment and improvement of the quality of care – is an essential component of modern high quality health care. It will also be an essential component of effective clinical governance. Participation in clinical audit is recognised by the General Medical Council and other professional bodies as an integral part of good practice²². The Government also expects all health professionals working in the NHS to undertake clinical audit and to use the results to improve the quality of care.
- 52 Hospitals, PCGs/PCTs and health authorities that together comprise local networks of cardiac care should agree a regular programme of clinical audit which includes the items listed in the table overleaf. This is part of the developing systematic and structured approaches to identifying, investigating and treating people who may benefit from revascularisation.

Interpretation of audit criteria: performance indicators, not performance measures

- 53 Importantly these clinical audit criteria are *indicators and not measures* of access and quality of care. There are many reasons why an individual's or an institution's figures may appear to be better or worse than expected. Possible explanations include differences in the quality and completeness of data recording, differences in the characteristics of the people being treated (e.g. age, severity of illness, their general health etc) and chance as well as differences in quality of care.

Triggered focused clinical audit/review of recent practice

- 54 One of the reasons for collecting and reviewing these indicators is to allow people to identify possible problems early. If the indicators suggest that an individual's or an institution's figures are not as they would have expected, this should prompt a more detailed review and audit.
- 55 The focus of a review can vary and should reflect local circumstances and local performance. For example, if revascularisation rates are low but angiography rates are not, then a review of what happens to people after angiography might be relevant. By contrast, if both angiography and revascularisation rates are low, then it may be more appropriate to review whether people are being denied referral to cardiologists with access to angiography facilities.

Clinical audit criteria for revascularisation and angiography

Access to care

- age-sex standardised rates of CABG/million population by PCG/PCT and HA
- age-sex standardised rates of PTCA/million population by PCG/PCT and HA
- age-sex standardised rates of angiography/million population by PCG/PCT and HA
- age-sex standardised rates of exercise ECG/million population by PCG/PCT and HA

Angiography

- annual number of all catheterisation procedures performed in each laboratory
- annual number of all catheterisation procedures performed by each trained operator
- number of trained operators per catheterisation laboratory
- number and % of angiographies repeated because of poor image quality by operator and by laboratory

PTCA

- annual number of PTCA procedures performed in each laboratory
- annual number of PTCA procedures performed by each trained operator
- number of trained operators trained in PTCA per catheterisation laboratory
- number and % of successful PTCAs by lesion type^{viii} by operator and laboratory
- number and % of PTCAs leading to complications by lesion type and by operator and laboratory

CABG

- annual number of CABG operations performed in each centre
- annual number of CABG operations performed by each trained surgeon
- number of trained surgeons per centre
- number and % of successful CABGs by lesion type and by operator
- risk adjusted number and % people dying after CABG before discharge from hospital by surgeon and by centre (see paragraphs 56-60)

On-going care

- number and proportion of people discharged alive following revascularisation recruited to a cardiac rehabilitation programme
- number and proportion of people discharged alive following revascularisation prescribed:
 - a aspirin
 - b statin.

^{viii} Lesion types as classified Type A, Type B1, Type B2, Type C according to the modified American College of Cardiology/American Heart Association task force classification. Circulation 1990;**82**:1193-202.

Risk adjustment and measuring outcome

- 56 Un-adjusted mortality rates are unhelpful and uninformative in assessing the outcomes of surgical teams and of hospitals²³. There are several systems which can be used to estimate people's risk of death associated with CABG. These include:
- **Parsonnet**⁹ – This method of risk adjustment was originally developed in the US in 1985. With recent advances in clinical practice this now tends to overestimate people's risk of death
 - **Euroscore**¹⁰ – recently developed in Europe, this is thought to be a better predictor of risk than Parsonnet, but is still being validated.
 - **UK Bayes**²³ – developed by Society of Cardiothoracic Surgeons of Great Britain and Ireland using what are thought to be the best predictive variables from the other scores. Early indications are that it is a better predictor of risk than the other systems including the US Bayes system. However it requires further validation.
- 57 Hospitals should estimate risk adjusted CABG mortality rates using one of these three methods of risk adjustment pending agreement on a national system.
- 58 The National Institute for Clinical Excellence (NICE) will recommend a method of clinical audit for coronary revascularisation that can be used throughout the NHS. The information systems that are being developed by the Information Authority as part of the new information strategy will support these national audits.
- 59 Until NICE-commissioned national audits are available, cardiologists and surgeons should continue to contribute to relevant professional society audits and databases. These include the Society of Cardiothoracic Surgeons (SCTS) surgical register and the British Cardiovascular Intervention Society (BCIS) intervention register. The SCTS dataset and definitions are given in Appendix B. The BCIS dataset is in Appendix C.
- 60 The NHS funded Central Cardiac Audit Database (CCAD) pilot project has been designed to demonstrate the feasibility of implementing a national risk stratified outcome audit for all cardiac intervention including PTCA and CABG. Proposals for national roll-out have been submitted to the NHS Executive.

[F] Immediate priorities

- 61 The immediate priorities for implementing this area of the NSF are:
- by April 2002, increasing the total number of revascularisation procedures, providing an extra 3,000
 - delivering the early milestones.
- 62 Progress with these priorities will be monitored using routinely collected data and the performance management processes.

[G] Milestones and goals

- 63 The current marked inequalities in revascularisation rates suggest that different hospitals, practices, PCGs/PCTs and health authorities will have different starting points for the implementation of this NSF. For example, in some parts of the country, revascularisation rates are relatively high in relation to the needs of the local community, but in others they are relatively low. Similarly, in some parts of the country, the NHS uses clear referral and treatment guidelines and in others it does not.
- 64 Whatever the local starting point, this NSF provides a mechanism for continually improving the quality of care. The milestones listed below provide a measure against which every hospital and PCG/PCT can assess itself. The milestones should be used by the hospitals, PCGs/PCTs and health authorities that together form local networks of cardiac care, to agree realistic and achievable targets for improving quality of care. These targets should be reflected in Health Improvement Programmes and other local plans.
- 65 The standards set out in this NSF will take several years to be achieved in full. The milestones map out the initial path.

Revascularisation milestones for local networks of cardiac care

Milestone 1

By October 2000, in every local network of cardiac care:

hospitals should have an effective means for setting hospital-wide clinical standards^{ix} for common conditions

hospitals should have a systematic approach to determining whether agreed clinical standards are being met

PCGs/PCTs and hospitals that together form a local network of cardiac care should have effective means for agreeing an integrated system for quality assessment and improvement.

Milestone 2

By April 2001, in every local network of cardiac care:

hospitals and PCGs/PCTs should have agreed network-wide protocols for the identification, referral, investigation and treatment of people who may benefit from coronary revascularisation.

^{ix} Where national standards exist they should be included as part of the locally agreed hospital-wide standards.

Milestone 3

By April 2002, in every local network of cardiac care:

hospitals and PCGs/PCTs should have clinical audit data no more than 12 months old that describes all the relevant audit criteria* (see page 15). Where relevant these data are derived from participation in national audits.

By April 2002, throughout England:

the total number of revascularisation procedures will have increased by 3,000.

The NSF goal

Everyone meeting the NSF criteria for angiography and revascularisation is identified and treated within the agreed waiting times to the standards set out in this NSF. Current estimates are that this will equate to a national rate equivalent to at least 750 pmp for PTCA and at least 750 pmp for CABG.

NSF waiting time goals

Referral by GP to specialist assessment/consultant appointment: two weeks maximum

Prompt investigation and, for those for whom it is indicated, revascularisation within three months of the decision to operate.

67 By October 2000 every relevant hospital Trust and PCG/PCT should have identified its local networks of cardiac care and assessed itself against these milestones, achieved milestone 1 and agreed a target milestone with its Regional Office or HA.

68 Over time, as these milestones are reached, new more demanding milestones will be added to promote the continuous improvement of quality of care throughout the NHS.

* Over time, ambulance services, hospitals and clinicians will be expected to participate in national audits.

[H] Holding the NHS to account

69 The Commission for Health Improvement and Regional Offices of the NHS Executive will use both local and national indicators to judge the performance of individual organisations.

70 NHS organisations will be expected to demonstrate that, in implementing this National Service Framework, they are making full use of the new mechanisms for improving quality of care. This includes ensuring that local systems of clinical governance and life-long learning are used to promote the quality of services for the prevention and treatment of CHD.

NHS Performance Assessment Framework

71 Nationally the Performance Assessment Framework (PAF) and the associated High Level Performance Indicators (HLPis) can be used to assess overall performance of the NHS. Equally the PAF can be used to assess performance of a specific aspect of the NHS, supported by suitable indicators. The CHD performance indicators, relevant to this chapter, fit within the areas of the Performance Assessment Framework as shown below (those shown in italics cannot yet be derived from routinely available data). The performance indicators should reflect differences in need between communities. Relating the indicators for access to those for CHD mortality will provide an estimate of whether the local need is being met, but the exact relationship between these indicators has still to be determined.

Health Improvement

- age standardised or age and sex standardised CHD mortality rates by HA (and 10 yearly, by socio-economic class)

Fair access and effective delivery of appropriate health care

- age-sex standardised rates of CABG/million population by *PCG/PCT* and HA
- age-sex standardised rates of PTCA/million population by *PCG/PCT* and HA
- age-sex standardised rates of angiography/million population by *PCG/PCT* and HA

Efficiency

- Reference costs for:
 - CABG (HRG codes for E04)
 - PTCA (E15 and E16)

Health outcomes of NHS care

- the number and % of people dying after CABG or PTCA before discharge from hospital. This indicator will be replaced by the following as soon as possible
 - *risk adjusted 30 day and one year mortality rates for CABG or PTCA by Trust.*
-

- 72 The NHS Executive will provide detailed advice about the collection of each of these data items. Reference costs are reported annually now, and it is anticipated that:
- the following items will be available from April 2001:
 - age-sex standardised rates of CABG/million population by *PCG/PCT* and HA
 - age-sex standardised rates of PTCA/million population by *PCG/PCT* and HA
 - age-sex standardised rates of angiography/million population by *PCG/PCT* and HA
 - the following item will be available as soon as the relevant data is available:
 - *risk adjusted 30 day and 1 year mortality rates for CABG and PTCA by hospital.*

[1]

Summary

- 70 This chapter has described:
- the investigation and treatment of people who may benefit from coronary revascularisation
 - service models that the NHS will be expected to put into place to reduce inequalities in service provision over time
 - milestones to mark progress, and NSF goals
 - measures that will be used to judge progress and performance.

References

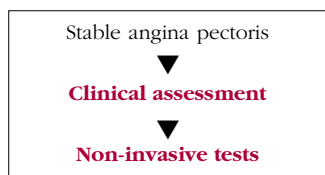
- 1 NHS Centre for Reviews and Dissemination. Management of stable angina. *Effective Health Care Bulletin* 1997;**3**:1- 8.
- 2 Meyer BJ, Meier B, Bonzel T. Interventional cardiology in Europe. *Eur Heart J* 1996;**17**:1318-28.
- 3 Tu JV, Naylor CD, Kumar D et al. Coronary artery bypass graft surgery in Ontario and New York State: which rate is right? *Ann Int Med* 1997;**126**:13-19.
- 4 Black N, Langham S, Coshall C, Parker J. Impact of the 1991 NHS reforms on the availability and use of coronary revascularisation in the UK (1987-1995). *Heart* 1996;**76** (supplement 4):1-30.
- 5 Spencer I, Unwin N, Pledger G. Hospital investigation of men and women treated for angina. *BMJ* 1995;**310**:1576.
- 6 Lear JT, Lawrence IG, Burden AC et al. A comparison of stress test referral rates and outcome between Asians and Europeans. *J Roy Soc Med* 1994;**87**:661-2.
- 7 Black NA, Langham S, Petticrew. Coronary revascularisation: why do rates vary geographically in the UK? *J Epidemiol Community Health* 1995;**49**:408-12.
- 8 Naylor CD, Sykora K, Jaglal SB, Jefferson S and the Steering Committee of the Adult Cardiac Care Network of Ontario. Assessment of priority for coronary revascularisation procedures. *Lancet* 1990;**335**:1070-3.
- 9 Parsonnet V, Dean D, Bernstein AD. A method of uniform stratification of risk for evaluating the results of surgery in acquired heart disease. *Circulation* 1989;**13**:I12.
- 10 Nashef SAM, Roques F, Michel P et al and the Euroscore study group. European system for cardiac operative risk evaluation (Euroscore). Presented to the 12th annual meeting of the European Association for Cardiothoracic surgery 1998.
- 11 Hadorn DC, Holmes AC. The New Zealand priority criteria project II: coronary artery bypass graft surgery. *BMJ* 1997;**110**:26-30.
- 12 Yusuf S, Zucker D, Peduzzi P et al. Effect of coronary artery bypass graft surgery on survival: overview of 10 year results from randomised trials by the Coronary Artery Bypass Graft Surgery Trialists Collaboration. *Lancet* 1994;**344**:563-70.
- 13 Rogers WJ, Coggin CJ, Gersh BJ et al. Ten year follow up of quality of life in patients randomised to receive medical therapy or coronary artery bypass graft surgery. *Circulation* 1990;**82**:1647-58.
- 14 RITA-2 Trial Participants. Coronary angioplasty versus medical therapy for angina: the second Randomised Intervention Treatment of Angina (RITA-2) trial. *Lancet* 1997;**350**:461-8.
- 15 Macaya C, Serruys PW, Ruygrok P et al. Continued benefit of coronary stenting versus balloon angioplasty: 1 year clinical follow-up Benestent trial. Benestent Study Group. *J Am Coll Cardiol* 1996;**27**:255-61.

- 16 Scottish Intercollegiate Guidelines Network (SIGN). Coronary revascularisation in the management of stable angina pectoris: a national clinical guideline. Edinburgh; 1998 p19-21.
- 17 Hannan EL, O'Donnell JF, Kilburn H Jr et al. Investigation of the relationship between volume and mortality for surgical procedures performed in New York State hospitals. JAMA 1989;**262**:503-10.
- 18 Hannan EL, Kilburn H Jr, Racz M et al. Coronary artery bypass surgery. Med Care 1991;**29**:1094-107.
- 19 Hannan EL, Siu A, Kumar D, et al. The decline in coronary artery bypass graft surgery mortality in New York State: the role of surgeon volume. JAMA 1995; **273**:209-13.
- 20 Joint Working Group on Coronary Angioplasty of the British Cardiac Society and British Cardiovascular Intervention Society. Coronary Angioplasty: guidelines for good practice and training. Heart 2000; **83**:224-235.
- 21 Aps C. Fast-tracking in cardiac surgery. British Journal of Hospital Medicine 1995; **54**: 139-142.
- 22 General Medical Council. Good Medical Practice. General Medical Council. London 1998.
- 23 Keogh BE, Kinsman R for the Society of Cardiothoracic Surgeons of Great Britain and Ireland. National Adult Cardiac Surgical Database report, 1998. Society of Cardiothoracic Surgeons of Great Britain and Ireland. London, July 1999.

Appendix A

An example from Scotland of a quick reference guide on coronary revascularisation in the management of stable angina pectoris

C Management of patients with stable angina referred for coronary revascularisation should be part of an **overall disease modification strategy**, including risk stratification, secondary prevention, lifestyle measures, and cardiac rehabilitation.



C The **projected symptomatic and prognostic gains** of coronary revascularisation are relative and should be evaluated against the **risks of intervention** and the possible attenuation of the projected benefits by **effect modifiers** such as advanced age and co-morbidity

Coronary angiography is appropriate in:

C Patients who have **limiting angina** despite optimal medical therapy and may therefore benefit **symptomatically** from CABG or PTCA.

C Patients whose clinical characteristics or non-invasive investigations suggest they have an **adverse prognosis** and may therefore benefit **prognostically** from CABG

B Patients in whom non-invasive tests have been **inconclusive or negative**, but who **continue to have chest pain** which is severe, frequent, or resulting in recurrent admission to hospital

Coronary revascularisation

A **Coronary revascularisation** is appropriate in patients with limiting angina despite optimal medical treatment who have suitable coronary anatomy

Percutaneous Transluminal Coronary Angioplasty (PTCA)

A PTCA is an appropriate alternative to CABG in patients with:

- two vessel disease without a significant proximal left anterior descending (LAD) stenosis
- single vessel disease

B In patients who have already undergone bypass surgery, an initial strategy of PTCA (if technically feasible) is preferable to repeat CABG

Coronary Artery Bypass Grafting (CABG)

CABG is appropriate because it has been shown to improve prognosis in patients with:

A • a significant left main stem stenosis of 50% or more

A • triple vessel disease

A • two vessel disease including a significant proximal LAD stenosis

B particularly if left ventricular function is impaired or the exercise test is strongly positive

B To maximise benefits, revascularisation should be performed with the **minimum** of delay

B Patients undergoing coronary revascularisation should **stop smoking**

A Benefits achieved with coronary revascularisation should be maintained with appropriate **secondary prevention**, including **aspirin** and **lipid lowering** therapy

A B C indicates grade of recommendation

Source: Scottish Intercollegiate Guidelines Network

SOCIETY OF CARDIOTHORACIC SURGEONS MINIMUM DATASET

3

RISK FACTORS FOR CORONARY DISEASE

Diabetes:	0 [] = No	2 [] = oral therapy
	1 [] = Diet	3 [] = insulin
Hypercholesterolaemia (>6.5 mmol/l or treated)	0 [] = No	1 [] = Yes
Hypertension (140/90 or treated)	0 [] = No	1 [] = Yes
Smoking	0 [] = Never smoked	2 [] = Still smoking
	1 [] = Ex-smoker	

ADDITIONAL MEDICAL HISTORY & RISK FACTORS FOR MORBIDITY

Renal	0 [] = No	2 [] = Cr > 200µmol/l
	1 [] = Functioning transplant	3 [] = Acute RF: Dialysis
		4 [] = Chronic RF: Dialysis
Respiratory	0 [] = No	1 [] = COAD / Emphysema
		2 [] = Asthma
Cerebro-Vascular	0 [] = No	5 [] = Previous CVA < 2 weeks
	1 [] = Previous TIA < 6months	6 [] = Previous CVA > 2 weeks
	2 [] = Previous TIA > 6months	7 [] = Carotid bruit
Peripheral-Vascular	0 [] = No	1 [] = Peripheral VD
		2 [] = Previous DVT
Pre-op Arrythmia:	0 [] = None (SR)	1 [] = A trial Fibrillation/ flutter
		2 [] = Complete heart block
		3 [] = Recent VF/VT

VALVE SURGERY DATANumber of valves replaced / repaired:

DISEASED VALVE?	Please ring letter	A	M	T	P
Haemodynamic pathology	1 = Stenosis 2 = Regurgitation 3 = Mixed				
Valve Pathology (more than one may be entered)	0 = Unknown 1 = Rheumatic 2 = Congenital 3 = Ischaemic 4 = Marfans 5 = Myxomatous degeneration 6 = Failed prior repair 7 = Prosthetic valve failure 8 = Paraprosthetic leak/dehiscence 9 = Prosthetic valve thrombosis 10 = Active infection 11 = Previous infection				
Prosthetic Valve Explant	<i>Local Codes required</i>				
Type of explant:	1= Mechanical, 2= Biological				
PROCEDURE	1 = Replacement 2 = Repair				
Replacement:	1= Mechanical, 2= Biological				
Valve Implant:	<i>Local Codes required</i>				
Repair / Conservation	1 = Commissurotomy 2 = Valve repair - ring 3 = Valve repair - no ring 4 = Aortic valve / cusp resuspension				
Valve / Ring Serial Number					
Valve / Ring Size	Enter size in mm				
AORTIC ROOT ENLARGEMENT 0 [] = No 1 [] = Yes					

SOCIETY OF CARDIOTHORACIC SURGEONS MINIMUM DATASET

8

AORTIC AND VASCULAR SURGERY DATA

Concomitant carotid endarterectomy: 0 [] = No 1 [] = Yes

Aortic procedure: 0 [] = No 1 [] = Yes

If yes complete below:

<p>AORTA</p> <p>1 = Ascending 4 = Descending 7 = Sinus of valsava 2 = Arch 5 = Abdominal 3 = Asc + Arch 6 = Desc + Abdominal</p>		
<p>PATHOLOGY</p> <p>1 = Unknown 6 = Atheromatous 10 = Other connective 2 = Aneurysm 7 = Marfan's tissue disorder 3 = Dissection 8 = Syphilis 4 = Transection 9 = Mycotic 5 = Coarctation 10 = Congenital</p>		
<p>AORTIC PROCEDURE <i>If aortic valve replaced include details in valve surgery section</i></p> <p>1 = Interposition tube graft 2 = Tube graft + AVR 3 = Root replacement with composite valve graft 4 = Root replacement with preservation of native valve 5 = Homograft root replacement 6 = Autograft root replacement 7 = Patch graft</p>		

SOCIETY OF CARDIOTHORACIC SURGEONS MINIMUM DATASET

9

Myocardial Protection :

Predominant method of myocardial preservation:

1 [] = Cardioplegia 0 [] = Non cardioplegic

If Cardioplegia:

Solution:	1 [] = Blood
	2 [] = Crystalloid
Infusion mode	1 [] = Antegrade
	2 [] = Retrograde
	3 [] = Antegrade and retrograde
Infusion Temperature	1 [] = Cold
	2 [] = Warm
Infusion Timing	1 [] = Intermittent
	2 [] = Continuous

If Non cardioplegic myocardial protection:

1 [] = XC fibrillation (XC/VF)
2 [] = VF with Perfusion
3 [] = Coronary perfusion
4 [] = Beating heart + XC
5 [] = Beating heart + perfusion

Bypass Related data

Patient Height (cm)

Weight (Kg)

Body Surface Area:

Body Mass Index.

Cumulative bypass time

Cumulative XC time

If VF/XC used then **longest XC Time:**

Circulatory arrest time

(Enter Time in minutes)

POST-OPERATIVE COMPLICATIONS & INTERVENTIONS

Cardiac Complications

Low cardiac output:	0 [] = No	1 [] = Inotropes (Excluding renal dopamine) 2 [] = IABP 3 [] = VAD(s)
Arrhythmias:	0 [] = None	1 [] = SVT requiring treatment 2 [] = VF/VT requiring intervention 5 [] = Permanent pacing required

Bleeding & Blood products

Blood Used	0 [] = No	1 [] = Yes
------------	------------	-------------

Reoperation	0 [] = None	1 [] = For bleeding / tamponade/ cardiac Arrest 3 [] = Other (Exclusive of sternal resuturing)
--------------------	--------------	---

Sternal Resuturing	0 [] = No	1 [] = Yes
---------------------------	------------	-------------

Ventilation		1 [] = Immediate Extubation 2 [] = < 12 hours 3 [] = < 24 hours
--------------------	--	--

Number of days if >1

Pulmonary Complications

0 [] = None	1 [] = Reintubation and ventilation 2 [] = Full Tracheostomy 3 [] = Pulmonary embolism
--------------	---

Neurological Complications

0 [] = None	1 [] = Transient Stroke / neurological deficit 2 [] = Permanent Stroke
--------------	---

Infective Complications

0 [] = None	1 [] = Sternotomy requiring debridement ± resuture 2 [] = Septicaemia due to any cause
--------------	---

SOCIETY OF CARDIOTHORACIC SURGEONS MINIMUM DATASET

11

Renal Complications

- 0 [] = None 1 [] = Mild/Moderate (Cr >200µmol/l)
 2 [] = HF/Dialysis Required
 3 [] = Already on pre-op dialysis

Gastrointestinal Complications

- 0 [] = no 1 [] = Peptic ulcer
 2 [] = Pancreatitis
 3 [] = Other

Multisystem failure

- 0 [] = no 1 [] = Yes

Summary of post-operative course:

Total length of stay on ITU:

Number of nights:

Readmitted to ITU

- 1 [] = No [] = Yes

Status at discharge:

- 1 [] = Alive 2 [] = Dead

Date of discharge / death:

MORTALITY

Died on post operative day:(Automatically calculated)

In Hospital death

- 1 [] = < 30 days 2 [] = > 30 days

Cause of Death:

- 0 [] = Unknown 4 [] = Septicaemia
 1 [] = Cardiac 5 [] = Carcinoma
 2 [] = Neurological 6 [] = Other
 3 [] = Pulmonary

National Adult Cardiac Surgical Database 1998

The Definitions Associated With the Adult Cardiac Surgical Minimum Dataset of the Society of Cardiothoracic Surgeons of Great Britain and Ireland.

Question title	Definition of response options where appropriate
<p>Cardiac history Angina status – as defined by the Canadian Cardiovascular Society (CCS)</p>	<p>CCS0: No angina. CCS1: Ordinary physical activity such as walking or climbing stairs does not cause angina. Angina may occur with strenuous, rapid or prolonged exertion. CCS2: There is slight limitation of ordinary activity, angina may occur on walking or climbing stairs rapidly, walking up hill or walking after meals, in the cold, wind or under emotional stress or climbing more than one flight of stairs under normal conditions. CCS3: There is marked limitation of ordinary physical activity, angina may occur after walking 100 yards or climbing one flight of stairs under normal conditions at a normal pace. CCS4: Inability to perform any physical activity without discomfort. Angina may occur at rest.</p>
<p>Dyspnoea status – as defined by the New York Heart Association (NYHA)</p>	<p>NYHA1: Patients with cardiac disease but without limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation or dyspnoea. Asymptomatic patients should be classified as Class 1. NYHA2: Cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitations or dyspnoea. NYHA3: Cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary physical activity results in fatigue, palpitations or dyspnoea. NYHA4: Cardiac disease resulting in an inability to conduct any physical activity without discomfort. Symptoms of cardiac failure may be present even at rest. If any physical activity is undertaken discomfort is increased.</p>
<p>Congestive cardiac failure</p>	<p>Yes: A history of left ventricular failure with pulmonary oedema requiring either admission to hospital or treatment with diuretics.</p>
<p>Previous Q-wave MIs</p>	<p>Number of previous Q-wave myocardial infarctions.</p>
<p>Last Q-wave MI</p>	<p>A transmural myocardial infarct represented by new Q waves in two or more contiguous leads on the ECG.</p>
<p>Recent MI: EuroSCORE supplemented</p>	<p>Yes: MI within the last 90 days. To allow calculation of EuroScore from data.</p>

Question title	Definition of response options where appropriate
Previous non-surgical interventions	
Recently failed non-surgical intervention	Yes: Any failed cardiological intervention (coronary or valvular) necessitating immediate surgery or surgery during the same admission.
Thrombolysis within 24 hours prior to surgery	Yes: Any form of thrombolytic therapy administered within 24 hours of surgery.
Date of last intervention:	Enter dd/mm/yy; use 01 if day unknown and 06 if month unknown.
Risk factors for coronary disease	
Hypercholesterolaemia	Yes: A history of serum cholesterol of greater than 5.0mmol ⁻¹ or lower if on treatment.
Hypertension	Yes: A history of blood pressure greater than 140/90mmHg on two occasions, or lower if on medication.
Smoking	Patients who have smoked within one month of surgery should be considered to be current smokers.
Additional medical history and risk factors	
GI tract	<p>No: No history of GI problems.</p> <p>Peptic ulcer: Previous surgery, medical treatment or current treatment for known peptic ulceration.</p> <p>Previous surgery: Previous gastrointestinal surgery (exclude groin or abdominal hernias).</p> <p>Other: Any other GI/or hepatobiliary symptoms. Include symptoms of indigestion or hiatus hernia.</p>
Renal system	<p>No: No history of renal disease and creatinine < 200µmol l⁻¹ on admission.</p> <p>Functioning transplant: Functioning renal transplant, irrespective of creatinine</p> <p>Creatinine > 200µmol l⁻¹ : Creatinine > 200 µmol/l at the time of surgery.</p> <p>Acute renal failure: Renal failure within 6 weeks of surgery necessitating any form of dialysis up to the time of surgery.</p> <p>Chronic renal failure: Chronic renal failure on regular dialysis.</p>
Pulmonary disease	<p>No: No history of pulmonary disease.</p> <p>COAD/Emphysema: Patient requires medication (inhalers, aminophylline or steroids) for chronic pulmonary disease or FEV1 less than 75% predicted value. Venous pO₂ < 600mmHg, pCO₂ > 50mmHg.</p> <p>Asthma: Intermittent or allergic reversible airways disease treated with bronchodilators or steroids.</p>
Cerebrovascular disease	<p>No: No history or symptoms of cerebrovascular disease.</p> <p>TIA: An cerebral neurological deficit lasting less than 24 hours.</p> <p>CVA: Any neurological deficit lasting > 24 hours irrespective of the extent of recovery</p> <p>Carotid bruit: A carotid bruit on physical examination.</p>

Question title	Definition of response options where appropriate
Neurological dysfunction EuroScore Supplement	Yes: Disease severely affecting ambulation or day-to-day functioning. To allow calculation of EuroScore from data.
Peripheral vascular disease	Yes: Any one of <ul style="list-style-type: none"> • history or evidence of aneurysm, occlusive peripheral vascular disease or carotid disease • aortic aneurysm • previous aortoiliac or peripheral vascular surgery • reduced or absent peripheral pulses and/or angiographic stenosis of more than 50%. • include carotid bruits as evidence of carotid disease.
Pro-op arrhythmia Within two weeks of the procedure	Normal (RS): Patient in sinus rhythm. Atrial fibrillation/flutter: Demonstrable, chronic or paroxysmal atrial fibrillation or flutter. Complete heart block: No association of P waves to QRS complexes or pacing system in place. VF/VT: Sustained VT/VF requiring cardioversion or IV medication i.e. amiodarone infusion.
Catheterisation data	
Was the patient catheterised?	Yes: Cardiac catheterisation was performed at any time as part of the preoperative assessment.
Date of catheterisation	Enter dd/mm/yy, use 01 if day unknown and 06 if month unknown.
Extent of coronary vessel disease	The number of major (LAD, Cx, RCA system) vessels with >50% narrowing in any angiographic view. (NB excludes Left Main Stem – Enter 0 if LMS only).
Indices and pressures	
Left ventricular function (EF)	Good: Left ventricular ejection fraction of 50% Fair: Left ventricular ejection fraction of 30-49% Poor: Left ventricular ejection fraction of <30%.
Pre-operative support	
Pacemaker	Yes: Patient has any type of pacemaker (temporary or permanent)
Cardiogenic shock	Yes: Any one of (prior to anaesthesia): Hypoperfusion with a systolic BP < 80mmHg and adequate central filling pressure without inotropes. A cardiac index < 1.81 min ⁻¹ m ⁻² without inotropes Inotropes + IABP required to maintain CI > 1.81 min ⁻¹ m ⁻²
Intravenous inotropes	Yes: Any inotropic agents, excluding renal dose dopamine at the time of leaving theatre or in ITU. Temporary inotropes discontinued before the patient leaves theatre should not be included. Vasoconstrictors to combat peripheral vasodilatation are excluded.
Intra-aortic balloon pump	Yes: The presence of a preoperative intra-aortic balloon pump for haemodynamic reasons. Do NOT include IABP's inserted prophylactically just prior to surgery because these represent post-operative support.

Question title	Definition of response options where appropriate
Operative status	
Operative priority	<p>Elective: Routine admission from the waiting list. The procedure can be deferred without risk.</p> <p>Urgent: Patients who have not been scheduled for routine admission from the waiting list but who require surgery on the current admission for medical reasons. They cannot be sent home without surgery.</p> <p>Emergency: Unscheduled patients with ongoing refractory cardiac compromise. There should be no delay in surgical intervention irrespective of the time of day.</p> <p>Salvage: Patients requiring CPR en-route to the operating theatre or prior to anaesthetic induction. CPR following anaesthetic induction should not be included.</p>
Surgical training	
Operation performed by	The grade of operating surgeon.
Type of trainee	<p>1 NTN, VTN or FTTN trainee (UK registered trainee).</p> <p>2 Other trainee</p>
Calman year of trainee	If the operation is performed by a NTN, VTN or FTTN trainee, the career grade year 1-6.
Coronary bypass, valve and aortic procedure details	
Total number of distal coronary anastomoses	Enter appropriate number
Coronary artery	<p>Enter site of each anastomosis – the sites are described by AHA segments: CCAD definition is currently (v1.06)</p> <p>Site: 1 = Prox RCA, 2 = mid RCA, 3 = Distal RCA, 4 = RCA-PDA, 5 = LMS, 6 = Prox LAD, 7 = Mid LAD, 8 = Distal LAD, 9 = Diag 1, 10 = Diag 2, 11 = Prox LCX, 12 = Int/OML, 13 = Distal LCX, 14 = OM2, 15 = CX-PDA, 16 = RCA – LV branch.</p>
Number of valves replaced/repaired	Enter the appropriate number.
Diseased valves replaced/repaired	<p>Enter the site of each valve replaced or repaired</p> <p>17 = Aortic, 18 = Mitral, 19 = Tricuspid, 20 = Pulmonary.</p>
Valve pathology	<p>1 Rheumatic, 2 Congenital, 3 Ischaemic, 4 Marfans, 5 Myxomatous degeneration, 6 Failed prior repair, 7 Prosthetic valve failure, 8 Paraprosthetic leak/dehiscence, 9 Prosthetic valve thrombosis, 10 Active infection, 11 Previous infection, 12 Calcific degeneration, 13 Annulaortic ectasia, 14 Other degenerative valve disease, 15 Dissection, 16 Tumour, 99 Unknown.</p>
Prosthetic valve explant	Local or UK Heart Valve registry Code.
Valve implant	Local or UK Heart Valve registry Code.
Valve repair/conservation	Type of conservative procedure.

Question title	Definition of response options where appropriate
Valve/ring serial numbers	Serial number of prosthesis.
Aortic procedure	<p>Interposition tube graft: Any interposition graft without a valve, irrespective of whether or not other vessels (e.g. head vessels, intercostals) are implanted into the graft.</p> <p>Tube graft + AVR: Include valve details under valve replacement.</p> <p>Root replacement composite valve graft: Include details under valve replacement</p> <p>Root replacement native valve conserved: Root replacement with preservation of native valve and coronary reimplantation.</p> <p>Homograft root replacement: Include details under valve replacement.</p> <p>Autograft root replacement: Autograft root replacement (Ross Procedure).</p> <p>Aortic patch graft: Any patch irrespective of material used.</p>
Myocardial protection	
Non-cardioplegic myocardial protection	Enter predominant technique used for NON-CARDIOPLEGIC protection: Aortic cross clamping with fibrillation, fibrillation with perfusion, cross clamp with direct coronary perfusion, cross clamp and beating heart, beating heart without cross clamp.
By-pass related data	
Cardiopulmonary bypass	Yes: Cardiopulmonary bypass used for part or all of the procedure.
Cumulative bypass time	Enter time in minutes.
Circulatory arrest time	Enter time in minutes.
Cumulative cross clamp time	Enter time in minutes.
Longest ischaemic period	Enter time in minutes.
Patient height	Enter in centimetres.
Patient weight	Enter in kilograms.
Body Surface Area	Calculated from height and weight.
Body Mass Index	Calculated from height and weight.
Post-operative course	
Low cardiac output	<p>Can have multiple values.</p> <p>Inotropes: On leaving theatre, or commenced in the ITU (exclude if $< 5\mu\text{g kg}^{-1} \text{min}^{-1}$ Dopamine).</p> <p>Intra-aortic balloon pump: If used at any stage in the post operative course.</p> <p>VAD(s): If used at any stage in the post operative course.</p>

Question title	Definition of response options where appropriate
Arrhythmias	Can have multiple values. SVT: Includes all atrial tachycardias requiring treatment. VT/VF: Ventricular tachycardia or fibrillation requiring treatment. Permanent pacing: Insertion of a permanent pacemaker post-operatively.
Blood used	Yes: Blood used intra-operatively or post-operatively.
Reoperation	Can have multiple values. For bleeding/tamponade: Reoperation for bleeding related reasons Other: Exploration for other reasons e.g. cardiac arrest, additional grafting.
Sternal resuturing	Yes: for any reason – technical failure or infection.
Ventilation (hours)	Whole number of hours, if less than 24.
Ventilation (days)	Whole number of days, if more than 24 hours.
Pulmonary complications	Full tracheostomy: either surgical or percutaneous. Pulmonary embolism: Documented pulmonary embolism.
Neurological complications:	Can have multiple values. Transient stroke/neurological deficit: Neurological deficit, which has recovered fully by the time of discharge from hospital. Permanent stroke: Persisting neurological deficit at time of discharge from hospital.
Infective complications	Can have multiple values. Septicaemia: From any source, known or unknown.
GI complications	Can have multiple values. Peptic ulceration: Proven peptic ulceration causing, pain, bleeding or perforation. Pancreatitis: Amylase >1500iu Other: Any other GI complication delaying recovery.
Length-of-stay on ITU	Whole number of nights.
Post-operative length-of-stay	Whole number of days.

Appendix C

British Cardiovascular Intervention Society (BCIS) Dataset

Centre details

Your Centre	Description
Name of Centre	
Hospital Identifier	Code number only known to centre and BCIS
Your name	Name of person completing the form
Position	Position/Grade of person completing the form
Contact tel. number	Tel. No. of contact person
Contact fax number	Fax No. of contact person
Contact email address	E-mail address of contact person
Surgical cover	0 = None, 1 = On-site, 2 = Off-site
Your catheter laboratories	
Number of catheter laboratories	No. of labs in your centre
Number of adult catheter sessions per week	Session = half day in a single lab. (Includes mobile labs)
Do you have QCA?	Yes/No
Number of cine labs	Number 0-6
Number of digital labs	Number 0-6
Method of archiving	Video, CD, Laser disk, Optical disk, Cine film may use more than 1 method
Diagnostic catheter procedures	
Number of diagnostic catheterisers	Total number of diagnostic catheterisers
Consultant cardiologists (local)	Consultant employed principally in your centre
Consultant cardiologists (visiting)	Consultant employed principally in another hospital
Consultant radiologists	
Associate specialists	
Specialist registrars (Cardiology)	
Other grade	
Total adult diagnostic procedures	Coronary and valve studies (excludes pacing, electrophysiology, paediatric and other work)
Intervention procedures	
Number of consultant interventionists	
Specialist registrars (Radiology) Cardiologists	Number
Radiologists	Number
Associate specialists	Number
Number of interventional trainees	Number (this refers to specialist registrars specifically being trained in intervention and not those just given exposure to PTCA)

Your Centre	Description
Other staffing questions	
Number of catheter laboratory nurses	In your department
Number of cardiac technicians	In your department
Number of cardiac radiographers	In your department
Total number of specialist registrars SpR's:	
In your centre	Number
Outside your centre	Refers to SpR's in other hospitals but rotating with your centre
Other catheter laboratories locally	
Type of laboratories:	List names of other hospitals undertaking catheterisation in your region/deanery and name possible contact person for each
Fixed dedicated cardiac	
Fixed shared	
Mobile	

BCIS/CCAD minimum data set to be completed annually by each centre 1/4/99

Annual Procedure Summary

Total coronary intervention procedures

Breakdown of procedures

Number

Number (include no. of procedures involving use of any of these technologies)

Balloon alone (POBA)

No. of procedures involving stent insertion

Direction atherectomy (DCA)

Cutting balloon

Rotational atherectomy

Laser angioplasty

TEC device

Intravascular ultrasound

Angioscopy

Thrombus removal device

Groin closure device

Procedures when ReoPro used

Other

Specify

Other interventional procedures

Number (include no. of procedures involving use of any of these technologies)

Mitral valvuloplasty

Aortic valvuloplasty

Pulmonary valvuloplasty

Coarctation (native) dilatation

Re-coarctation dilatation

Closure of PDA

Closure of PFO

Removal of foreign bodies

Embolisations

Other

Specify

Breakdown of number of adult cardiac interventional procedures undertaken annually and submitted to BCIS/CCAD

Individual Case Data

Total coronary intervention procedures

Number

General

Patient name
Date of birth
Gender
NHS number
Post code
Hospital ID number
Hospital

Indication for procedure

Clinical syndrome (one choice only)

Stable angina
Asymptomatic myocardial ischaemia
Unstable angina (stabilised)
Unstable angina (currently unstable)
Re-intervention
Primary PTCA for acute MI
Rescue (salvage) PTCA for acute MI
Re-infarction (no thrombolysis)
Post MI unstable angina
Post MI unstable angina
Post MI stable angina
Other (specify)

Urgency

Urgency of procedure (elective, urgent, emergency, unknown)

Clinical factors

Angina severity
Dyspnoea status
Previous MI
Diabetes
Peripheral vascular disease
Cerebrovascular disease
Previous stroke
Cardiogenic shock

CCS class
NYHA class
Yes/No
None, Non-IDDM, IDDM, Unknown
Yes/No
Yes/No
Yes/No
Yes/No

Diagnostic catheter data

LV Function

Visual assessment (normal, mild, moderate, severe dysfunction, LV angiogram not performed)

LV ejection fraction (%)

If measured

Extent & severity of native coronary artery disease

Duke matrix (pre-procedure)

Was the patient catheterised (cardiac)?

Diagnostic catheter undertaken at any time as part of the pre-operative assessment (Yes/No)

Date of catheter

Previous CABG

Yes/No

	Description
Intervention procedure	
Date of procedure	
Name of operator 1	
Status of operator 1	1 = consultant cardiologist, 2= consultant radiologist, 3=specialist registrar
Number of vessels attempted	Number 1-5
Number of lesions attempted	Number 1-7
Restenosis lesion	Yes/No
ReoPro used?	Yes/No
Chronic occlusion	Yes/No
Stent(s) used	Yes/No
Post-procedural CAD score	Duke matrix (post-procedure)
Devices used	Directional atherectomy (DCA) Rotational atherectomy Cutting balloon Laser angioplasty TEC device IVUS Angioscopy Thrombus removal device Groin closure device (specify) ReoPro Other
Laboratory outcome	
	Procedure successful Procedure partially successful Failed procedure (no complication) Myocardial infarction Emergency CABG Death
Post-AMI final TIMI coronary flow	TIMI 0-3 (for AMI patients only)
Transfer to theatre?	N/A, cardiac massage, haemodynamically unstable, haemodynamically stable, unknown If applicable
Time to bypass	
Hospital outcome	
Death	Yes/No
Date of death (if applicable)	
Q-wave MI	Yes/No
Non-Q wave MI	Yes/No
Re-infarction	Yes/No
Re-intervention	Yes/No
Emergency CABG	Yes/No
Elective in-house CABG	Yes/No
Was post-procedure CPK measured?	Yes/No

Individual patient details recorded for each intervention procedure and submitted to BCIS/CCAD

