

**Department of Health Social
Services and Public Safety**

**Needs and Effectiveness Review
of Cardiology and Cardiac
Surgery in Northern Ireland**

Summary Report

Final Version

27th September 2006

1. INTRODUCTION AND BACKGROUND

In March 2005, Deloitte MCS Limited (Deloitte) and York Health Economics Consortium (YHEC) were appointed by the Department of Health, Social Services and Public Safety (DHSSPS) to undertake a needs and effectiveness review of cardiology and cardiac surgery services in Northern Ireland. The purpose of the review was to consider the future direction for cardiology and cardiac surgery services given new technology, interventional techniques, and service developments; to evaluate the effectiveness of current service provision; and to determine the direction and resources required for the service over the next number of years. This review was to take account of separate reviews of cardiac surgery (2001) and cardiology (1999) completed by DHSSPS and progress achieved in implementing actions contained in the Joint Cardiac Surgery and Cardiology Action Plan issued by DHSSPS to the Health and Personal Social Services in April 2003.

The full Terms of Reference for the review are included at Appendix I.

In taking forward the review the Deloitte/YHEC team were advised by the following:

- Mr James Roxburgh, Consultant Cardiac Surgeon, Guy's & Thomas' NHS Foundation Trust;
- Dr Jim McLenachan, Consultant Cardiologist, Leeds General Infirmary.

The review involved an iterative process of consultation with DHSSPS, Trusts and Boards. This included representatives of all units currently providing interventional cardiology or cardiac surgery services in Northern Ireland.

This report is a summary of the key issues arising from the review and the following sections outline:

- the key recommendations arising from the review;
- future interventional cardiology needs and service targets;
- future cardiac surgery needs and service targets;
- performance review of cardiac surgery; and
- conclusions.

2. KEY RECOMMENDATIONS

- 2.1 A clinical network should be established to include representatives from those who commission and deliver cardiology and cardiac surgery services in Northern Ireland. This network should be responsible for taking forward the recommendations arising from this review and for developing an evidence based patient pathway that meets agreed standards of care for all patients (eg Crest Guidelines and British Cardiac Society Clinical Governance Peer Review Standards).
- 2.2 All provider units, working in conjunction with the clinical network, must ensure that appropriate clinical standards are met.
- 2.3 Provider units should ensure that robust management information systems are in place to facilitate audit, service improvement and feedback to commissioners on how standards are being met.
- 2.4 In line with service reforms, all patients should access outpatient, diagnostic and inpatient services through an agreed booking system within the prevailing target waiting times for patients being referred with heart disease.
- 2.5 Commissioners and providers working together, in conjunction with the clinical network, should make provision for a phased increase in diagnostic and interventional cardiology procedures, taking account of:
- the findings of this review;
 - the needs of the region as a whole;
 - advice from the clinical network; and
 - future changes in clinical practice.
- 2.6 Commissioners and providers working together, in conjunction with the clinical network, should develop a comprehensive range of performance measures for cardiology and cardiac services to include: cancellation rates; utilisation of capacity (particularly with reference to Cardiac Surgery Intensive Care Unit (CSICU)); length of stay; Healthcare Resource Group (HRG) costs; and specialty costs.
- These should be benchmarked against other UK providers and circulated to all stakeholders on a quarterly basis.
- 2.7 All cardiac surgery theatre sessions provided during the normal working week (Monday to Friday) should be allocated to HPSS patients. No HPSS patient should be disadvantaged by private patient activity.

- 2.8 Centralised referral management processes should be established for inpatients referred for cardiac surgery, including inpatient transfers and urgent referrals, and quarterly data provided to commissioners and the clinical network demonstrating adherence to the agreed processes.
- 2.9 The referral process to cardiac surgery must be simplified, with the majority of patients being directly referred to a common waiting list. Joint meetings between cardiac surgeons and cardiologists to discuss complex cases should be reduced to a minimum (eg 2 per month) and telemedicine links utilised as appropriate.
- 2.10 Within cardiac surgery and cardiology teams the skills and competencies of all staff must be maximised, eg through enhanced roles and multidisciplinary workings.
- 2.11 Commissioners and providers working together, in conjunction with the clinical network, should undertake a feasibility study to consider the implications of the introduction of acute PCI in Northern Ireland.
- 2.12 The Royal Hospitals Trust should ensure implementation of all the clinical practice standards listed at Paragraph 5.6.

3. FUTURE INTERVENTIONAL CARDIOLOGY NEEDS AND SERVICE TARGETS

In April 2006, the Second Report of the British Cardiovascular Society Working Group was published. This reported on interventional cardiology provision across the four UK countries and made comparisons between service levels in each. The key findings arising from this report are outlined in Table 3.1 below

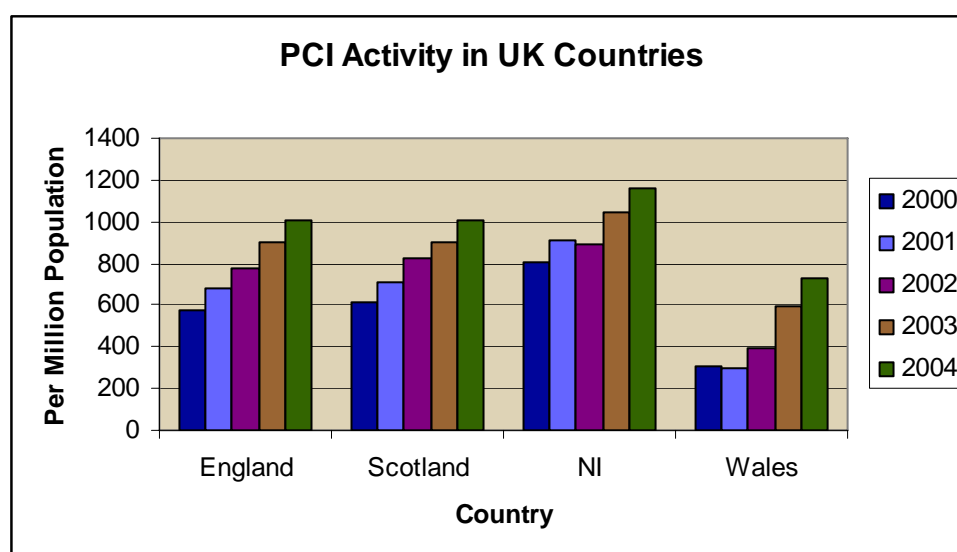
Table 3.1
Interventional Cardiology Activity in UK Countries 2004

	England	Scotland	NI	Wales
Percutaneous Coronary Intervention (PCI) per million population (PMP)	1,019	1,019	1,169	725
% of Stents Used Which are Drug Eluting Stents	48%	14%	54%	52%
New Pacemaker Implementation PMP	410	360	310	380
Implantable Cardioverter-Defibrillator (ICD) Therapy PMP	35	47	50	30
Cardiac Resynchronisation Therapy (CRT) PMP	35	13	48	7

Source: British Cardiovascular Society Working Group

Table 3.1 indicates that NI is currently ahead of the other UK countries in terms of provision for all procedures measured, with the exception of new pacemaker implementation. This is not a new trend, particularly in respect of PCI. Figure 3.2 below gives the trends in PCI implementation PMP over the past five years for each of the UK countries. This shows that the NI population has consistently had greater access to PCI procedures than in the other UK countries.

Figure 3.2
UK Trends in Interventional Cardiology Activity 2000 - 2005 (PMP)



Source: British Cardiovascular Society Working Group

In December 2004, the British Cardiac Society published population based estimates for interventional cardiology to be used for future planning purposes. These gave lower, median and higher estimates per procedure type per million population (PMP). These estimates are detailed in Table 3.3 overleaf, together with projected outturn using NISRA population projections for NI to 2010.

We have also considered what activity would look like in 2010 if increases experienced in the five years between 2000/01 and 2004/5 continued at the same rate of growth for the next five years. These projections are also included in Table 3.3

Table 3.3

Activity Estimates for Interventional Cardiology in 2010 Using British Cardiac Society Guidelines and Recent Growth Trends

	British Cardiac Society Guidelines						Recent Growth Trends		
	Low		Median		High		2004/5 Activity	Growth Over Past 5 Years	Activity Estimate to 2010 Based on Growth Rates
	PMP	Activity	PMP	Activity	PMP	Activity			
Diagnostic Angiograms	1,650	2,879	3,300	5,758	3,750	6,543	4,681	+16.6%	5,458
Diagnostic Angiogram and Follow-on PCI	1,500	2,617	2,200	3,838	3,000	5,234	1,152	+75.1%	2,017
PCI Only							864	+6.1%	917
Electrophysiology – ICDS	100	174	700	1,395	N/A	N/A	159	+124%	197
Electrophysiology – Pacemakers	450	785	900	1,570	N/A	N/A	718	0%	718
Electrophysiology – Other	150	262	350	611	700	1,221	210	-20.4%	167

Source: British Cardiac Society Guidelines/Provider Activity Data

The above estimates for diagnostic angiography and PCI have been reviewed by our team and planning estimates for 2010 developed, as outlined in Table 3.4 below. These take account of a review of the most recent UK PCI activity which shows a slowing in the rate of rise of PCI. The growth of 15 to 20 per cent per annum seen over the last five years is likely to slow to around 10 to 12 per cent per annum. Furthermore, a higher proportion of patients are presenting acutely (via accident & emergency) rather than through the out-patient clinic. This will lead to a reduction in the number of patients requiring diagnostic angiography only, but will lead to an increase in those requiring angiography and follow-on PCI as a single procedure. Referrals for cardiac surgery are likely to decline but there will still be a cohort of patients with diffuse or single vessel disease who should be offered coronary artery bypass grafting. The ratio of PCI to CABG, however, is likely to be around 3 or 4 to 1. Revised planning estimates which take account of these changes are outlined in Table 3.4 below.

Table 3.4
Revised Estimates for Diagnostic Angiography and PCI

	PMP	Activity
Diagnostic Angiography (Total)	3,000	5,100
Diagnostic Angiography leading to medical treatment	1,900	3,230
Diagnostic Angiography leading to CABG	500	850
Diagnostic Angiography leading to separate PCI Procedure	600	1,020
Diagnostic Angiography and Follow-on PCI in One Session	1200	2,040
Total PCI	1800	3,060

Source: Cardiac Advisor

Electrophysiology (ICD's)

Implantation of ICDs is a relatively new area in interventional cardiology. NICE guidance published in 2000 recommends their use in certain sub-groups of patients with very specific characteristics and it was suggested that an implant rate of approximately 50 per million population (PMP) would be appropriate for the UK as a whole. Implant rates in NI (including bi-vents) are currently running at about 93 per million population. The second report of the British Cardiovascular Working Group (April 2006) has shown that NI is out-performing the other home nations in relation to implant rates at approximately 50 pmp, only Scotland comes close with Wales lagging well behind at 30pmp. This would suggest that the rate of increase in NI would slow relative to the rest of the UK over the next 5 years to 2010.

Electrophysiology (pacemakers)

The second report of the British Cardiovascular Society Working Group (April 2006) reveals that 518 new or replacement pacemaker implants are currently undertaken in the UK per million population. NI lags behind the rest of the UK (approximately 310 pmp in 2004 and 422 pmp in 2005). The 2005 figures include 335 pmp new pacemakers.

Summary

Based on the above analysis, we would recommend that the Department plans on the basis of the following range of activity targets for interventional procedures by 2010:

- Diagnostic angiograms: 5,100 (based on our review of recent UK PCI activity) to 5,500 (based on growth being maintained at actual levels experienced in NI over past 5 years);
- Diagnostic angiogram and follow-on PCI: 2,020 (based on growth being maintained at actual levels experienced in NI over past 5 years) to 2,040 (based on our review of recent UK PCI activity);
- Diagnostic Angiogram leading to separate PCI procedure: 920 (based on growth being maintained at actual levels experienced in NI over past 5 years) to 1,020 (based on our review of recent UK PCI activity);
- Electrophysiology - ICDs: 170 (based on British Cardiac Society lower level estimates) to 200 (based on growth being maintained at actual levels experienced in NI over past 5 years);
- Electrophysiology – Pacemakers: 720 (based on growth being maintained at actual levels experienced in NI over past 5 years) to 960 (based on 450 pmp population new pacemakers outlined by D Hackett as the target for the UK as a whole, with the same proportion of replacement pacemakers as at present i.e. 26%);
- Electrophysiology – other: 170 (based on growth being maintained at actual levels experienced in NI over past 5 years) to 260 (based on British Cardiac Society lower level guidelines).

However, given the uncertainties in the literature at present regarding the future direction of interventional cardiology and cardiac surgery, we recommend that all planning assumptions are kept under regular review.

3.2 Service Targets

Based on our review of literature and current performance achieved in provider units, we would recommend use of the following service targets for interventional cardiology.

- Targets outlined in the British Cardiac Society Clinical Governance Peer Review Standards should be met by all units. These currently include:
 - All units undertaking coronary angiography should perform \geq 500 procedures per annum, carried out by \geq 2 trained operators;
 - Each trained operator should perform \geq 100 cardiac catheterisations per annum;
 - Units undertaking PCI should perform \geq 200 procedures per annum, carried out by \geq 2 trained operators;
 - Each trained PCI operator should perform \geq 75 procedures per annum;
 - Trainers should perform \geq 125 PCI procedures per annum;

The above targets should be updated in line with any changes arising from the British Cardiac Society and should be measured and monitored as part of the clinical governance framework developed by the clinical network.

- Target throughput per laboratory session should be in the following ranges:
 - Diagnostic angiograms – 5 per session;
 - Angioplasty (single vessel) – 3 per session;
 - Pacemakers – 2-3 per session;
 - Bivent pacemakers – 1 per session.

A session represents a morning or afternoon in the catheterisation laboratory and lasts for approximately 4 hours;

- To reduce waiting lists so that patients have to wait no longer than 8 weeks for an out-patient appointment with a cardiologist, no longer than 13 weeks for a diagnostic angiogram, and no longer than three months from angiogram to follow up PCI.

4. FUTURE CARDIAC SURGERY NEEDS AND SERVICE TARGETS

It is anticipated that the overall demand for cardiac surgery procedures is likely to remain fairly constant over the next few years. The number of CABG procedures is likely to remain constant or decrease, while valvular work is likely to experience a small but consistent growth.

Estimates of CABG to PCI ratios indicate that demand levels for cardiac surgery are likely to remain within a range of 950 – 1100 cases for the foreseeable future. Analysis of the costs of undertaking cardiac surgery procedures at the Royal Hospitals, compared to current costs of having this

service provided elsewhere in ROI and GB, has shown that it is more cost effective to have the service delivered locally. Therefore, it is recommended that DHSSPS work with the Royal Hospitals to increase capacity locally, as necessary, in response to prevailing demand.

It should also be noted that the DHSSPS is currently considering future provision for patients in NI requiring paediatric cardiac surgery and is exploring relationships with UK and Republic of Ireland providers.

4.1 **Service Targets**

Based on the work undertaken to date we would advocate that future targets set for the cardiac surgery directorate at the Royal should include the following:

- One NHS patient operated on per funded theatre session. Theatre data should be rigorously monitored and audited to ensure the most effective use of theatre capacity and to identify situations where theatres sessions are lost as a result of the following:
 - simple cases develop complications in theatre that extend the theatre time into the second theatre slot;
 - cancellations resulting from the patient condition on admission, staff illness or lack of facilities (e.g. ICU/Ward bed unavailability).

A target of <5% cancellations arising from the above factors should be established.

- Average Length of stay in HDU/ICU should be monitored and following the development of applicable discharge protocols, the Royal should be aiming to achieve LoS comparable to that of the hospitals in the North West Heart Group (2.4 days);
- To reduce waiting times consistent with service performance targets.

5 **PERFORMANCE IN CARDIAC SURGERY**

5.1 **Comparison to UK Benchmarks**

Benchmarking data has been used to compare performance at the Royal Hospitals to UK peers. Areas considered include:

- average throughput per funded theatre session;
- throughput per ICU bed;

- comparison to national average HRG costs;
- comparison to national average lengths of stay; and
- comparison to applicable waiting list targets.

As part of the information gathering process for this review, York Health Economics contacted a number of cardiac surgery facilities in England, of which six replied, to obtain benchmarking data. Data was obtained by York Health Economics in 2005 and is reproduced in Appendix II.

Throughput per theatre session achieved at the Royal Hospitals during 2004/5 was 0.96 NHS cases per funded theatre session. This is in the middle of the results from the six benchmark hospitals.

Throughput per funded ICU/HDU bed at the Royal Hospitals in 2004/5 was 67.9. This compares favourably to three of the benchmark hospitals who achieved throughput per ICU bed of 42, 58 and 51 respectively. However, three of the benchmark hospitals achieved significantly greater throughput per funded ICU bed, achieving levels of 78, 96 and 105 respectively.

5.2 HRG Costs

Appendix III compares HRG costs for the major procedures undertaken in the Royal Hospital's cardiac surgery unit to national benchmarks from the 2003/4 Reference Costs.

Costs achieved by the Royal Hospitals in 2003/4 for cardiac valve procedures are lower than national benchmarks. These procedures account for approximately 34.5% of total expenditure in 2003/4. For all other procedures, costs incurred at the Royal Hospitals are higher than for national benchmarks. If costs were at national benchmark levels for all procedures, annual savings of approximately £318k for elective and £101k for non-elective procedures could potentially be realised

The Royal Hospitals should investigate the cause of variations in HRG costs when compared to national averages in conjunction with benchmark partners, the objective being to meet or better national averages for all procedures.

5.3 Average Length of Stay

Appendix IV gives the average length of stay for the major procedures undertaken within the cardiac surgery unit at the Royal Hospitals (these account for 91% of total bed days).

In general, the average length of stay for the major procedures undertaken at the Royal Hospitals is below the national average (based on the mean).

For some CABG procedures, however, LoS is higher than national averages. This may be a reflection of the fact that a number of routine cases are transferred out of NI to GB and ROI. However, the cause of such variations should be investigated by the Royal Hospitals with the objective being to meet or better national average LoS in all procedures.

5.4 Waiting Lists

There has been a significant reduction in the waiting list between 2001 and 2006. 504 adult and 41 paediatric patients were on the waiting list in March 2001, compared to 226 adults and 17 paediatric patients in March 2006. This reduction has been achieved largely by sending patients outside NI for treatment in recent years. Having met the 6 month maximum waiting time target in March 2006, the challenge for the Royal Hospitals now is to maintain shorter waiting times and further improve patients' access to cardiac surgery.

5.5 Cardiac Surgery Clinical Practice Standards

As part of this review of cardiac surgery services, Deloitte sought an opinion on clinical practice at the Royal Hospitals to determine if any improvements to current systems could be identified. A summary of the recommendations contained in this opinion is given below:

- criteria should be agreed between cardiologists and the cardiac surgeons relating to patients who undergo angioplasty so cardiac catheterisation meetings focus on only those patients who need to be discussed. Patients undergoing angiography should be divided into:
 - those for ongoing medical therapy and/or further investigation;
 - those for surgery;
 - those for angioplasty; and
 - those for discussion at joint meetings.
- for all first time coronaries, referrals should be on the basis of a “Dear Colleague” letter, with a unit administrator allocating cases to surgeons on a weekly basis based on their current waiting list. Similarly, cardiac in-patients should be allocated to cardiac surgeons on a pro-rata basis;
- good quality, graphical, waiting list information should be reviewed by the unit administrator and cardiac surgeons on a weekly basis, and should also be provided to other cardiac surgeons and cardiologists;
- the long term aim should be to introduce a patient agreed booking system in outpatients, whereby patients only make one visit pre operation and have all preoperative tests completed at this session;
- inpatient referrals should be allocated on a pro-rata basis, with surgeons setting aside dedicated theatre slots each week to undertake inpatient emergencies. Inpatients should be split into two types: urgent inpatient referral and urgent out-patient scheduled surgery. Patients in the latter category can be assessed on the ward, attend a pre-admission clinic and leave hospital with a scheduled elective operation date;

- transfer protocols should be developed regarding the transfer of patients from other regional hospitals to the Royal Hospitals Cardiac Surgery Unit. This should include diagnostic information to accompany the patient on arrival;
- management information needs should be considered by senior directorate management and the means of obtaining such information identified. Information routinely provided to cardiac surgeons should include:
 - risk profile of patients;
 - case mix of patients treated;
 - pre-operative length of stay (by procedure i.e. first time CABG, valve only, valve and CABG split into elective and non-elective cases);
 - post-operative length of stay (by procedure i.e. first time CABG, valve only, valve and CABG split into elective and non-elective cases); and
 - length of stay in ICU/HDU.;
- consideration should be given to the expansion of nursing roles, including nurse assistants for theatres, nurse case managers, nurse led follow up clinics and nurse consultants.

6 CONCLUSIONS

This review has shown that a lot of good practice has been established within interventional cardiology and cardiac surgery units in Northern Ireland. This is at a time when demand for interventional cardiology in particular has increased significantly, a trend which is set to continue over the next five years. As with any service, however, the review has identified areas where current practices could be further improved and several recommendations have been developed in relation to:

- a. development of clinical networks;
- b. setting robust performance standards and ensuring all units meet all appropriate clinical standards;
- c. changing processes to further streamline patient flows and ensure an efficient and effective service is provided;
- d. provide appropriate management information to facilitate service improvement; and
- e. maximise the role of all of staff as part of a multidisciplinary team.

APPENDIX I
Terms of Reference

The terms of reference for the review are as follows:

1. to review trends over the past 10 years in the prevalence of ischaemic heart disease and its mortality/morbidity in Northern Ireland with other countries (GB/Europe, US);
2. to review trends in service demand over the past five years including waiting times for cardiac surgery and cardiology, with particular reference to invasive investigation and treatment;
3. to review the trends in treatment activity including CABG/PCI and valvular procedures/surgery over the past 5 years in Northern Ireland, compared with other countries. (GB, Europe, US);
4. to assess the implications of advances in cardiology and cardiac surgery, including electrophysiology, implantable devices, drug eluting stents, primary angioplasty and their likely impact on service provision;
5. to use the information gathered at points 1, 2, 3 & 4 to anticipate future demand over the next 5 to 10 years for both cardiology and cardiac surgery and to identify service and workforce and financial resource implications;
6. to compare case mix adjusted activity and staffing and financial resources by hospital in Northern Ireland for interventional cardiology and cardiac surgery with similar units elsewhere in the UK;
7. to undertake a comparative cost analysis of treatment regimes including interventional procedures and surgery;
8. to consider the implications for workforce planning of changes to surgical staff training, i.e. cardiothoracic versus separate cardiac and thoracic;
9. to draw conclusions regarding efficiency and effectiveness of cardiac surgery services provided by the Royal Group of Hospitals and to make recommendations for improvement;
10. to draw conclusions regarding efficiency and effectiveness of interventional cardiology services provided by the Royal Victoria Hospital and other Trusts in NI and to make recommendations for improvement;
11. to provide advice on future, needs/demands for future investment in cardiac viz a viz cardiology services to meet local needs and to quantify outputs and outcomes to be achieved from further investment;
12. to make recommendations, on future activity targets and strategic developments required to achieve them.

APPENDIX II

Activity Generated from Cardiac Surgery Benchmarking Research

Table I
Activity Generated From Benchmarking Research

Info Request No.		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	RVH
1	Funded WTE Consultant Surgeons							
	Cardiac	8	4	5.5	3	5	4.2	5.0
	Cardiothoracic	0	0	0	3	1	0	
2	In Post WTE Consultant Surgeons							
	Cardiac	8	4	5.5	3	5	4.2	4.1
	Cardiothoracic	0	0	0	3	1	0	
3	Target in-patient cardiac surgery activity (FCEs)	No target	650	1079	1210	1000	704	N/A
	Target per WTE Consultant Surgeon		162	180	242	167	168	N/A
4	Actual inpatient cardiac surgery activity (FCEs)	1731	630	1088	1086	920	818	807
	Actual FCEs per WTE surgeon	216	158	181	217	153	195	196
5	Theatre sessions made available to cardiac surgeons (per week)	5PAs = 2 10 hour days	4.25	5	5.7	3.5	4	4
6	Target throughput per theatre session	1 case	1 case	1 case	1 case	1 case	1 case	1 case
	Theatre sessions available (no. of surgeons x sessions per week x number of operating weeks)	1600	748	1,260	1197	651	706	840
	Actual Throughput per theatre session	1.08	0.84	0.86	0.91	1.41	1.16	0.96

Info Request No.		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	RVH
7	Average Number of operating weeks for a cardiac surgeon	40	44	42	42	31	42	42
8	No ICU beds for cardiac surgery	10-12	6	14	8/6	8	8	13
9	No HDU beds for cardiac surgery	6	-	12	6/8	8	8	ICU/H DU
	Throughput per ICU/HDU bed	96-108	105	42	78	58	51	67.9
10	Arrangements for transfer of long stay cardiac surgery patients to other intensive care facilities	No	No	No	Limited number of general ITU	Yes Agreement to take long stay cardiac patients	7 patients	No
11	Fast Tracking arrangements in place	No	No	No	Approx 30-40% of patients fast tracked from CITU to HDU		No, following a trial the practice was abandoned due to the lack of evidence of cost savings	No

APPENDIX III

Cardiac Surgery – Comparison to National HRG Costs

Table II Comparison to National Benchmark HRG Costs

HRG Code	Description	Elective		Non-Elective	
		Royal Hospitals Unit Cost	National Benchmark	Royal Hospitals Unit Cost	National Benchmark
		£	£	£	£
E03	Cardiac Valve Procedures	9,091	9,640	9,389	10,683
E04	Coronary Bypass	7,845	7,066	7,686	7,356
E40	Other Cardiothoracic or Circulatory Procedures >18	7,170	2,985	6,650	2,803
E41	Other Cardiothoracic or Circulatory Procedures <19	6,726	4,567	5,773	2,840
S19	Complications of Procedures	3,247	1,692	2,676	1,162

Source: Royal Group of Hospitals/NHS Reference Costs 2004

APPENDIX IV

Cardiac Surgery – Average Length of Stay

Table III Average Length of Stay

Procedure		2003/4			National Benchmark (Mean)	Difference in ALoS	(Reduction) or Increase in Bed-days
		FCE	Bed Days	ALoS			
K25.3	Plastic Repair of Mitral Valve - Prosthetic Replacement	41	610	14.9	16.1	1.2	50.6
K25.9	Plastic Repair of Mitral Valve – Unspecified	9	103	11.4	15.3	3.9	35.1
K26.3	Plastic repair of Aortic Valve - Prosthetic Replacement	121	1265	10.5	14.2	3.7	453.4
K41.1	Other Autograft Replacement of Coronary Artery - 1 artery	55	807	14.7	11.1	(3.8)	(196.5)
K41.2	Other Autograft Replacement of Coronary Artery - 2 arteries	141	1360	9.6	10.7	1.1	148.7
K41.3	Other Autograft Replacement of Coronary Artery - 3 arteries	177	1574	8.9	12.2	3.3	585.4
K41.4	Other Autograft Replacement of Coronary Artery - 4+ arteries	123	1444	11.7	8.6	(3.1)	(386.4)
K47.3	Repair of Coronary Artery	4	116	29.0	N/A	N/A	N/A
Total		671	7279				690.3

Source: Royal Group of Hospitals/Hospital Episode Statistics 2003/04