

**A Review of Cardiology Catheter Laboratory Services
Report to the Eastern Regional Health Authority**

**From Public Health Direct Ltd
Final Report**

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A review of cardiology catheter laboratory services

Final Report

This report has been prepared following a review of cardiology laboratory services in the Eastern Regional Health Authority. The membership of the Steering Group was as follows.

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Executive summary

Introduction

The Cardiovascular Health Strategy (Building Healthier Hearts) sets out a strategic plan (211 recommendations) to reduce heart disease mortality and morbidity experienced by Irish people. One quarter of all deaths in the Eastern Region are caused by heart disease and Ireland has the highest premature mortality rate (under 65 years) from heart disease in the EU. While death rates are on the decline, hospital admissions and discharges are increasing slightly. Targeting effective interventions is an important factor in reducing the burden experienced by people from heart disease. Catheter laboratories offer a wide range of services from diagnosis such as angiography to treatment (angioplasty, electrophysiological work (EP)).

As part of the Eastern Regional Health Authority's overall strategy to improve the prevention and management of heart disease, the Cardiovascular Health Strategy Steering Group commissioned a review of cardiology catheter laboratory services. Following an open tendering process an outside consultancy firm, Public Health Direct, was selected to undertake this review. The terms of reference for the review are described in section 1 of the Report. The review has been carried out over a six-month period from March to September 2002 and has involved face-to-face contact with staff of the Authority, provider organizations, professional staff, professional organizations and the private sector. Developments in this field of cardiology in Europe and the United States have been incorporated.

The key question for the Region is whether the need for laboratory services, (both for the Region's own population and for those who are referred in), are being met by existing laboratory services and whether they have sufficient capacity to meet future needs over the next five years.

Current needs for catheter laboratory services

Although the Irish death rate from coronary heart disease in the under 65 year age group is the highest in the EU the Eastern Region has a significantly lower standardised

mortality rate than Ireland as a whole. The incidence of ischaemic heart disease among men and women rises with age.

In estimating 'need' Building Healthier Hearts set a national target of 1200 angioplasties per million population by the year 2002, and projects that the European average will be 2000 angioplasties per million by the year 2010. The current rate in the United States of America is 2000 per million with an annual growth rate of 5% (American Health Association 2001)

Another important measure of need is the waiting list. Although strictly a measure of demand it does demonstrate that existing demand is not being fully met. While the overall numbers waiting for cardiology procedures in the region has fallen from 1365 in March 2001 to 1076 in March 2002, waiting numbers and times remain an issue of concern.

Current supply of services

The Authority uses an accepted norm of 1.4 million population when planning for local services and 2.5 million when dealing with tertiary procedures. Within the Eastern Region cardiology catheter laboratory services are provided in five public hospitals, the DATHs, (The Mater, Beaumont, St James's (two laboratories), St Vincent's and Adelaide & Meath incorporating the National Children's Hospital, (AMNCH), and additionally in two private hospitals (the Mater Private (two laboratories) and Blackrock Clinic) giving a total of nine laboratories.

When analysing the activity in these hospitals, 2001 data gathered as part of this review shows that 16,564 procedures were carried out including 11,873 angiograms and 2843 angioplasties. Taking the total figure of 2843 angioplasties, carried out in both public and private sector, and applying it to an estimated referral population of 2.5 million this represents an angioplasty rate of 1137 per million in 2001 which closely approximates to BHH target of 1200 per million. Seventy percent of this work is carried out in the public hospitals and approximately half of these procedures were carried out on patients resident

outside the Eastern Region. Activity and waiting list information indicates an inordinate load experienced at the one laboratory at the Mater hospital.

Current activity in the Eastern Region 2001

Hospitals (Adults)	No.of Labs	Angio Grams	Angio plasties	Ratio of A'grams to A'plasties	Total of all Procedures
Mater	1	2180	666	3.27	3147
Beaumont	1	1400	250	5.60	2152
St James's	2	2162	718	3.01	3217
St Vincent's	1	1254	190	6.60	1689
AMNCH	1	1200	157	7.64	1488
DATHs	6	8196	1981	3.64	11693
Total		69.03%	69.68%		70.6%
Private Hospitals					
Mater Private	2	2215	617	3.59	3107
Blackrock Clinic	1	1462	245	5.97	1724
Private Hospitals Total	3	3677	862	4.27	4831
		30.97%	30.32%		29.4%
All Adult Hospitals Total	9	11873	2843	3.81	16564

Source: Public Health Direct

In addition to the current activity, estimates are given of the maximum capacity of existing laboratories and the total number of angioplasties that could be carried out when new laboratories come on stream. There are several caveats within the report including the uncertainty surrounding the plans to expand catheter laboratory facilities in the other regions of the country.

The five DATHs have very different histories regarding referral patterns. Both the Mater and St James's have on-site cardiac surgery and are major referral centers. The other three hospitals serve large local populations and also accept referrals from wider catchment areas. In planning future services, consideration would have to be given to the provision of services at these hospitals to the total population in their own area together with recognition, where appropriate, of those parts of the surrounding Health Boards, which naturally feed into them and other historical referral patterns from around the country. Planning should take into account the needs of this population base, the plans for developing catheter laboratory services around the county and whether it is desirable to establish twin laboratories in each major hospital.

Workforce Plan

There is a substantial variance within hospitals in terms of the length of the working day. This too may be caused by differences in establishment and availability of staff. Current staffing levels in this specialty need to be benchmarked, reviewed and a comprehensive workforce action plan be developed to ensure that there are appropriately trained staff in sufficient numbers to meet the Authority's strategic objectives both current and planned in this field

Changes in practice and future needs

The main pressures that should influence the total planned future activity are:

Population Growth: The population base for planning purposes is of 1.4 million for local services and 2.5 million for highly specialised services and the population historically referred. Population projections from the Central Statistical Office show that over the period 1996 to 2030 the East will be the fastest growing area with increases of 56%. What is difficult to calculate is the extent to which catheter laboratory developments throughout Ireland may alter the referral patterns to the Eastern Region. What is likely to occur is a phased reduction in the referral of patients for diagnostic work and an increase in referral for treatment work (i.e. angioplasty, EP) and other complex procedures in this evolving branch of cardiac medicine .

Growth in repeat procedures: Although developments in this branch of medicine result in improvements in the outcome of treatment (i.e. stents) such procedures may not necessarily offer a permanent solution and many patients will return for further treatment procedures. Current best estimates are that within one year patients arteries may narrow (re-stenose) in 10% - 15% of cases and 40% - 50% over five years. Furthermore in the Electrophysiology (EP) area the need for regular follow up and assessment is clearer as well as the burden of replacement of treatments such as pacemakers and implantable defibrillators.

Incident prevalent issue: The natural history of cardiovascular disease in Ireland, the growth in aging population, the increasing survival with current treatments and the changing pattern of patient management suggests that there is likely to be a pool of cardiovascular disease that has not yet been treated. Before need is met by the current target rate (1200 per million) there is therefore a need to catch up over a period of several years and this problem may result in high waiting lists in the short term. Addressing this issue will require an increase in the target rate of 1200 per million procedures.

Other influencing factors

It is important that early warning systems are established so that innovations that may have a profound influence on practice can be taken account of at the earliest possible stage. However, predicting all significant influences on demand for catheter laboratory services would seem unlikely given the overall uncertainty regarding innovations.

Another pressure that relates to the capacity is the need to accommodate emergency cases, i.e. primary angioplasty. Although laboratories may run at maximum capacity this may not be sustainable in the long term. Cardiologists refer to an ideal planned activity level that does not exceed 85% of full capacity. .

What is most difficult to estimate is the impact of future developments in this branch of cardiology. Factors to be considered include:

- **EP (Electrophysiology):** Historically a gap between EP services in Ireland and elsewhere is noted. If one were to accept the UK NICE recommendation of 50 implantable defibrillators per million this would be a five-fold increase on current practice. Although the numbers are relatively small based on complexity it is estimated that EP work alone will require additional capacity equivalent to approximately 68% of an efficient laboratory.

- **24 hour service:** In considering the future management of patients with acute myocardial infarction the review concludes that this is an appropriate development which will require appointment of adequate levels of staff to allow for an around-the-clock service availability within the region.

- **Recent and anticipated future developments:**
 - New definitions for myocardial infarction (heart attack) mean that many more patients will be diagnosed and as these will be 'milder' myocardial infarction the survival rates will improve and a larger proportion will be eligible treatment in a catheter laboratory
 - The more recent development is in early intervention treatment (i.e. primary angioplasty) for myocardial infarction and 'unstable angina'. However, one should not ignore future possibilities of pharmacological thrombolysis. Consequently developments are anticipated in non-mechanical delivery that may contribute to reduction in use of catheterisation in the longer term.

- **Changes in Clinical Practice**
 - Another anticipated change in practice is an increasing intervention in patients with irregular heart beat (arrhythmias). This will put increasing demands on the electrophysiological service and is likely to lead to more pacemaker and implantable defibrillator insertions. It is difficult to predict other developments that may occur. Cardiological opinion is that while

the numbers of laboratory procedures may not increase greatly, the complexity of the procedures is likely to create more pressure on time and space in the mid-term.

Proposals to meet these activity targets

At the time of this report there are two approved capital hospital programmes. One at St Vincent's hospital, is part of the current major development at this site (due to open in 2004/5) and was envisaged as a replacement for the existing laboratory. However, it is proposed by the hospital that the existing laboratory will continue to function when the new laboratory is opened (although the formal application for recurrent funding to support a second laboratory has not yet been submitted).

The other approved scheme is part of the 2008 major capital development at the Mater hospital, which will give a total of three adult laboratories on this site.

In addition to the two capital schemes there are two submitted proposals under consideration by the Authority. One of these, at the Mater, is for the establishment of a second laboratory and is argued from the standpoint of reducing current unacceptable pressures, improving workload management and improving the electrophysiology services on the north side of the city. The other from St James's involves the development of an existing lead lined room into a third laboratory. This development would be a major improvement in electrophysiology services and further strengthen the collaborative arrangements on the south side of the city.

There are other opportunities for increasing activity in existing laboratories. This applies to St James's and more particularly at St Vincent's and AMNCH. Key to all the above developments is the appointment of additional staff.

Strategic options

The following are the criteria upon which the Steering Group agreed future investment decisions should be made:

- Investment should be based on meeting the estimated need set out in this report, which is based on Building Healthier Hearts, European and international projections.
- Existing capacity must be maximised.
- Investment in developing additional catheter laboratories must be linked with activity performance at existing sites and the emergence of capacity constraints.
- Nationally agreed referral patterns and working relationship between laboratories and other acute hospitals that are likely to sustain and grow demand for services at these laboratories in the future.
- Cognisance is taken of investment already in progress for which additional major capital is not required.
- The commissioning of new laboratories would be based on comparison of the relative cost submitted by providers.
- Funding availability to the Authority for commissioning additional activity.
- That investment of capital and revenue resources in EP facilities would be based on agreement on the concentration of specialist work from a number of sites in these facilities.

The Review sets out a menu of four options that differ in capacity level, timing of provision of catheter laboratory activity and in meeting population need. Commissioning of further catheter laboratories is dependent on the criteria outlined above. Consideration is also given to commissioning work from the private sector.

Option Menu

	2004	2007	2008	Costs Range	Related Capital

	Number of PCTAs & (rate per million)	Number of PTCAs & (rate per million)	Number of PTCAs & (rate per million)	€ million	€ million
Option 1	4010 (1604)	4010 (1604)	4510 (1804)	2.5 - 4.8	0.2
Option 2	4510 (1804)	4510 (1804)	5010 (2004)	5.4 – 8.6	1.4
Option 3	4510 (1804)	6010 (2404)	6510 (2604)	5.4 – 11.8	1.4
Option 4	4010 (1604)	5510 (2204)	6510 (2604)	2.5 – 9.1	0.2 – 1.2

Note: Activity in 2001 was 2843 PTCAs (1137 per million)

PTCA = angioplasty

In line with the comprehensive estimate of need as set out above, options three and four can deliver the capacity over the medium term. These options support the immediate development of a 2nd laboratory at the Mater Hospital, maximize existing capacity, cater for phased growth in activity over the five year timeframe and increase the procedure rate for the population serviced in line with European targets with a range of costs outlined.

Other Relevant Findings

Equipment Replacement Fund

Based on experience to date it is appropriate to assume that equipment will need to be replaced after a ten-year period. In view of the high cost of equipment in cardiology catheter laboratories there is a case for provision of a fund for equipment replacement.

Estimates of equipment costs have come from three sources. A figure of €1,800,000 has been used to represent the cost of replacing equipment in a single laboratory. This has been multiplied by six to represent the possible cost of replacing the equipment in all six of the current laboratories (€10,800,000). An average equipment life of ten years has been assumed. This gives a possible annual equipment replacement budget of €1,080,000. To date it has not been possible for the Authority to address equipment replacement on a planned basis under the National Development Plan. If continuity of service and efficient workload management are to be maintained there is a need for dedicated equipment replacement funding over and above the existing National Development Plan.

Private sector role

In considering various options it is understood that within existing payment structures, as operated by the insurances companies, the current number of procedures, in the two private hospitals will remain relatively stable over the period from 2002 to 2008. The current total number of angioplasties in the two private hospitals is 862.

The Authority, in considering options to increase activity, is open to commissioning capacity from within the private sector as in previous waiting list initiatives.

Cardiology laboratory services for children

The issue of cardiology laboratory services for children is considered separately from adult services. Given the brevity of this children's review, the fact that there are different issues concerning children compared with adults, and that key stakeholders exist beyond the Eastern Region, it is important that a more detailed review take place.

Conclusion

The target of 1200 angioplasties per million (as set out in BHH) is almost attained. Seventy per cent of activity is carried out in the public hospital sector with approximately half of these procedures being carried out on residents of other regions. Despite current levels of activity there is still a substantial waiting list for laboratory interventions.

In looking to the future it is expected that there will be an increase in demand and an increase in patients who will need to return for repeat angioplasty and repeat procedures following initial insertion of pacemakers and implantable defibrillators. Projections have been made of the number of procedures that could be carried out in existing laboratories and in those additional laboratories that are currently under consideration. The planned increase in laboratory capacity will be critically dependent on an expansion of professional staff. Not only will posts need to be established but greater concern will have to be given to training, recruitment and retention of staff. This is one of several areas where the Authority should take the lead in ensuring a match between patient needs and the development of the workforce to meet those needs.

The Report makes the following recommendations.

- That the Authority, as a planning goal, supports the additional capacity outlined in strategic option four. This option will provide, over a phased basis, a level of activity that will meet local and national objectives.
- That decisions taken on current and future bids for hospital developments should fit within the Authority's strategic plan for catheter laboratories and investment in developing catheter laboratories on particular sites must be linked with activity performance.
- That, given the difficult financial climate for new capital developments and the competitive nature of future bids both at National and local level, future activity requirements should come, in the first instance, from existing laboratories.

- That current staffing levels in this specialty be reviewed and that a comprehensive workforce strategic plan be developed to ensure that there are appropriately trained staff in sufficient numbers to meet the Authority's strategic objectives in this field.
- That detailed discussions proceed with hospital providers to explain the apparently wide cost variance in procedures between hospitals.
- That estimating the current and future costs of the cardiology catheter laboratory services is problematic. In terms of current costs there is no agreed standard methodology for apportioning costs for a complex service that is currently funded across many different budget lines. This means that future costs are likely to be higher than those estimated based on current costs.
- That a model for a 24-hour service be developed.
- That, given the high cost of consumables, discussions should taken place with providers to ensure that maximum savings are achieved through central purchasing arrangements.
- Given the nature of the equipment it may be appropriate to assume that equipment will need to be replaced after a ten-year period. A figure of €1,800,000 has been used to represent the annual cost of replacing equipment in a single laboratory.
- That the Monitoring and Evaluation Directorate develop with provider hospitals a system of activity information that is more timely and more useful than the current systems. This would include waiting times for interventional cardiology catheter services.

- That an early warning system be developed concerning innovations and that appropriate measures are in place to assess the cost effectiveness of innovations prior to their being introduced.
- Given the brevity of this children's review, the fact that there are different issues concerning children compared with adults, and as a national service that key stakeholders exist beyond the Eastern Region, it is important that a more detailed review take place.

1. Introduction

1.1 Terms of reference

The purpose of the review was to ensure that existing cardiac catheter laboratories within the region were utilised to achieve maximum health and social gain and to plan an orderly development of diagnostic and interventional services, which required the infrastructure of a catheter laboratory. The assessment should have regard to factors such as:

- The existing services in the Region including current capacity and use and service delivery patterns
- Current patient flows to the Eastern Region for the range of procedures, which require catheter laboratory facilities
- Future demographic trends
- The expanding nature of the service as envisaged in ‘Building Healthier Hearts’ aiming at 1200 angioplasties per million population by 2002 and later a 24-hour emergency service
- Emerging technology and related procedures.

Following a competitive tender Public Health Direct, a UK based consultancy firm, was selected to carry out this work. The terms of reference for this review were set out in the original tender documents.

1.2 Methodology

The methodology was agreed at the first meeting of the Steering Group on March 22nd 2002 and was further described in the interim report that was considered by the Steering Group on 3rd May 2002. In summary, the review has involved extensive discussions with staff from the Authority, the Area Health Boards, the Dublin Academic Teaching Hospitals (DATHs), the Area Board hospitals, professional associations, general practitioners and hospital professional staff, including doctors, nurses, technicians and radiographers as well as private hospitals, the insurance industry and independent suppliers of catheter laboratory services. A list of these contacts is provided in Appendix 1. Public Health Direct has examined the documentation that describes the principles that

govern the Authority's approach to the planning and delivery of services. These include the Report of the Cardiovascular Health Strategy Group, Building Healthier Hearts (1999), the health strategy document, 'Shaping a Healthier Future' (2001); the Cardiovascular Strategy (2000); the National Health Promotion Strategy; Children First; The Ten Year Action Plan for the Elderly; the National Alcohol Policy; Quality and Fairness Report (2001), A Health System for You; Primary Care, A New Direction and The list of relevant documents is given in Appendix 2.

Throughout the review it has been recognised that the Authority in commissioning this review of cardiology laboratory services in the Eastern Region was fully aware that this topic could not be considered in isolation from wider issues concerning the reduction in heart disease as a whole. The Authority is currently developing a five year Action Plan that covers the whole range of cardiovascular interventions. It also recognised that the Eastern Region provided a very substantial service to people who were referred from outside the region and that account would have to be taken of the development plans in the other seven Health Boards. Underlying the review was the acceptance of a set of values that would influence future plans. They included the need for equity of access (between and within regions) and the balance between prevention and treatment of heart disease.

1.3 Structure of the Report

The Report is structured in the following way. Section 2 covers various aspects of need that underpin the national target of 1200 angioplasties per million population by the year 2002. Reference is made to the average European level of 1750 per million in 2000 and the likelihood that the average European figure in 2010 will be 2000 per million.

Sections 3 and 4 review current and future capacity in the Eastern Region and throughout Ireland. This is followed by factors that will influence future practice, which include the changing nature of the electrophysiology services, the development of a 24 hour service, innovations and the implication for future work load from patients who are returning for repeat and replacement procedures. There are also sub sections on staffing and training issues, working practices, the insurance industry and private sector roles. Section 6

describes the strategic vision for the development of cardiology catheter services. Section 7 provides a summary of current proposals. This is followed by a section that lays out the options facing the Authority and includes a provisional assessment of the budgetary implications. Section 9 considers the provision of laboratory services for children. Conclusions are outlined in section 10 together with a series of recommendations to the Authority. There follow several additional appendices. Appendix 3 presents an additional table that analyses activity by county of residence. Appendix 4 provides a set of situation reports for each of the Dublin Academic Teaching Hospitals and the Eastern Region's three Area Board hospitals. Appendix 5 describes the planned development of catheter laboratory services throughout Ireland. Appendix 6 provides additional financial information concerning the development plans for the electrophysiological services. Appendix 7 presents the alternative revenue costs of providing mobile or modular units. The final Appendix describes the provision of mobile and modular catheter laboratories available from the independent sector.

2. Estimate of need

There are several factors to take into account when estimating the need for cardiac catheter laboratory services. They include the underlying incidence and prevalence of cardiovascular disease; demographic trends; changing patterns of referral from outside the Eastern Region; changing patterns of referral regarding age and sex; waiting lists, national targets and comparisons with other countries, and the number of patients returning for repeat procedures. This final factor is considered in section 5.5.

2.1 Epidemiology

Estimates of incidence and prevalence are affected by definitions (for example, what constitutes angina, numbers of vessels occluded and degree of occlusion) and how these are measured. When discussing coronary heart disease, some authors include those who possess risk factors or those with asymptomatic mild coronary occlusion; others restrict their definition to those with chronic stable angina, unstable angina, acute coronary syndrome or myocardial infarction. One measure that has been widely used to represent incidence is ischaemic heart disease mortality. In 1999, the age standardised mortality was approximately 2 per thousand for men and 1.5 per thousand for women (Irish Heart Foundation, 2001). Although rates have been falling during the last 15 years, Irish men have the third highest mortality rates and Irish women the 6th highest rates when compared with 31 other countries.

The British Cardiac Society guidelines for the management of chronic stable angina noted a range of estimates of prevalence depending on questionnaire assessment, anti-anginal medication or use of GP services (de Bono, 1999). Estimates of incidence amongst men range from 0.44 per thousand for those aged 31-40 to 2.32 per thousand for those aged 61-70. The corresponding figures for women are from 0.08 per thousand to 1.01 per thousand respectively. This suggests that the incidence in men aged 31-40 was approximately 5.5 times that in women of the same age. In the 61-70 age-range the male incidence was approximately 2.9 times that in women. More reliable estimates are anticipated in the WHO MONICA project. This will give 'event rates' in Glasgow and Belfast, the two nearest centres (Kuulasmaa, 2000). Ireland coronary artery disease

mortality is now the highest in Western Europe (WHO, 2001; Irish Heart Foundation, 2001). Comparison of age standardised rates in Ireland with those for UK would suggest a standardised mortality ratio (SMR) (Ireland to UK) of approximately 117 for men and 110 for women. Although the Irish death rate for coronary heart disease in those under 65 is amongst the highest in the EU, within Ireland the Eastern Region has a significantly lower mortality rate than Ireland as a whole. In Wales models of need have adjusted upwards for SMR (Hamilton Kirkwood, 1999). More refined models of need have estimated the relative size of the pool of waiting and potentially waiting patients. One proposal has been to over-provide for five to ten years to reduce the pool to that comparable to other countries (West, 1999). The way in which coronary disease is managed differs substantially and different countries show wide variation in thresholds for referral, diagnosis and treatment. These are influenced by definition of incidence and prevalence as well as the provision, access and availability of services (Stevens, 1994).

2.2 Demography

In relation to demographic change, population projections have been estimated by the Department of Public Health, based on data made available from the Central Statistical Office. Although based on the census of 1996, the projections cover the period from 2001-2031 (CSO, 2001). In summary, they show that over the 35-year period from 1996 to 2030 the population of Dublin will grow by 56%. The earlier projections based on the 1996 census for the period to 2010 showed the total population of the Eastern Region was set to increase by 300,000. The highest users of the health services (those aged over 45) were set to surge in the coming years. In the east itself, the numbers aged between 45 and 64 will increase by 25%, while the number aged over 65 will go up by 13% between 1996 and 2006. Those aged over 85 are projected to increase by 40% by 2011. Although there has been some reduction in the incidence of myocardial infarction this has not been observed in other categories of cardiovascular disease. Confidence in such long-term projections will be influenced by data from the 2002 census. A preliminary report has just been published (CSO, 2002). This shows that the Eastern regional population is currently 1.4 million which represents 36% of the total Irish population of 3.9 million. More detailed figures will shortly be available showing the breakdown by age and sex.

Nevertheless, the existing figures are of great importance in predicting the need for cardiology services. There is clearly a demographic bulge and this will influence the future need for services. By modelling this and other factors the Report will show how future supply will meet the projected future need.

2.3 The delivery of services in the Eastern Region to out-of-region residents

Detailed work has been carried out by the Department of Public Health on the area of residence of those treated in the Eastern Region. The work was based on figures for 1999. Calculations were made of the minimum and maximum population base for each of the three Area Health Boards. The figures were based on the 1996 census population. Taking the whole of the area covered by the Eastern Regional Health Authority this showed a catchment population of a minimum of 1.6 million and a maximum of 2.45 million. The Authority uses an accepted norm of 1.4 million population when planning for local services and 2.5 million when dealing with tertiary procedures. The following table shows the number of Percutaneous Transluminal Coronary Angioplasties (PTCAs) carried out by Dublin Academic Teaching Hospitals (DATHs) in the Eastern Region by Health Board of residence for the years 1998, 1999 and 2000 (ERHA, 2001). It excludes the private hospitals.

Table 1 Number of PTCA procedures (excluding Stent double counting) in ERHA hospitals by Health Board of residence for the years 1998, 1999 and 2000

	1998	1999	2000
Eastern	622	800	727
Midland	109	101	119
Mid-Western	27	19	45
North Eastern	144	169	181
North-Western	73	93	85
South-Eastern	116	102	172
Southern	9	5	8
Western	42	54	49

Foreigners	2	7	5
Total	1144	1350	1391
% Non Eastern Residents	46%	41%	47.7%

Source: ERHA Department of Public Health.

The figures presented are patient-based and exclude double counting from the insertion of more than one stent. There was an overall increase from 1144 to 1391. The figures for residents of the Eastern Region went up from 622 to 727. Of all procedures carried out in the DAT hospitals in the Eastern Region in 2000, 47.7% were carried out on non-residents. What is of considerable interest from this table is the number of patients treated in the Eastern Region who were not resident in the Eastern Region. This showed that there were 522 non-residents treated in 1998, 550 in 1999 and 664 in 2000. Over this period the number of angiograms and PCTAs treated outside the Eastern Region increased. Although not too much should be inferred from comparisons between one year and the next it does suggest that even where there is expansion of facilities outside the Eastern Region the number of patients referred into the Eastern Regional actually increased. Table 2 shows the figures for Eastern Region residents by Area Health Board. The largest increase was for residents in the South Western Area Health Board.

Table 2 Number of PTCA procedures (excluding Stent double counting) in hospitals in ERHA by Area Health Board of residence for the years 1998-2000

	1998	1999	2000
East Coast	102	118	126
South Western	207	266	283
Northern	313	415	318
Total	622	799	727

Source: ERHA Department of Public Health.

The following table shows the estimates of the number of PCTAs that would need to be carried out in Ireland to meet the recommendations in Building Healthier Hearts (BHH, 1999) based on 1200 per million by the year 2002. It uses the published population figures based on the 1996 census. Calculations have been made of the numbers expected to be treated in the Eastern Region from each of the Health Boards of residence based on current referral patterns. The percentage of residents in any one Health Board who were treated in the Eastern Region varied from about 2% in the Southern Board to over 99% in MHB, NEHB and NWHB.

Table 3 Projected number of PTCAs that would need to be carried out in line with recommendations in Building Healthier Hearts

	Population 1996 Census	No. of PTCAs carried out in the Eastern Region 2000	Total No.of PTCAs recommended by BHH by 2002 throughout Ireland	No. expected to be carried out in the Eastern Region in the short term
ERHA	1,295,939	727	1555	1555
MHB	205,542	119	246	245
MWHB	317,069	45	380	Nil
NEHB	306,155	181	367	363
NWHB	210,872	85	253	245
SEHB	391,517	172	470	404
SHB	546,640	8	656	26
WHB	352,353	49	423	135
Total	3,626,087	1391*	4350	2973

Source: ERHA Department of Public Health.

* This figure excludes private provision. A further table that analyses activity in the Eastern Region by county of residence is provided in Appendix 3.

2.4 Changing patterns of referral regarding age and sex

In section 2.1 incidence figures were quoted for men and women based on mortality data and the data from stable angina. They suggested that the incidence in men aged 31-40 was approximately 5.5 times that in women of the same age and in the age range 55-64 was 3.9 to 1. In the 61-70 age range the male incidence was approximately 2.9 times that in women and in the age range 65-74 was 2.5 to 1. The following tables based on an analysis of returns as part of the Hospital Inpatient Enquiry (HIPE) for the year 2000 show the numbers of procedures and the male:female ratio. In the case of angiograms, the male:female ratios show no evidence of male bias (Table 4). In the case of angioplasties (Table 5) in one age group that is those under 45, the male:female ratio was higher than the expected epidemiological ratio (13 against 5.5). Without more detailed

information on the clinical cases it is difficult to conclude that there is currently a bias towards men and one cannot therefore infer that the future need for catheter laboratory services should be influenced by a requirement to redress a gender imbalance.

Table 4 Number of angiography procedures (codes 885 and 3721-3723) excluding double counting in ERHA hospitals in the year 2000 by age and sex

Age	Male	Female	M:F ratio	Total
<45	541	288	1.88	827
45-64	2420	1038	2.33	3456
65+	1465	877	1.67	2342
Total	4426	2199	2.01	6625

Source: ERHA Department of Public Health based on HIPE returns.

Table 5 Number of angioplasties (PTCA) as principal procedure performed in ERHA hospitals by age and sex

Age Group	Male	Female	M:F ratio	Total
<45	78	6	13.0	84
45-64	559	136	4.11	695
65+	341	190	1.79	531
Total	978	332	2.95	1310*

Source: ERHA Department of Public Health based on HIPE returns.

* This total differs by 81 from the 1391 shown in Table 3 due to incomplete information on gender.

2.5 Socio-economic factors

The recording of socio-economic status of patients is limited in the health service. Nevertheless, it is possible to use General Medical Services (GMS) status as a proxy. The following table shows the numbers of people who were admitted to hospitals in the Eastern Region in the year 2000 by GMS status with acute myocardial infarction and those who received angiograms and angioplasties.

Table 6 Admission and procedure by GMS status in the year 2000

	Acute myocardial infarction	Angiograms	Angioplasties
GMS	(42%) 616	(38%) 1,465	(39%) 285
Non GMS	(58%) 855	(62%) 2,430	(61%) 442
Total	1,471	3,895	727

Source: ERHA Department of Public Health.

Admission for acute myocardial infarction is a relatively good indicator of need and actual admission to hospital through Accident and Emergency Department is less likely to suffer from referral bias than some other conditions. Of those being admitted with this diagnosis 42% were GMS patients. One might therefore expect the same percentage to be seen in those receiving angiograms and angioplasties. The figures of 38% and 39% do not suggest any substantial bias.

Another approach to assessing inequality of access involves an analysis of public and private mix. The following table shows the public private mix within public hospitals in the Eastern Region for the year 2000 for the same condition as above.

Table 7 Public private mix in public hospitals in the year 2000

	Acute myocardial infarction	Angiograms	Angioplasties
Public patients	(76%) 1,117	(81%) 3,137	(75%) 528
Private patients	(24%) 354	(19%) 758	(25%) 199
Total	1,471	3,895	727

Source: ERHA Department of Public Health.

In trying to assess whether there is any bias towards treating private patients the percentage figures from the above table have been applied to the 2001 activity data that are available from both public and private hospitals. Table 8 shows the public private split in public hospitals and the use of private hospitals.

Table 8 The public private split in public hospitals and admissions to private hospitals (2000 figures applied to 2001)

	Hospital type	Angiograms	Angioplasties
Public patients	Public hospital	(81% of 8196) 6,639	(75% of 1981) 1,486
Private patients	Public hospitals	(19% of 8196) 1,557	(25% of 1981) 495
Total		8,196	1,981
Private patients	Private hospitals	3,677	862
Total in all hospitals	Both	11,873	2,843
Total private	Both	5,234	1,357

Source: Public Health Direct based on data supplied by ERHA Department of Public Health.

8196 angiograms and 1981 angioplasties were carried out in the public hospitals and 3677 angiograms and 862 angioplasties were carried out in private hospitals. If one assumes that the public private mix in public hospitals in 2001 was similar to 2000 (see figure above) then one can apply the 81% to 19% percent split for angiograms and the 75% to 25% split for angioplasties to the 2001 figures. This gives 6,639 angioplasties on public patients and 1,557 on private patients. If one then adds the 1,557 to 3,677, the number of angiograms to patients in private hospitals this gives a grand total of private angiograms of 5,234. As a percentage of all 11,873 angiograms this is 44.08% of the total. For angioplasties the percentage is 47.73 (1,357 of 2,843). These figures are approximate because those given for the private hospitals do contain a number of public patients treated under contract as part of the waiting list initiative.

A recent publication from the Central Statistics Office gives a figure of 51.4% for private health insurance in the Eastern Region (CSO, 2002). It would be reasonable therefore to use a figure of 50% for those living in the Eastern Region when calculating the likely demand for private investigation and treatment and when trying to calculate the relationship between need and demand for public services.

The benefits offered vary by individual health plans and information is not available on the detailed breakdown of these plans. It is clear from the description of the benefits that only those holding plans D or E would have full cover for treatment in either of the two private hospitals with cardiology catheter laboratory facilities. Those with plan C would be covered only at 40% for accommodation and 90% for procedures. Those with plan B and those with plan A would be covered at 45% and 90% and at 35% and 35% respectively. Without detailed knowledge of the numbers of individuals holding different plans it is not possible to draw conclusions on the equity issue. Although it is likely that there are differences in morbidity between those with and without out health plans and between those with different plans this information is not available. Nevertheless, the tentative analysis presented above does suggest that the socio-economic circumstances of individuals do not play a large part in determining the method of treatment. The view held by clinicians is that there is no bias in terms of method of investigation and

treatment towards those with health insurance. This may determine where the patient is treated but not how. The question of when the patient is treated is addressed below.

2.6 Waiting lists

Information on waiting lists is collected regularly from hospitals and submitted by the Authority to the Department of Health and Children. It is a useful reference source for comparing hospitals and for reviewing trends over time. However, until recently comparable waiting list information across the region was only available to the Authority at specialty level. The Authority has been working with providers to make available more comprehensive waiting list information on a routine basis. Specific catheter laboratory activity is not available and so cardiology activity has to be used as a proxy. In relation to cardiology, information includes length of time patients are waiting at procedure level, area of residence by Health Board and length of time on waiting list. Hospitals are at different stages in their capacity to provide this information on a routine basis and so at present comprehensive regional information at this level is not available.

From the information available in a comparable format there has been a reduction in overall numbers waiting for cardiology procedures in the region from 1365 patients in March 2001 to 1076 patients in March 2002. However both numbers waiting and waiting times remain an issue of concern. Of the 1076 patients awaiting cardiology procedures 384 patients had been waiting more than 12 months (218 patients have been waiting over 12 months for cardiology inpatient procedures and 166 patients waiting over 12 months for cardiology day procedures). Waiting list returns for March 2002 indicate that 52 patients have been waiting over four years for cardiology procedures. Where area of residence breakdown of the waiting list is available indications are that over 25% of those on cardiology waiting lists reside outside the Eastern region (31% of those awaiting an in-patient cardiology procedure and 15% of those awaiting a day case cardiology procedure reside outside the region). Not only are there long waiting times for investigation and treatment, there are long waits for patients to be seen in outpatients by a consultant cardiologist. The comments from General Practitioners confirm the length of these delays. It is likely, however, that attendances at Accident and Emergency

Departments are increased by patients who would under normal circumstances see a consultant cardiologist in outpatients but who, because of long waiting lists, take the A and E option. Waiting lists and waiting times are important indicators of unmet demand. In the past waiting list initiatives have led to the public sector contracting with the private sector to carry out elective procedures. This has happened both at the Mater Private Hospital and Blackrock Clinic in relation to cardiac surgery.

In October 2001 a cardiology questionnaire survey was carried out by the Authority's Public Health Department. The following table shows the then current number of patients on the waiting list for angiography and the average waiting times at October 2001.

Table 9 Number of angiograms on waiting list in October 2001

	Number on waiting list	Average waiting time
Mater	700	Not given
Beaumont	62	Not given
St James's	11	Three weeks
St Vincent's	28	Six days
AMNCH	32	Less than one month

Source: ERHA Department of Public Health.

Hospitals without catheter facilities were also asked how long it took for a patient to be admitted by one of the above hospitals for angiography. The results were as follows.

**Table 10 Waiting times for angiography for patients in Area Board hospitals
(October 2001)**

Hospital	Waiting time
Naas General	Two to fourteen days
Blanchardstown (JCMH)	Twelve days
St Michaels	Seven days
St Columcille's	Eight to twenty eight days

Source: ERHA Department of Public Health.

Even when waiting list figures are up-to-date it is well to remember that they can change quite rapidly if there are unplanned staff shortages or other exigencies in individual hospitals. In one hospital, nurse shortages, together with a winter vomiting epidemic, led to bed closures and the rapid increase in the number on the waiting list from in that hospital from 28 to 125.

2.7 National targets

The Irish target for angioplasties (PTCA) (BHH, 1999) is 1200 per million per annum. The Building Healthier Hearts Report went further by referring to the current and future European average. It stated that it expected the European average in 2000 to be 1750 per million and in 2010, 2000 per million. There does not appear to be a target for total revascularisations, that is angioplasties and coronary artery bypass grafts (CABGs). If one were to use the UK Department of Health figure for CABG of 750 per million (Dept Health 2000) this might suggest a figure of approximately 2000 per million revascularisations in Ireland. In fact the English National Service Framework has set a target of 1500 revascularisations per million (750 CABG + 750 PTCA) by 2010 (Dept Health 2000). This level of activity falls short of what is currently provided in many Western European countries. Scotland anticipates the PTCA/CABG ratio increasing to 3:2 rather than the 1:1 rate in England.

Although the UK may be an inappropriate model for Ireland, the system has been well described by the British Cardiac Society. In considering the number of diagnostic

angiograms that would be needed in the United Kingdom one can apply the usual guide ratio for investigations to revascularisation of 2:1. Fifteen hundred revascularisations would require 3000 investigations and adding for valve disease and grown up congenital heart disease gives a target figure of approximately 3300 diagnostic cardiac catheterisations per million per annum would be recommended (Brit Cardiac Soc, 2002). The fifth report from the British Cardiac Society was presented to their Annual General Meeting in May 2002. In Wales, taking account of their higher Standardised Mortality Ratios and a pool of waiting patients/potential patients arising from years of under-provision (compared with England), a target has been set at 4000 angiograms with a longer-term objective of 5000 angiograms (Todd, 1999). Applying the median Welsh figure of 4500 angiograms per million population to Ireland this would suggest a diagnostic angiogram figure of over 16,300 for Ireland as a whole and 11,250 in the Eastern Region. If one applies the English figures to the whole of Ireland the number of diagnostic angiograms would be approximately 12,000 and for the Eastern Region, 8,250. It is noteworthy that in contrast to the rate at which the number of PTCAs are increasing, the number of CABGs seem to be increasing less quickly. This will lead to a greater proportion of all revascularisations being carried out as PTCAs and will increase the PTCA:CABG ratio.

3. Current activity

Activity levels have been assessed by the Authority through three systems. The first is the regular HIPE returns and these have been analysed up to and including the year 2000. The second was a survey carried out by the Authority's Department of Public Health for the year 2000. The third has resulted from individual enquiries at each DAT Hospital by Public Health Direct during the review period in 2002. Not only has it been possible to trace the trends in activity over the last five years it has also been possible to compare the HIPE figures with those of the survey. Despite some limitations in the HIPE figures, they are sufficiently close to the survey figures to be able to use them with some confidence in describing broad changes in activity levels.

3.1 Current activity in the Eastern Region

The following table (Table 11) shows the activity figures for the five DATHs and the two private hospitals in the Eastern Region for the year 2001. The information was collected by inviting each hospital to provide its own figures and these have been confirmed by the respective hospital Chief Executives. It is still possible that different hospitals have used different definitions. For example, if a patient has a diagnostic angiogram and proceeds to angioplasty it may be that this is recorded as two procedures in one hospital (one angiogram and one angioplasty) and one in another hospital (angioplasty). This may depend on whether the procedures follow immediately one after the other or with an overnight gap. This possible discrepancy is not important when assessing the number of angioplasties but could be a factor when estimating angiogram to angioplasty ratios. The Authority may wish to enter into further discussions with hospitals with catheter laboratories in order to ensure the future reliability and validity of coding, in relation to angiograms, in patients who proceed to angioplasty.

Table 11 shows that approximately 30% of procedures carried out in catheter laboratories in Dublin were carried out in the two private hospitals. It also shows that in terms of activity per laboratory there are very substantial differences between the activity levels of different hospitals; differences between 1488 and 3147 procedures and 157 and 666 angioplasties.

Table 11 Current activity in the Eastern Region 2001

Hospitals (Adults)	No.of Labs	Angio Grams	Angio plasties	Ratio of A'grams to A'plasties	Total of all Procedures
Mater	1	2180	666	3.27	3147
Beaumont	1	1400	250	5.60	2152
St James's	2	2162	718	3.01	3217
St Vincent's	1	1254	190	6.60	1689
AMNCH	1	1200	157	7.64	1488
DATHs	6	8196	1981	3.64	11693
Total		69.03%	69.68%		70.6%
Private Hospitals					
Mater Private	2	2215	617	3.59	3107
Blackrock Clinic	1	1462	245	5.97	1724
Private Hospitals Total	3	3677	862	4.27	4831
		30.97%	30.32%		29.4%
All Adult Hospitals Total	9	11873	2843	3.81	16564

Source: Public Health Direct

Taking the total figure of 2843 angioplasties carried out in both public and private sector and applying it to the catchment population of 2.5 million this represents an angioplasty rate of 1137 per million in 2001.

Table 12 shows the activity by DATHs over the last four years. Care should be taken in making comparisons between years as the figures for the years 1998-2000 are based on

HIPE returns and those for 2001 have been supplied by each hospitals as described above. Nevertheless, it does show a substantial increase overall, as well as in individual hospitals.

Table 12 Number of angioplasties carried out in DAT Hospitals in the Eastern Region

Hospital	HIPE 1998	HIPE 1999	HIPE 2000	PHD 2001
Mater	494	589	536	666
Beaumont	65	95	35	250
St James's	429	479	585	718
St Vincent'	135	152	163	190
AMNCH	21	33	72	157
Total	1144	1348	1391	1981

Source: HIPE, the Authority's Public Health Department and Public Health Direct.

The activity regarding electrophysiological (EP) work is less easy to establish. This is partly to do with procedure coding but also because some EP work is carried out by general cardiologists and may be carried out other than in the catheter laboratories. This applies particularly to the insertion of pacemakers. The questionnaire survey referred to above collected information on EP activity across all hospitals in the Eastern Region. The following table shows the number of pacemakers and the number of implantable defibrillators for the year 2000 by hospital. Where information on 2001 was available it has been included.

Table 13 Numbers of pacemakers and implantable defibrillators by hospital in the year 2000 and 2001

	Pacemakers		Implantable defibrillators	
	2000	2001	2000	2001
Mater	159	189	4	17
Beaumont	150	250	4	na
St James's	198	180	13	20
St Vincent's	139	186	8	na

AMNCH	83	na	0	na
Total	729		29	

Source: Public Health Direct.

Information from the two private hospitals for the year 2001 gave total EP procedures of 103 at the Mater Private Hospital and 17 at the Blackrock Clinic.

3.2 Current activity throughout Ireland

Four of the seven health boards are currently involved in cardiac catheterisation; the Mid West Health Board (Limerick), the North Western Health Board (Sligo), the Southern Health Board (Cork) and the Western Health Board (Galway). These figures (based on the year 2000) were supplied to the National Taskforce on Cardiology Manpower Needs when the Health Boards were applying for additional consultant cardiology posts.

Table 14 Number of angiograms and angioplasties carried out in other health board regions for the year 2000 and 2001

	Angiograms			Angioplasties		
	2000	2001	Projected 2002	2000	2001	Projected 2002
MWHB	na	1136		na	154	
NWHB	0	328	400	0	0	
SHB	1290	1402		405	410	
WHB	c1000	1014	1600	c200	247	300
Total	c2290	3880		c605	811	

Source: Public Health Direct.

The figures shown for 2002 were provided by the respective Health Boards and are estimates of their full year position.

3.3 Existing capacity

When visiting each hospital attempts were made to assess whether the hospital could increase its activity by maximizing the potential of its existing infrastructure. If this were possible discussions took place concerning the barriers that would need to be overcome to take on additional cases. Some of these barriers are financial, others relate to absolute staff numbers, others to problems associated with increasing the length of the working day. It is difficult to escape the conclusion that there is some unused capacity in six of the seven hospitals in the Region, that is all with the exception of the Mater. The capacity issue is largely one of staff. There is a substantial variation in the length of the

working day between hospitals and in the length of shifts. The average number of procedures per day varies between six per day and twelve per day based on a fifty-week year. There are differing opinions concerning the length of the working day in terms of safety, and efficiency. There is a strongly held view amongst some clinicians that no technical, nursing or medical staff should have to be present physically in a laboratory for more than six hours per day and that the working day, including unplanned cases, should not exceed eight hours for any single individual. If the laboratories are going to be worked for more than six hours a day then safe staffing levels need re-examination. A system in which any staff are required to work more than eight hours a day without relief is potentially dangerous. If laboratories are to be used for very long periods they have to be staffed appropriately. Attention also has to be given to the demands that are placed on sophisticated equipment and the likelihood that this may lead to down time due to mechanical failure. Added to this is the fact that up to two weeks routine servicing is required per annum. Holidays have to be taken into account. In a single laboratory, emergencies, unplanned and unscheduled angioplasties and unplanned complex pacemaker insertions can lead to a substantial extension of hours. In order to cope with these factors it will be necessary to reduce the number of planned procedures per day. It may also be prudent to reduce the number of weeks available in the year that can be worked to 47 rather than 50.

A more recent development has been problems with in-hospital infection such as MRSA and the need to clean and disinfect laboratories after such cases have been dealt with. This results in the loss of up to one hour's time for each case. These problems are of course considerably lessened by the provision of twin laboratories.

Many issues are raised in the presentations from each hospital concerning barriers to expansion. Some of these are to do with the appointment of consultants, some to the need to establish additional posts, some to the availability of staff. Some are structural in terms of the proximity of day beds or ward beds, others are to do with prioritisation, for example, the availability of porters.

4. Future expansion possibilities

4.1 Future expansion possibilities in the Eastern Region

One of the observations that has emerged from the review has been the many examples of good collaborative relationships between organisations. This applies to the relationships between the Area Board Hospitals and the DATHs; between the DATHs themselves and between hospitals in the public and private sector.

Capital approved projects

At present there are two capital approved schemes that have implications for future cardiology laboratory capacity. The first of these is the hospital development at St Vincent's where a new wing is due to open in 2004. The new building will contain a cardiac catheter laboratory and a new vascular suite. The new laboratory is described as a replacement for the existing laboratory. It is understood that the cost of equipment for the new catheter laboratory has been included in the costs of the capital scheme. The new hospital development at St Vincent's allows for the provision of a second cardiology laboratory. This has been confirmed by the Hospital's Chief Executive, although the formal application for recurrent funding to support a second laboratory has not yet been submitted. It is proposed by the hospital that the existing laboratory will continue to function when the new laboratory is opened. The possibility of providing these laboratories back to back is being explored and has been accepted as a preferred solution. Such a development would be accompanied by the provision of a reception area, a recovery area and with day beds in the vicinity of the laboratory. Many of the problems of throughput at St Vincent's have arisen because of the difficulty in getting bed access for patients. They should be resolved by the proposed measures.

St. Vincent's is about to change with the establishment of common governance between the University Hospital and the Private Hospital. This brings an extra 168 beds on to the campus. Proposals to develop a catheter laboratory in the Private Hospital are being re-examined in the light of these developments and a partnership between the two institutions is likely to lead to a significant increase in the workload. It is envisaged that the governance issue will have been finalised by the end of 2002.

The second capital approved scheme is at the Mater and it relates to a major hospital building programme to be opened in 2008. This scheme has three adult laboratories within the new wing and it is understood that the new facility would replace the existing laboratory facility.

It is worth noting that there is great uncertainty about the availability of capital in the future and hospitals that have not yet secured approval may find that their schemes are substantially delayed.

Firm proposals

In addition to the two approved capital schemes there are two proposals that have been submitted to the Authority by provider hospitals for consideration for next year's budget. The first of these is at the Mater where there is a proposal to open a second laboratory in order to relieve some of the pressure in their one existing laboratories. The space they have in mind is small and would be suitable for some but not all procedures. It would allow some of the EP work to be moved to the second laboratory and this would ease the current situation. It is extremely difficult at present to manage the day's list if one EP procedure takes over four hours. The costs of equipping and running this second laboratory have been submitted. If this second laboratory were operational in 2003 this would allow an increase in the number of procedures at the Mater by an estimated 930 a year.

A further proposal is at St James's where they propose opening a third laboratory alongside the two existing laboratories. This development involves the equipping of the new laboratory and would require the appointment of additional consultant cardiologists. The plan to develop St James's as an EP centre is supported by the South Dublin Group of cardiologists. This proposal could result in a further 1200 procedures per year.

Preliminary outlines

In Public Health Direct's consultation with providers it emerged that a provisional proposal, developed by the cardiologists at JCMH, was being considered by the Northern Area Health Board. It has not yet been submitted to the Authority. This proposal is for a capital building scheme at JCMH to include a new catheter laboratory. It is supported by the wider national group of electrophysiologists. Further preliminary outlines were submitted by the other DATHs to the authority as part of their 2002 cardiovascular bids. Appendix 4 provides further details of the situation in individual hospitals in the Eastern Region.

4.2 Future expansion possibilities throughout Ireland

Information has been provided by each of the Health Boards on their plans for the development of interventional cardiology services. These were submitted in 2001 as part of the background to bids for increased cardiology consultants. Table 15 presents the catheter laboratory development plans. Below the Table there are specific notes explaining the status of the proposals.

Table 15 Plans for catheter laboratory development throughout Ireland

Board	Labs	Proposed labs	Approval status
EHRA	6 and 3 private	Additional 2 by 2008	Capital approved
MHB	0	1 at Tullamore	Capital approved
MWHB	1	0	
NEHB	0	1 at Drogheda	No approval to date
NWHB	Mobile	0	
SEHB	0	1	Unclear see below
SHB	1	4 at Cork	Capital approved
WHB	2	0	

The MHB has agreed that the Regional Cardiology Centre should be at Tullamore. Construction tenders have been received by the Department of Health and Children and this new development may be open in 2005. The design does include a laboratory but at

this stage the detailed specification of the equipment for the laboratory has not yet been agreed. This will determine, to some extent, the suitability of the laboratory for interventional cardiology.

The NEHB plans to develop Our Lady of Lourdes Hospital, Drogheda as the Regional Cardiology Centre. Although consideration may be being given to the inclusion of a cardiology catheter laboratory proposals have not yet been received by the Department of Health and Children for the establishment of a cardiac catheter laboratory on this site.

SEHB will soon be opening a new facility at Waterford (2002). The original specification was for a new laboratory within the X-ray Department. The plans and specifications have been proposed by the interventional radiologist at Waterford. It is unclear at this point whether the laboratory will be used for cardiac catheterisations and if so what level of activity will be achieved.

SHB has approval for a major new cardiac and renal centre in Cork. This has plans for five cardiac labs of which one is earmarked for electrophysiology. The timing of this development is not certain but the new facility is unlikely to open before 2005.

Appendix 5 provides a brief description of the submissions made by each Board to the National Cardiology Manpower Committee. Each Health Board stressed the need to establish further consultant cardiology posts and each discussed the possible future development of local catheter laboratory facilities.

5. Changes in practice and future needs

5.1 Electrophysiology services

Development of electrophysiology services in Ireland

Historically Ireland has been slow to introduce specialist electrophysiology (EP) services. Although the current review has not attempted to provide a detailed analysis of the development of the service our view supports the general view of cardiologists that this service remains significantly underprovided when compared with services in Europe and North America and may be as much as ten years behind developments elsewhere. Part of the recognition of under provision has come with the appointment of specialists in this field but they are few in number. Public Health Direct has received a submission from the six cardiologists in Ireland with a special interest in electrophysiology (Appendix 6). What is included here is a brief description of the procedures themselves and the need for these procedures.

The procedures themselves

Electrophysiologists commonly perform four types of invasive procedure. Studies that assess the risk of sudden death provide information on the mechanisms for supraventricular and ventricular arrhythmias. They typically take one to two hours and involve the placement of three or four pacing catheters in the heart. Radiofrequency ablation is the therapeutic component of EP studies. This would be performed after the above studies have been completed. Typically ablation is carried out at the same sitting as the EP study, prolonging the procedure by two to four hours. Conventional pacemakers for the treatment of slow heart rhythms are implanted by both general cardiologists and electrophysiologists. They take about one hour to perform. Battery life is about seven years. Biventricular pacing is a new form of pacing used to treat patients with heart failure. The procedure is more complex, requires an additional lead and is carried out by electrophysiologists. The implantation of cardioverter defibrillators (ICDs) is another specialist procedure. The battery typically lasts about five years. ICD follow up should involve three monthly visits to an ICD clinic.

Need for these procedures

It is estimated that, of those with supraventricular tachycardia, approximately 333 per million (1,240 patients in Ireland), would be candidates for EP ablation treatment; of patients with syncope approximately 300 per million may benefit from diagnostic EP studies. In estimating future need, changes in the management of atrial fibrillation may increase the number of ablation studies to 3,600 patients per year. About 1000 pacemakers are currently implanted annually in Ireland. Given the evidence for their effectiveness this number is likely to increase.

Approximately 5000 people in Ireland die suddenly each year of myocardial infarction. It is estimated that 10% of these patients have identifiable risk factors that could lead to ICD implantation. Current ICD implant rates in Ireland are approximately 20 per million population compared with 37 per million in the UK, 67 per million in Germany and 175 per million in the USA. Recent recommendations from the National Institute of Clinical Excellence (NICE) in the UK are for annual implant rates of 50 per million. Recently published data from the MADIT II trial suggest an implant rate of 200 per million.

5.2 24-hour services

The discussion with stakeholders has produced varying views about the feasibility of running 24-hour cardiac catheter laboratory services. At an international level many countries have developed such facilities. The general view amongst cardiologists is that this development will be driven by the recognition that acute coronary occlusion will be increasingly managed by emergency angioplasty and less by fibrinolytic therapy.

In Dublin the most developed 24-hour emergency service is provided by paediatric cardiologists at Our Lady's Hospital for Sick Children, Crumlin. Because of the nature of neonatal presentation at any hour of the day or night and the need to respond urgently to certain congenital heart conditions a de facto 24-hour service currently exists. In terms of adults, the Mater regularly and the other DATHs occasionally offer an extended hours service that may lead to procedures being carried out during the night. These depend substantially on the good will and commitment of staff. Developments in current practice

will mean that more patients presenting in Accident and Emergency Departments will be likely to benefit from early intervention. Because of the clinical need for a 24-hour service the Authority should develop a model for the Region as a whole. Aspects to consider include team availability, team mobility, patient mobility, lessons from existing 24-hour services and transportation. Given the importance of having an emergency cardiology catheter laboratory service in hospitals that provide cardiac surgery the Region may wish also to take account of this factor when developing its Regional model.

5.3. Innovations

Recent developments and possible future developments

The more recent development is in early PTCA for myocardial infarction and 'unstable angina' (Mehta, 1999; BCS, 2001). New definitions for myocardial infarction based on troponin (ESC/ACC, 2000) means that many more patients will be diagnosed and as these will be 'milder' myocardial infarction the survival rates will improve and a larger proportion will be eligible for revascularisation.

However, one should not ignore future possibilities of pharmacological thrombolysis. Developments are anticipated in non-mechanical delivery that could mean some reduction in use of catheterisation in the longer term.

There may be further developments in 'non-invasive' technologies, including quantitative stress echo and nuclear scintillography. These may provide more information than angiography and it is argued by some that they may have higher sensitivity and specificity and may provide more prognostic information (Kaul, 1988; Krivocaviti, 1993). Nevertheless, angiography is currently considered to be the 'gold standard' and it does provide, uniquely, an anatomical diagnosis. If alternative diagnostic techniques to catheterisation are used this may have an impact on the number of angiograms and the angiogram to angioplasty ratio. Given that diagnosis rates are currently increasing in most centres, it is likely that this will increase the number of revascularisations. This does mean that the ratio of investigation to referral for CABG/PTCA will vary from place to place and over time and will be difficult to interpret.

Given the uncertainty about possible innovations and developments it would seem unsafe to predict that they would have a significant influence on demand for catheter laboratory services in the short to medium term. It is important that early warning systems are established so that innovations that may have a profound influence on practice can be taken account of at the earliest possible stage.

5.4 Future workload: the incident prevalent issue

In trying to predict the future workload one has to move from the number of new cases each year that may require interventional cardiology to the wider natural history of cardiovascular disease and the changing patterns of patient management. (If one focuses initially on angioplasties at a target rate of 1200 per million per year this means that over the course of five years one may have up to 6000 per million prevalent cases). There is likely to be a pool of cardiovascular disease that has not yet been treated. There is therefore a need to catch up over a period of several years before need is being met by the current target rate and this problem may result in high waiting lists in the short term.

5.5 The need to plan for patients returning for repeat procedures

Although the patency of coronary arteries, post angioplasty, is improving with the widespread use of stents, this is not necessarily a permanent solution and many patients will return for further revascularisation procedures. Even though there are now decades of experience in this field, return rates, and repeat angioplasty rates are imprecise. Current best estimates are that 10% to 15% may re-stenose within one year and 40% to 50% over five years. In the case of electrophysiology the need for regular follow up and assessment is even clearer. Despite increases in battery life patients will need return to the laboratory for replacement. This will occur both with pacemakers and with implantable defibrillators.

In view of these factors it is important to provide sufficient capacity in the laboratory to cope with patients returning for repeat procedures as well as those who present for the first time.

5.6 Staffing issues

Staffing issues are a combination of insufficient posts and problems of recruitment, retention and training. In the case of cardiologists there has been considerable work over the last two years to quantify the needs for consultants across the whole country. The Authority has been working closely with clinical colleagues and has submitted a bid to the Department of Health and Children. Not only did the bid indicate the absolute number of posts that were needed, it provided a description of the range of cardiology subspecialties and provided a prioritisation and timetable for the appointments. Although there is a significant need for more interventional cardiologists in order to maximise catheter laboratory activity, there is also a pressing need, not least in the Area Board hospitals, for cardiologists with other subspecialty skills.

The position within nursing is complex not least because there is much discussion and redefinition of roles and the development of appropriate training and educational courses to meet the needs of these new roles. In many cases the training will be longer and will require a higher level of skill for such roles as specialist nurses in catheter laboratories. The availability of specialist nurses in this field cannot be taken for granted. Much will depend on the skills of nurse managers to organise the service to encourage maximum retention. Any proposal to extend the working day or to introduce a 24-hour emergency service will require a substantial investment in posts. It will also require attention to improving terms and conditions within the laboratory setting.

Radiographers with specialist training in this field are few in number and are in great demand. In the past their absence has led to the temporary closure of laboratories. In developing a workforce plan for radiography in this field it is important to recognise the importance of appropriate management arrangements for these staff. Contact has been made with the Irish Institute of Radiographers who have responsibilities for the development of training programmes. There is no shortage of recruits for degree

programmes. The problem is in the funding of adequate numbers of student places. This is one of several areas where the Authority may wish to develop a workforce strategy to ensure that sufficient numbers of appropriately qualified individuals are available to staff the laboratories in the future. This will be critical if 24-hour services are to be developed.

It has been possible through the National Society of Cardiology Laboratory Technicians to assess the issues facing this professional group. It is clear that they are determined to develop appropriate training programmes to prepare individuals for these roles. The National Society is not satisfied with the adequacy of the current basic qualification. They would like to see a much more structured programme based on a four year course. At present eight new students are in their first year of such a course. If one looks at existing vacancies and future vacancies with an expansion of catheter laboratories across Ireland the shortage of cardiac technicians will be of increasing importance. The increased length of training currently proposed by the National Society of Cardiology Laboratory may lead in the short term to a decrease in the availability of trained staff.

5.7 Working practices: length of the working day

There is considerable variation in the length of the working day in different laboratories. The most extreme example in terms of length is the Mater where the schedule is 10 hours but with the acceptance of additional patients onto the list the working day may extend to 12 hours or even longer. Other hospitals schedule cases for an eight-hour period. Not all hospitals are staffed to provide laboratory services each morning and afternoon five days per week.

5.8 Insurance industry

Limited contacts have taken place with the insurance industry. There has been only minimal discussion about the system of payment from the insurance industry to the DATHs and to private hospitals. It does appear that the DATHs can only reclaim the per diem rate for insured patients treated in their hospitals. By contrast a procedure payment has been negotiated for private hospitals. The problem, however, for private providers is

that the insurance industry has negotiated with them for target rates for admissions for certain procedures, particularly high cost procedures, and above this will only pay a marginal rate. Private hospitals are required to work within an overall cost envelope and so if this is exceeded they will not be further reimbursed for additional work.

5.9 Private sector roles

Continuing the theme mentioned above, private hospitals are unlikely to increase their activity in interventional cardiology unless they can negotiate an increase in the procedure payments. Even if this were successful it would still require a raising of the overall cash ceiling before it would be likely that activity levels would increase. It is unlikely that the ERHA can influence these negotiations. Nevertheless, it would be useful if they were at least discussed with the Department of Health and Children to see whether public policy has a role in this regard.

Given the limits that are placed by the insurance industry, private sector hospitals may find themselves with unused catheter laboratory capacity. The experience of the recent past is that they are more than willing to enter into contracts with the public sector to carry out procedures on public patients. Specific funding has been found for cardiac surgery through waiting list initiatives. Clearly this is something that could be repeated if it were not possible to expand the procedures within the DATHs. Until such time as the planned increase in consultant cardiologists occurs it may well be that unacceptably long waiting lists will require similar contracts in the future. This issue of reducing waiting times is strongly supported by the Government.

A further potential role for the private sector is the provision of mobile and modular cardiology catheter laboratory facilities. This approach has been adopted in Sligo and several of the other Health Boards are looking at this facility as a short-term measure until they have built their own laboratories. Within the Eastern Region there appears to be few opportunities for the use of mobile units or the installation of modular units. In the case of the latter they may be important in providing day case facilities in hospitals that have this deficit. Appendix 7 provides information on the costs of the services

offered by the independent sector, including the provision of staff. Appendix 8 provides some further details of these services.

6. Strategic vision for development of cardiology catheter laboratories in the Eastern Region

The period of this review is from 2002 to 2008. In estimating the population that the Eastern Region should serve, a base figure of 1.4 million has been used with an assumption that there will be an additional growth of 300,000 in the period from 2002 to 2008. In addition the Region has to plan for those who live in the immediate neighbouring regions who will continue to use hospitals in the Eastern Region. There is an additional number of patients who live outside the Region and whose assessment may well be in other regional centres but who will still be referred to the Eastern Region for complex procedures. Consequently it would seem prudent to use a total referral population base of 2.5 million.

6.1 Cardiology standards

Modern medicine and modern management is increasingly influenced by standards, guidelines and guidance. These, in turn, are requiring more detailed approaches to clinical audit. Good cardiology practice should ensure that patients at high risk will be identified and that appropriate prevention and treatment strategies will be put in place. Patients whose stable angina is identified in primary care should be reviewed by a consultant cardiologist within three months. Non-invasive evaluation should be available as a one-stop clinic. Specialised tests, for example, stress echo or technetium scan should be available within one month. This should also apply for angiography. Intervention should be available within three months.

Patients with recent onset chest pain should be reviewed within 24 hours in a rapid access chest pain clinic. Patients with ongoing pain require immediate access to Accident and Emergency facilities and should benefit from cardiology led (protocol based care) or preferably care provided by cardiologists on the day of admission. In any event they should not be discharged without cardiological evaluation. In hospital, management should include immediate ECG and assessment on arrival, troponin testing and thrombolysis within 30 minutes where appropriate. For those admitted, observation in a facility with adequate monitoring, including a central viewing station and staff trained in

rhythm recognition and defibrillation, is required. Patients also require pre-discharge evaluation. Those with ongoing pain, very high risk status or who are positive on non-invasive testing should have access to intervention (PTCA or CABG as appropriate) during the same admission. During and after discharge attention must be paid to lifestyle modification and management of risk factors. This requires a fully-fledged rehabilitation service to manage patients appropriately.

Patients with breathlessness due to cardiac failure should have access to evaluation and the pivotal diagnostic test (echocardiography) should be available within three months. A heart failure clinic should be available in each centre to see patients in a consistent fashion and to ensure that the relatively complex treatment regimes are optimised.

Patients with syncope, palpitations and asymptomatic arrhythmias in high risk populations require a separate and dedicated approach. Electrophysiological evaluation forms a critical part of this service but it is only the apex of a much larger service structure that requires development. General cardiologists need to form part of the complement of any service structure. They need to have ready access to 24-hour Holter monitoring, loop monitoring, implantable monitoring devices and tilt testing to determine the cause of symptoms or determine the level of risk in patients they care for. In addition they need access to electrophysiologists who can meet their needs in terms of invasive evaluation, ablation and implantation of defibrillators. Finally, they need unrestricted access to facilities to implant pacemakers as required.

The correct management of patients with valvular heart disease is another area where care needs to improve. The provision of consistent care requires an interest in keeping up with current thinking and ready access to investigations and surgery as appropriate. Another area of cardiology that needs development is that of cardiac rehabilitation. When discussing the situation with senior cardiologists in the region it is clear that they take a balanced view of the need for a wide range of cardiology subspecialties in order to be able to focus on the different aspects of the management of heart disease.

6.2 Laboratory norms and standards

The British Cardiac Society 5th Report (Section 7.19) recommends that a tertiary centre, providing for a million population should have three to four cardiology laboratories plus one for electrophysiology. The Hackett Appendix to the 5th Report bases provision estimates on standard times. The standard unit of time is 30 minutes. Diagnostic angiography is set at 1.25 units and electrophysiology at 2.65 units. The Report itself does not quote standard times for angioplasty or for ablation following electrophysiological studies but clinical opinion has proposed that angioplasty should be assigned 2 units of standard time and EP studies followed by ablation 5.3 units. In estimating activity capacity of individual laboratories one can make assumptions about the length of a working day, the number of sessions per week and the number of weeks of the year that the laboratory will be operating. The figures quoted in the Hackett Appendix assume a session is three hours and therefore can accommodate six units of work; that there are 10 sessions per week; and that the laboratory is functioning for 49 weeks of the year. This gives a total of 2940 units per year. The figures assume full consultant capacity to utilise all weekday sessions with cross cover for teaching, committees, holidays and illness.

This would be equivalent to 2350 diagnostic angiograms, or 1470 angioplasties, or 1110 electrophysiology investigations. Considering a laboratory that does no EP work one can estimate the number of angiograms and angioplasties that could be carried out. Using a four to one ratio this would allow 1680 diagnostic angiograms and 420 angioplasties. Using a 3:1 ratio this would allow 1533 angiograms and 511 angioplasties.

If there is a separation of procedures with electrophysiology being conducted in a specialised EP laboratory then one could expect such a laboratory to carry out approximately 500 ablations per year.

All of the above figures are approximate and depend not only on the standard time estimates but also on assumptions about the length of the working day. The experience of laboratories in Ireland is that their sessions are longer than three hours. If one allows

for a 20% increase in the availability of units of time this gives approximate figures of 2000 angiograms and 500 angioplasties per laboratory using a 4:1 angiogram to angioplasty ratio and approximately 1840 angiograms and 610 angioplasties using a 3:1 ratio. A figure of between 500 angioplasties per year would appear to be an appropriate target for a well functioning laboratory. It is arguable whether the UK figures are directly transferable to Ireland.

6.3 Norms for revascularisation rates

The UK National Service Framework recommends 750 angioplasties and 750 bypass grafts per million population. These figures were achieved by five of fourteen European countries by 1995. In the case of bypass grafts the change over time from 1991 to 1996 was from 290 to 460 per million. This figure has remained the same since 1996. As the bypass grafts seem to have reached a plateau the revascularisation targets can only be achieved by substantial increases in angioplasties. This would suggest UK targets closer to 1000 angioplasties and 500 bypass grafts per million. Figures from the United States for 1997 showed a total 686,000 angioplasties and 366,000 bypass grafts which in terms of the angioplasty to bypass ratio was approximately 2:1.

Another factor is the need to streamline access to the service. Given the capital costs of catheter laboratories and the high staffing levels needed to run them one cannot justify their under-use because of the lack of day bed facilities. Because much of the work is semi-urgent or urgent it is less easy to model bed needs than would be the case with a simpler elective system. Nevertheless, bed availability needs to be matched to laboratory capacity if the service is to become more efficient.

6.4 Future capacity

In estimating the capacity required to meet the need a range of figures has been used to represent the numbers of units of work and of time that are appropriate for a modern efficient catheter laboratory. In terms of standard units a figure of 2940 units has been used. The number of angioplasties that can be achieved in such a laboratory depends on the case mix. This includes the number of EP procedures that take longer but it also includes the ratio of angiograms to angioplasties. At present there is wide variation from

approximately three to over seven in this ratio in the Eastern Region. These ratios do reflect to some extent the experience of the unit and the degree to which their clinicians use the procedures primarily as a diagnostic tool or as a front line form of treatment. A range for all procedures of 2000-2500 per annum is considered appropriate. Within this total range, a figure of 500 angioplasties per annum is used as a guide for each general cardiology catheter laboratory.

Insufficient attention has so far been given to the likely impact of patients returning after interventional procedures. Current estimates of re-stenosis are that 15% will require revascularisation after one year and 40%-50% will require revascularisation after five years. This means that the Region should be allowing for approximately 10% returns per year for each of its previous years activity. In the year 2003 one could therefore expect 10% of the 2002 activity (estimated at 2260), that is 226; 10% of the 2001 activity (2220), that is 222, 10% of the 2000 activity (1391), that is 139; 10% of the 1999 activity (1348), that is 135; and 10% of the 1998 activity (1144), that is 114. Based on these re-stenosis rates for patients receiving angioplasties between 1998 and 2002 there would be 836 patients returning for revascularisation in 2003. On the basis of two units of standard time for an angioplasty this represents a further 1672 units for repeat revascularisation procedures. This represents 56% of the total capacity of an efficient cardiology catheter laboratory.

Section 5.1 emphasised the historic gap between EP services in Ireland and those elsewhere. If one were to accept the UK NICE recommendation of 50 implantable defibrillators per million this would be a five-fold increase on current practice. Although the numbers are relatively small this would lead to an estimated increase of over 400 units of laboratory time. Increases could also be expected in pacemaker insertions. EP studies followed by ablation are assigned 5.3 units of time and are predicted to at least double between now and 2008. Taking these factors together it is estimated that EP work alone will require an additional 2000 units of time. This represents about 68% of the total capacity of an efficient laboratory. Taken together with the above estimate for revascularisation of 56% of the total capacity of an efficient cardiology laboratory this

amounts to 124%, that is the equivalence of 1.25 additional laboratories to meet these specific needs.

In addition to the changing nature of the case mix there is a further set of factors that have to be taken into account when predicting future capacity. They include:

- The need to introduce a 24-hour service
- The need to reduce waiting lists
- The need to be able to respond to urgent and emergency cases. This involves the recognition that laboratories should not be scheduled to operate at 100% capacity on the basis of elective procedures. An 85% scheduled rate would leave 15% capacity to be used for non-elective emergency procedures.
- Issues of safety if staff are working excessively long hours with inadequate cover
- The changing nature of cardiac surgery.
- The changing nature of clinical practice.
- The need for services, based on Building Healthier Hearts and international norms.
- The need to maximise the use of existing capacity.
- The need to link future development to hospitals that have maximised their existing capacity.
- A recognition of what is realistically achievable and
- An acknowledgement of investments in progress that do not require major capital expenditure.

One of the factors that is difficult to predict relates to the balance between interventional cardiology and cardiac surgery in relation to revascularisation. The majority opinion appears to be in favour of interventional cardiology over the next few years. Although cardiac surgery revascularisation is increasing it is increasing at a slower rate than angioplasty. The relative effectiveness of surgical and cardiological medical intervention seems to be moving in the direction of angioplasty. If this view were to be further reinforced it may be that a move away from cardiac surgery may develop. If, in the

medium term, the Eastern Region is to remain a major provider of tertiary care, then the development of catheter laboratories elsewhere in Ireland may lead to a change in the complexity of cases that will be referred. There is unlikely to be any significant increase in activity without the appointment of additional consultant and other staff.

In summary there are several pressures that should influence the total planned future activity. There is an additional pressure that relates to the capacity of individual laboratories. Although laboratories may run at maximum capacity this may not be sustainable in the long term. Cardiologists refer to an ideal planned activity level that does not exceed 85% of full capacity. What is most difficult to estimate is the impact of modern cardiology (See Mark & Hlatky, 2002). Taking all these factors into account it is considered appropriate that the Region should seek to increase its activity over the next six years in line with the recommendations in Building Healthier Hearts. Returning to that publication it states: “It is expected that by the year 2000 the European average will be 1750 per million and that by the year 2010 it will be 2000 per million”.

Section 7 describes current capital and development proposals and bids for replacement equipment. This is followed by an option section for the provision of laboratory services to meet future needs.

7. Summary of current proposals

7.1 Capital approved programmes

There are two approved programmes, one at St Vincent's due to open in 2003 and one at the Mater due to open in 2008. The new capital development at St Vincent's will provide a replacement catheter laboratory. The current plan is to open the laboratory with new equipment and to transfer staff from the existing laboratory. In 2008, when the new build at the Mater is due to open it is estimated that this would provide the hospital with the capability of carrying out 1320 angioplasties per year.

7.2 Equipment replacement, new equipment costs and consumables

To date inadequate information has been obtained from the hospitals on the age of their equipment. In several cases it is well past its original planned life. There is a bid from St James's for equipment costs to replace a bi planar unit that is currently functioning only as a single plane machine. Hospitals have been asked to produce an inventory of major equipment with information about its age and planned replacement date. The Authority will have to review the equipment in each of its five hospitals with catheter laboratories and discuss with hospitals the financing and scheduling of machine replacement. Given the nature of the equipment it may be appropriate to assume that equipment will need to be replaced after a ten-year period. In view of the high cost of equipment in cardiology catheter laboratories there is a case for identifying a Regional fund for equipment replacement. Estimates of equipment costs have come from three sources. Beaumont Hospital has provided figures for the equipping of their catheter laboratory when it opened in 2000. St Vincent's Hospital has provided figures for the equipment costs that are anticipated for their new laboratory, due to open in 2004. St James's has provided figures for equipping a third laboratory that would be used primarily for electrophysiology. The Beaumont figure at 2001 prices was €893,332. The St Vincent's figure is an estimate based on 2002 prices and is in the range of €1,900,000 and €2,400,000. The higher figure includes the purchase of a biplane system. The St James's figure was €1,217, 000. A figure of €1,800,000 has been used to represent the cost of replacing equipment in a single laboratory. This has been multiplied by six to represent

the possible cost of replacing the equipment in all six of the current laboratories (€10,800,000). An average equipment life of ten years has been assumed. This gives a possible annual equipment replacement budget of €1,080,000. This figure will need to increase with the development of additional laboratories. It also has to be recognised that the new generation of equipment tends to be more complex and more expensive and this will be particularly relevant if laboratories are commissioned that focus substantially on electrophysiology.

The general growth in activity has meant that hospitals have found themselves over budget for consumables. In the case of some high cost consumables hospitals have had to consider purchasing these consumables on a named patient basis. This has meant that they have been unable to benefit from reductions in cost that can come from bulk or central purchasing. This is another area where the Eastern Regional Health Authority may wish to work more closely with DAT hospitals in order to maximize the benefit of central planned purchasing.

7.3 Assessment of costs

Electrophysiology procedures require substantial capital investment. The following estimates have been supplied by the consultant cardiologists who specialise in electrophysiology (Erwin, Fahy, Foley, Galvin, Gumbrielle, Keelan, 2002). The costs include an EP work station (€175,000) a radiofrequency generator (€14,000) and an electrical stimulator (€14,000). In addition there are significant costs associated with each procedure. The average cost per case for diagnostic procedures is €500 and for ablation cases approximately €1,200. In addition connecting cables and sheaths cost approximately €50 each (€150-€200 per case). Conventional pacemakers cost approximately €1,500 and biventricular pacing devices approximately €4,500. ICD implants cost approximately €10,000 for single chamber and €28,000 for dual chamber devices. A major issue is the high cost of ICD devices. Budgets have been set on the basis of estimated numbers of implants but these budgets have soon been fully spent. There is a separate issue of the funding arrangements for those patients treated in the Eastern Region but who are resident outside the Eastern Region.

7.4 General considerations: economies of concentration

There are good clinical arguments for grouping cardiology laboratories together. Although single laboratories may be appropriate in local hospitals where the work is predominantly diagnostic, in hospitals that are taking a large number of referrals there are benefits in having two laboratories back to back. This allows some economies of concentration in that some staff can be shared. It is argued that the presence of dual laboratories leads to better overall management and may actually reduce some staff costs from overtime payments. It is certainly the case that consultant cardiologists can, with appropriate junior medical support, oversee procedures being carried out simultaneously in two laboratories. Although these arrangements may improve the management of the service and produce some reductions in unit costs it is not considered likely that they will have a significant impact on the total numbers of procedures that can be carried out in individual laboratories. The plans that are being finalised in the Southern Health Board are for a total of five catheter laboratories concentrated in one major centre at Cork. Although this development will not be completed before 2005 at the earliest it does illustrate the view that interventional cardiology is likely to become increasingly important and that there is an advantage in placing several laboratories along side a major cardiac surgical centre. In the Eastern Region there are two cardiac surgical centres in the public sector, at the Mater and at St James's. When considering the options that are available to the Eastern Region for the development of cardiac catheter laboratory services the co-location of cardiac surgical facilities should be a factor.

7.5 Current costs

Estimating the current and future costs of the cardiology catheter laboratory services is problematic. In terms of current costs there is no agreed standard methodology for apportioning costs for a complex service that is currently funded across many different budget lines. In general, costs are limited to those incurred within the cardiology catheter laboratory and exclude the associated hotel costs of patients who may occupy beds on a day case or inpatient basis. Capital funding has generally been excluded. Current costs are significantly weighted by the high volume procedures such as angiograms that are

low cost. The current ratio of angiograms to angioplasties is approximately 4:1. It is likely that this ratio will change towards and below 3:1. In addition there will be increases in other high cost procedures such as electrophysiology. This means that future costs are likely to be higher than those estimated based on current costs.

Clearly there are differences in case mix and therefore no direct comparisons should be made without controlling for case mix. Nevertheless, there are significant differences in the pay:non-pay ratios. At St James's, for example, the ratio is 1:3.01 whereas at the Mater it is 1:1.33. Although this may represent differences in staffing levels it is more likely to be the result of different ways of apportioning costs within the different hospitals. It is the case that the Mater has a substantially longer working day (10-12 hours compared to 8-10) and this will be reflected in overall pay rates.

Table 16 Overall expenditure for 2001 in Euros at St James's and the Mater

	St James	Mater	Overall
Total costs – Pay	€964,265	€1,626,757	€2,591,022
Total costs – Non-Pay	€2,903,592	€1,842,821	€4,746,413
Total costs	€3,867,857	€3,469,578	€7,337,435
Number of procedures	3,217	3,147	6,364

Source: Public Health Direct

7.6 Proposals from provider hospitals

Proposals have been received from the Mater and St James's concerning the development of additional laboratories.

A second laboratory at the Mater

The arguments for this have been previously stated. The Mater has a long tradition of interventional cardiology. It currently operates from a single catheter laboratory and this delivers the highest number of procedures from a single laboratory anywhere in Ireland. It has the longest operating hours. The current 12-hour shifts may be efficient but they do place a considerable strain on existing staff. With the arrival two years ago of two

interventional cardiologists with shared appointments between JCMH and the Mater there has been an increase in electrophysiological work. Because these procedures take longer it is increasingly difficult to draw up the days schedule given that a significant number of urgent cases are added on at short notice. If the laboratory is beginning a long electrophysiological procedure this puts even more pressure on the staff in terms of making judgements about relative priorities.

The proposal to have a second laboratory is likely to have two effects. Firstly the new laboratory could be used primarily for electrophysiology work. Secondly there will be a reduction in the pressure on the existing laboratory. This second laboratory is seen as a temporary solution until the major capital scheme that is planned to be completed in 2008. The costs of the additional laboratory are shown in Table 17. New equipment was purchased in 2001-2 at the cost of €1,562,400. Additional equipment needed for the second laboratory is estimated at €32,500. The refurbishment costs are estimated at €200,000. Based on a total revenue cost of €4,654,143 and 4076 procedures this gives an average costs per case with a second laboratory is €1,141.

Table 17. Predicted total cost in Euros in 2003 of opening a second laboratory at the Mater

	<i>Total cost</i>
Total costs – Pay	€1,924,447
Total costs – Non-Pay	€2,729,696
Total Pay and Non-Pay	€4,654,143
Refurbishing and equipment cost	€232,500
Total costs	€4,886,643
Number of procedures	4,076

Source: Public Health Direct

A third laboratory at St James's

The development of a third laboratory at St James's has the advantage that the structure exists alongside the existing two laboratories and is lead lined and available. By bringing

it into circulation it provides St James's with additional capacity in the hospital that also has a new cardiac surgical facility. The proposal is strongly supported by the cardiologists on the south side who have recommended that it be developed as a specialist electrophysiological centre and that patients are referred in from St Vincent's and the AMNCH for specialist procedures. This will involve consultants having joint appointments. The total extra activity that is proposed by St James's is 1228 procedures, of which there would be an additional 428 angiograms, 542 angioplasties, 105 EP studies, 60 pacemakers and 30 implantable defibrillators.

The full cost in the table include the costs of re-equipping the third room which is estimated at €1,217,000. The actual running costs (excluding the equipment costs) of three laboratories is estimated at €6,567,357 at an average cost per case of €1,477. This cost when compared with the Mater cost reflects the higher non-pay cost linked to the high number of EP procedures. These costs do not include the cost of replacing the biplane system in one of the existing labs (€1,847,670). They have also excluded the cost of two additional consultant cardiologists who are the subject of a separate bid.

Table 18 Predicted total cost in Euros in 2003 of opening a 3rd laboratory at St. James's

	<i>Total cost</i>
Total costs – Pay	€1,258,765
Total costs – Non-Pay	€5,308,592
Total Pay and Non-Pay	€6,567,357
Refurbishing and equipment cost	€1,217,000
Total costs	€7,784,357
Number of procedures	4,445

Source: Public Health Direct

8. Options for the Authority to consider

In considering various options open to the Authority it has been assumed that the current number of procedures in the two private hospitals will remain the same over the period from 2002 to 2008. In 2001 the total number of angioplasties in the two private hospitals was 862 (See Table 11). This has been rounded up to 870 for planning purposes. Four options are presented that cover increases in planned activity over the period from 2003 to 2008. The criteria that will underpin a decision in favour of a particular option will include the extent of health gain, the issue of safe practice and of access, the amount of capital funding required, the promotion of innovation, adherence to international standards, certain practical considerations, the overall activity that can be achieved, and cost. Cognisance must also be taken of investments in progress for which additional capital expenditure is not required.

As stated in section 7.5 estimating the current and future costs of the cardiology catheter laboratory services is problematic. Because of the changing nature of the service as it becomes more complex, projections based on current costs will underestimate future costs. Figures that have been used for current costs have excluded the associated accommodation costs in day beds and in inpatient beds. Capital funding has generally been excluded.

8.1 Option 1

This option involves the development of a 2nd laboratory at the Mater; maximising the activity in the existing labs at St Vincent's and AMNCH. Finally the option would include the development at the Mater in 2008.

Table 19 Activity projection (angioplasty) for Option 1

	2001	2002	2003	2004	2005	2006	2007	2008
Mater	666	670	820	820	820	820	820	1320
BH	250	500	500	500	500	500	500	500
SJH	718	820	820	820	820	820	820	820
SVH	190	190	190	500	500	500	500	500
AMNCH	157	160	160	500	500	500	500	500

Total	1981	2340	2490	3140	3140	3140	3140	3640
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Source: Public Health Direct

Health gain

This option offers early health gain in terms of additional activity.

Safe practice

The second laboratory at the Mater will reduce the pressure on the current single laboratory.

Access

This option improves access by increasing the activity at the hospitals with single laboratories to a standard 500 angioplasties per year. It would also assist in the reduction of the waiting list at the Mater hospital

Amount of capital funding required

This option has low capital funding requirements.

Adherence to international standards

Based on a population of 2.5 million for the supra-regional area this option produces a maximum rate of 1604 per million by 2007 with an increase to 1804 per million in 2008.

Promotion of innovation

This option has no direct impact on innovation although the opening of a second laboratory at the Mater may lead to greater specialisation of EP work.

Practical considerations

This option makes some impact on the underlying need for angioplasties. It has the least call on capital expenditure.

Overall activity that can be achieved with Option 1

As described above in assessing the overall activity it has been assumed that the current number of private angioplasties will remain constant over the mid term. The rounded up figure of 870 has been used in the following calculations. Under this option there would

be 4010 (3140+870 private) PTCAs in 2004 amounting to 1604 PTCAs per million for the 2.5 million tertiary referral area. In 2007 the activity levels would be the same. In 2008 there would be 4510 (3640+870 private) PTCAs amounting to 1804 per million for the 2.5 million supra-regional area.

Costs

The additional revenue costs in 2004 would include the costs at the Mater for the second laboratory and the cost of increasing activity at AMNCH by 340 cases and at St Vincent's by 310. The predicted number of angioplasties at Beaumont Hospital in 2002 will be 500. Using 2001 as the base line this represents an additional 250 cases. There is also a predicted increase in activity at St James in 2002 of 102 and of 3 at the Mater over the 2001 figures. The total predicted increased activity in 2002 over 2001 is 1005 cases. The cost of the total additional activity is based on a range of costs from the Mater and St James's of €1,141-€1477 at 2003 prices. This has been inflated at 7% to give a range for 2004 of €1,221-€1,580. The additional 1005 cases would cost between €1,227,105 and €1,588,292 in 2004. The additional costs at the Mater, originally based on 2003 prices, have also been inflated by 7%. The revenue costs for the 2008 Mater development have been excluded.

Table 20 Additional costs of Option 1 in 2004 at 2004 prices

Additional cost at the Mater Pay	€297,690 x 1.07	€318,528
Additional cost at the Mater Non-Pay	€919,375 x 1.07	€983,731
Additional cost at the Mater Total	€1,217,065 x 1.07	€1,302,260
Additional cost of the 1005 cases		€1,227,105-€1,588,292
Total		€2,529,365-€2,890,552

Source: Public Health Direct

By 2007 there is no change in activity over 2004. The estimated costs, however, in 2007 are based on the 2004 activity figures inflated at an annual rate of 7%. This gives a range of costs of €3,098,472-€3,540,926.

In 2008 there will be the additional cost of the 500 cases that arise from the opening of the third laboratory at the Mater. The cost per case used in the 2004 calculation has been further compounded by a factor of 1.3107 (1.07⁴) to give a figure for 2008. This gives a range from €1,600-€2,071. The total costs in Table 20 have also been inflated by the same factor 1.3107. No figures have been included for the capital costs in 2008

Table 21 Additional cost of Option 1 in 2008 at 2008 prices

Total costs in 2004 inflated to 2008 €2,529,365-€2,890,552 x 1.3107	€3,315,239-€3,788,646
Additional cost of 500 cases in 2008	€800,000-€1,035,500
Total	€4,115,239-€4,824,146

Source: Public Health Direct

8.2 Option 2

Option 2 would have the same characteristics as option 1. In addition it would include the third lab at St James's being introduced in 2003.

Table 22 Activity projection (angioplasties) for Option 2

	2001	2002	2003	2004	2005	2006	2007	2008
Mater	666	670	820	820	820	820	820	1320
BH	250	500	500	500	500	500	500	500
SJH	718	820	1320	1320	1320	1320	1320	1320
SVH	190	190	190	500	500	500	500	500
AMNCH	157	160	160	500	500	500	500	500
Total	1981	2340	2990	3640	3640	3640	3640	4140

Source: Public Health Direct

Health gain

This option offers early health gain in terms of additional activity and greater activity in 2004, 2007 and 2008.

Safe practice

As in Option 1 the second laboratory at the Mater will reduce the pressure on the current single laboratory.

Access

As in Option 1 this option improves access by increasing the activity at the three hospitals with single laboratories to a standard 500 angioplasties per year. The opening of a third laboratory at St James's in 2003 will provide the opportunity for specialised EP work to be transferred. Although some patients will therefore travel further for this treatment it will mean that referring hospitals have some increased capacity for treating other patients locally.

Amount of capital required

This option has relatively low capital funding requirements as the development at St James's is based on utilising existing laboratory space and the fact that this space is already lead-lined which substantially reduces the cost of bringing this space into use.

Adherence to international standards

This option produces a maximum rate of 1804 per million by 2007 with an increase to 2004 per million in 2008.

Promotion of innovation

The concentration of EP work in the third laboratory at St James's is likely to encourage specialisation and may have some impact on innovation.

Practical considerations

This option makes a significant impact on the underlying need for angioplasties. It has an additional call on equipment expenditure over Option 1 in equipping the third laboratory at St James's.

Overall activity that can be achieved with Option 2

Under this option there would be 4510 (3640+870 private) PTCAs in 2004 amounting to 1804 PTCAs per million for the 2.5 million tertiary referral area. In 2007 the activity would be the same. In 2008 there would be 5010 (4140+870 private) PTCAs amounting to 2004 per million for the 2.5 million tertiary referral area.

Costs

The additional revenue costs in 2004 would include the costs of Option 1 and the additional cost of opening the third laboratory at St James's. The revenue costs for the 2008 Mater development have been excluded.

Table 23 Additional costs of Option 2 in 2004 at 2004 prices

Additional cost of Option 1		€2,529,365-€2,890,552
Additional cost at St James's Pay	€294,500 x 1.07	€315,115
Additional cost at St James's Non-Pay	€2,405,000 x 1.07	€2,573,350
Additional cost at St James's Total	€2,699,500 x 1.07	€2,888,465
Total		€5,417,830-€5,779,017

Source: Public Health Direct

The additional staff costs include 3.5 staff nurses, 1 radiographer, 1.5 senior cardiac technicians, 1 administrative co-ordinator and 1 porter. They do not include the cost of the two consultants who have been the subject of a separate bid.

In 2007 the activity would be the same but the costs based on 2004 prices would be inflated by a factor of 1,225 (1.07³). This gives a range of costs in 2007 of between €6,636,842 and €7,079,29.6

In 2008 there will be the additional cost of the 500 cases arising from the opening of the third laboratory at the Mater. The cost per case used in the 2004 calculation has been further compounded by a factor of 1.3107 (1.07⁴) to give a figure for 2008. This gives a range from €1,600-€2,071. The total costs in Table 23 have also been inflated by 1.3107. No figures have been included for the capital costs in 2008.

Table 24 Additional costs of Option 2 in 2008 at 2008 prices

Total costs in 2004 inflated to 2008	€7,101,150-€7,574,558
€5,417,830-€5,779,017 x 1.3107	
Additional cost of 500 cases in 2008	€800,000-€1,035,500

Total	€7,901,150-€8,610,058
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Source: Public Health Direct

8.3 Option 3.

This option includes the developments of Option 2 (which includes the development of Option 1) and also proposes the opening of second laboratories at St Vincent's, Beaumont and AMNCH in phased in from 2007.

Table 25 Activity projection (angioplasties) for Option 3

	2001	2002	2003	2004	2005	2006	2007	2008
Mater	666	670	820	820	820	820	820	1320
BH	250	500	500	500	500	500	1000	1000
SJH	718	820	1320	1320	1320	1320	1320	1320
SVH	190	190	190	500	500	500	1000	1000
AMNCH	157	160	160	500	500	500	1000	1000
Total	1981	2340	2990	3640	3640	3640	5140	5640

Source: Public Health Direct

Health gain

This option offers similar gains to Option 1 and 2 in terms of additional activity as far as 2006 but in 2007 sees a further additional 1500 angioplasty cases with the opening of second laboratories at Beaumont, St Vincent's and AMNCH.

Safe practice

As in Option 1 the second laboratory at the Mater will reduce the pressure on the current single laboratory.

Access

This option has greater impact on access in that there would be increased activity at three additional hospitals.

Amount of capital required

This option has high capital funding requirements over and above Option 1 and 2.

Adherence to international standards

This option produces a maximum angioplasty rate of 2404 per million by 2007 with an increase to 2604 per million in 2008.

Promotion of innovation

In addition to the comments made for Options 1 and 2 the introduction of second laboratories at three additional hospitals is likely to encourage innovation.

Practical considerations

This option makes a significant impact on the underlying need for angioplasties. It has a significantly larger call on capital expenditure over Options 1 and 2.

Overall activity that can be achieved with option 3

Under this option there would be 4510 (3640+870 private) PTCAs in 2004 amounting to 1804 PTCAs per million for the 2.5 million tertiary referral area. In 2006 the projected activity would be the same. In 2007 there would be 6010 (5140 +870 private) PTCAs amounting to 2404 per million for the 2.5 million supra-regional area. The corresponding figures for 2008 would be 6510 (5640+870 private) PTCAs amounting to 2604 per million for the 2.5 million supra-regional area.

Costs

The additional revenue costs in 2004 would be the same as in Option 2.

Table 26 Additional costs of Option 3 in 2004 at 2004 prices

Additional cost of Option 1		€2,529,365-€2,890,552
Additional cost at St James's Pay	€294,500 x 1.07	€315,115
Additional cost at St James's Non-Pay	€2,405,000 x 1.07	€2,573,350
Additional cost at St James's Total	€2,699,500 x 1.07	€2,888,465
Total		€5,417,830-€5,779,017

Source: Public Health Direct

The additional revenue costs in 2007 are shown below for illustrative purposes. As bids have not yet been made no figures are yet available for the capital development of the three new laboratories. The total number of cases that would be additional to those shown for 2004 would be 1500. The total costs are shown below and include the costs of Option 2 which incorporates the cost of Option 1. The prices have been adjusted at an annual inflation rate of 7%. Over the three-year period from 2004 to 2007 the 2004 figures are inflated by 22.5%.

Table 27 Additional costs of Option 3 in 2007 at 2007 prices

Additional cost of Option 2 incorporating Option 1 €5,417,830-€5,779,017 x 1.225	€6,636,842-€7,079,296
Additional cost of 1500 cases The 2004 cost per case range of €1221-€1580- has been inflated by 1.225 to give the adjusted range of €1495-€1936	€2,242,500-€3,058,880
Total*	€8,879,342-€10,138,176

Source: Public Health Direct

These costs do not include significant capital costs for the three additional labs.

In order to make comparisons between the options a further table is presented for the costs of Option 3 in 2008. This has been calculated by multiplying the total costs in Table 27 by 1.07 to allow for 7% inflation in 2008. In addition, as a result of opening the third laboratory at the Mater, the cost of these 500 cases has been included. The range of costs per case were from €1,600-€2,071.

Table 28 Additional costs of Option 3 in 2008 at 2008 prices

Total costs in 2007 inflated to 2008 €8,879,342-€10,138,176 x 1.07	€9,500,896-€10,847,848
Additional cost of 500 cases in 2008	€800,000-€1,035,500
Total	€10,300,896-€11,883,348

Source: Public Health Direct

8.4 Option 4

This option delays the development of the third laboratory at St James until 2008 and brings forward the second laboratory at St Vincent's to 2005.

Table 29 Activity projection (angioplasties) for Option 4

	2001	2002	2003	2004	2005	2006	2007	2008
Mater	666	670	820	820	820	820	820	1320
BH	250	500	500	500	500	500	1000	1000
SJH	718	820	820	820	820	820	820	1320
SVH	190	190	190	500	1000	1000	1000	1000
AMNCH	157	160	160	500	500	500	1000	1000
Total	1981	2340	2490	3140	3640	3640	4640	5640

Source: Public Health Direct

Health gain

This option offers similar gains to Option 3 but delays the development of the third laboratory at St James's until 2008. It also has the gains associated with Option 3 in terms of the development of second laboratories at three hospitals but brings forward the second laboratory at St Vincent's to 2005.

Safe practice

As in Option 1 the second laboratory at the Mater will reduce the pressure on the current single laboratory. The development of second laboratories at three hospitals would mean no hospital carrying out angioplasties would be operating from a single laboratory.

Access

This option has greater impact on access in that there would be increased activity at three additional hospitals.

Amount of capital required

This option has high capital funding requirements over and above Option 1 and 2.

Adherence to international standards

This option produces a maximum angioplasty rate of 2204 per million by 2007 with an increase to 2604 per million in 2008.

Promotion of innovation

In addition to the comments made for Options 1 and 2 the introduction of second laboratories at three additional hospitals is likely to encourage innovation.

Practical considerations

This option makes a significant impact on the underlying need for angioplasties. It has a significantly larger call on capital expenditure than Options 1 and 2. By bringing forward the second laboratory at St Vincent's it coincides with the hospital's own development plan.

Overall activity that can be achieved with Option 4

Under this option there would be 4010 (3140+870 private) PTCAs in 2004 amounting to 1604 PTCAs per million for the 2.5 million tertiary referral area. This would increase to 4510 procedures in 2006 (3640 + 870 private) at an angioplasty rate of 1804 per million. In 2007 there would be 5510 (4640 + 870 private) giving an angioplasty rate of 2204 per million for the 2.5 million supra-regional area. In 2008 there would be 6510 (5640+870 private) PTCAs amounting to 2604 per million for the 2.5 million supra-regional area.

Costs

The additional revenue costs in 2004 would be the same as in Option 1.

Table 30 Additional costs of Option 4 in 2004 at 2004 prices

Additional cost at the Mater Pay	€297,690 x 1.07	€318,528
Additional cost at the Mater Non-Pay	€919,375 x 1.07	€983,731
Additional cost at the Mater Total	€1,217,065 x 1.07	€1,302,260
Additional cost of the 1005 cases		€1,227,105-€1,588,292

Total	€2,529,365-€2,890,552
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Source: Public Health Direct

The additional revenue costs in 2007 are shown below for illustrative purposes. No figures are yet available for the capital development of the three new laboratories. The total number of cases that would be additional to those shown for 2004 would be 1500. The costs of cases in 2007 are based on 2003 figures inflated at 7%. This gives a revised range of between €1801 and €2626 for these cases. The total costs are shown below.

Table 31 Additional costs of Option 4 in 2007 at 2007 prices

Additional cost of Option 1. This includes the original additional 1005 cases. The 2004 costs have been inflated by 1.225 to give an adjusted 2007 price	€3,098,472-€3,540,926
Additional cost of 1500 cases. The 2004 cost per case range of €1221-€1580- has been inflated by 1.225 to give the adjusted range of €1495-€1936	€2,242,500-€3,058,880
Total	€5,340,972-€6,599,806

Source: Public Health Direct

These costs do not include significant capital costs.

In 2008 there would be the additional cost of a further 1000 cases resulting from the opening of third laboratories at the Mater and St James's. Using the 7% inflation rate these additional case would cost between €1,600,000 and €2,072,000 at 2008 prices.

Table 32 Additional cost of Option 4 in 2008 at 2008 prices

Total costs in 2007 €5,340,972-€6,599,806 x 1.07	€5,714,840-€7,061,792
Additional 1000 cases between €1,600 and €2,072 per case	€1,600,000-€2,072,000
Total	€7,314,840-€9,133,792

Source: Public Health Direct

8.5 Comparison of options

Table 33 Comparison of options

	2004			2007			2008		
	Number of PTCAs and (rate per million)	Costs	Related Capital	Number of PTCAs and (rate per million)	Costs	Related Capital	Number of PTCAs and (rate per million)	Costs	Related Capital
Option 1	4010 (1604)	€2,529,365- €2,890,552	Mater 2 €232,500	4010 (1604)	€3,098,472- €3,540,926	None	4510 (1804)	€4,115,239- €4,824,146	Mater 3
Option 2	4510 (1804)	€5,417,830- €5,779,017	Mater 2 €232,500 James 3 €1217,000	4510 (1804)	€6,636,842- €7,079,29.6	None	5010 (2004)	€7,901,150- €8,610,058	Mater 3
Option 3	4510 (1804)	€5,417,830- €5,779,017	Mater 2 €232,500 James 3 €1217,000	6010 (2404)	€8,879,342- €10,138,176	BH 2 SVH 2 AMN 2	6510 (2604)	€10,300,896- €11,883,348	Mater 3
Option 4	4010 (1604)	€2,529,365- €2,890,552	Mater 2 €232,500	5510 (2204)	€5,340,972- €6,599,806	BH 2 SVH2 AMN 2	6510 (2604)	€7,314,840- €9,133,792	Mater 3 James 3 €1217,000

Underlying assumptions

It has been assumed that a general catheter laboratory could carry out 500 angioplasties per year. Clearly there are differences in case mix and overall activity will be influenced by the extent of EP procedures as these take significantly longer to perform. This has been recognised at both the Mater and St James's where it has been assumed that the development of an additional laboratory for EP procedures will increase the total number of angioplasties by an additional 320, that is, over and above the 500 at the Mater and 1000 at St James's in their existing laboratories. It has been assumed that there will be no increase in the private sector. In the above tables a figure of 870 per year has been used.

8.6 Possible role of the private sector

In considering the costs of catheter services it has been possible to compare the costs per case of existing laboratories in the DATHs with figures provided by the private sector although it has to be recognised from the outset that there are considerable differences in case mix and so comparisons have to be made with caution.

In addition to the services provided in private hospitals there are two other services provided by private companies. One of these is a mobile service where a laboratory is driven to the hospital site and remains there for one or two days each week or each month. A second service involves the semi permanent provision of a modular unit on the hospital site. Because it is possible to link a laboratory unit to a recovery unit to a day unit these units are generally described as modular. These modular units are usually leased over a one, three or five year period. Figures for mobile and modular units have been provided by Cardinal Healthcare, now part of the InHealth Group. The company performed over 13,000 procedures in 2001/2 and this equates to 13% of the total diagnostic angiography in the UK. Cardinal Healthcare's average mobile cost per case was €944. This included consumables and day bed recovery costs. Typical staffing arrangements for a mobile lab would be one nurse, one technician and one radiographer. It should be noted that a greater proportion of their procedures are diagnostic angiography where one would expect the average cost to be lower. The cases performed

in the mobile unit at Sligo are almost all angiograms. The average cost per case quoted by the North Western Health Board for these procedures is €1,106. Cardinal Healthcare refers to an average cost per case for all their procedures in the NHS in the UK as €1,353. This is a mixture of angiograms and angioplasties but with an emphasis on angiograms.

Figures for the provision of modular units are given in Appendices 7 and 8. Cardinal Healthcare does not provide an average cost per case for the modular unit. Figures from the two private hospitals in the Eastern Region are not published. Nevertheless a figure of €1,650 is quoted for the cost of a private angiogram. The various costs per procedure from the different organisations are provided as a rough guide. However the average costs in the public sector and the costs in the mobile unit are not comparable as the complexity and case mix are entirely different. The Authority may wish to consider whether some of the projected increase in activity in relation to any of the options could best be achieved through a partnership with the private sector.

9. Cardiology catheter laboratory services for children

The conclusions reached are based on a meeting with two of the three paediatric cardiologists at Our Lady's Hospital for Sick Children, Crumlin and the document submitted by the cardiologists to the central manpower committee in 2001. There have been no discussions with the Department of Health and Children nor with the Chief Executive Officer at Crumlin.

Currently OLHSC, Crumlin is the sole site providing paediatric catheter laboratory services. The status of approved capital development plans at Cork (possibly for 2006) and at the Mater/Temple Street Children's Hospital (for 2008) vis a vis paediatric catheter laboratories has the potential to influence service delivery going forward.

Table 34 below illustrates the changing role of the paediatric catheter laboratory and the changing nature of the workload. From being primarily a diagnostic tool, the laboratory is increasingly being used for therapeutic procedures. In the view of the paediatric cardiologists, efficient use of the laboratory should see at least 40-50 % of the total cases being interventional cases. As well as the numerical and proportionate increase in the number of cardiac interventional procedures, there has been an increase in complexity of the cases that is reflected in the cost of catheter laboratory consumables. Atrial septal defect occlusion devices, PDA occlusion devices, and electro physiology and ablation catheters account for a significant proportion of the increased cost of consumables. Already this year, the numbers have increased compared with last year and the Finance Department at the Crumlin estimates a 50% increase in the cost of catheter laboratory consumables compared with last year.

Table 34 Paediatric laboratory activity and costs of consumables 1999-2002

	1999	2000	2001	2002
Total number of Cardiac catheterisations	281	309	392	(estim.)410
Total number of cardiac interventional procedures	89 (32%)	141 (46%)	201 (51%)	(estim.)225 (55%)
Catheter laboratory	€215,000	€547,500	€634,870	(estim.) + 50%

consumables				
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Source: Public Health Direct

Further increases in the total number of cardiac catheterisations are expected directly as a result of the increased availability of new technologies for cardiac interventional procedures.

The recommendations of the Kennedy Report following the Bristol Enquiry define the catchment population for a specialist paediatric cardiac centre. In broad terms a population of five million is ideal and one paediatric cardiologist is recommended per 500,000 population. The population of Ireland justifies a single paediatric cardiac centre, as currently exists. Plans for the development of additional paediatric cardiology laboratories require review in the context of the international evidence base and national policy on the development of specialist paediatric services. The Health Strategy (Quality and Fairness) signals the setting up of a national review of paediatric services and it is considered that issues related to the configuration of paediatric cardiac services might usefully be addressed in the context of this review.

In recognition of the need to develop paediatric services, the Authority has approved an additional two whole time equivalent consultant posts. It is possible that one consultant may take up an appointment towards the end of this year and the second early next year. With an increased consultant establishment it would be possible to develop the full range of sub-specialties services including: interventional cardiac catheterization; electrophysiology, ablation and pacing; echocardiography and other non invasive imaging; exercise stress testing; foetal cardiology; grown up congenital heart disease (linked to an adult cardiology center); metabolic disorders and cardiomyopathy.

The current situation is far from satisfactory. In terms of outpatient services there are excessively long waits for non-urgent referrals; excessively large outpatient clinics and inadequate outpatient clinics in other Dublin Children's hospitals and in peripheral paediatric centres. The cardiac catheterisation waiting list is currently between six and twelve months. Out patient waiting lists are over twelve months (for new patients).

In trying to provide a National service it is important that consultants should liaise with paediatricians throughout the country. At present the existing consultants provide outpatient services in Cork, Limerick, Galway, Letterkenny and Waterford. They also have sessions at the Dublin Maternity Hospitals where there is an increasing need for echocardiography on site. In relation to more peripheral hospitals there is increasing pressure to develop tele-medicine diagnostic and management support. The relationship between the Crumlin and the Mater Hospital is strong, particularly in the management of grown up congenital heart disease.

Because of the nature of some paediatric referrals arising in the immediate period after birth Crumlin has provided a 24-hour emergency service for these babies. Although the numbers of these emergencies is relatively small this puts an enormous strain on staff that are already stressed from their daytime commitments.

Conclusion

Although the review of paediatric cardiology has been limited in scope it has been sufficient to conclude that policy needs to address the best model for delivery of services and the status of provisional plans to have more than one centre in Ireland. These discussions should take on board the recommendations in the Kennedy Report that a population of five million is needed to establish a single specialist center. Given the brevity of this children's review, the fact that there are different issues concerning children compared with adults, and that key stakeholders exist beyond the Eastern Region, it is important that a more detailed review take place.

10. Conclusions

The catheter laboratory review has led to the conclusion that the problem is not one primarily of inadequate capacity. At present the target of 1200 angioplasties per million is almost attained. If however one is to meet the European average of 2000 per million by the year 2010 then one will have to maximise existing capacity, invest in new laboratories and staff. Increasing activity will depend on the appointment of clinical consultants, nurses, radiographers and technicians, all of whom are critical to the successful running of the laboratory. There is a substantial range between hospitals in terms of the length of the working day. This too may be caused by differences in establishment and the availability of staff. What is needed both by the provider hospitals themselves and the Authority is a comprehensive workforce plan. In the case of cardiologists, this already exists. Regarding other staff, in particular, nurses, radiographers and technicians, this is a priority.

When considering the various options the Authority will wish to take account of several important criteria. These include the degree of health gain, the overall activity that can be achieved, issues of access, safety and equity, the amount of capital funding required, the extent to which international standards are met, and whether the option advances or hinders the promotion of innovation. It will also have to consider certain practical considerations, including costs and will want to maximize the benefits from investments already in progress for which additional capital expenditure is not required.

The Report makes the following recommendations.

- That the Authority, as a planning goal, supports the additional capacity outlined in strategic option four. This option will provide, over a phased basis, a level of activity that will meet local and national objectives.
- That decisions taken on current and future bids for hospital developments should fit within the Authority's strategic plan for catheter laboratories and investment in

developing catheter laboratories on particular sites must be linked with activity performance.

- That, given the difficult financial climate for new capital developments and the competitive nature of future bids both at National and local level, future activity requirements should come, in the first instance, from existing laboratories.
- That current staffing levels in this specialty be reviewed and that a comprehensive workforce strategic plan be developed to ensure that there are appropriately trained staff in sufficient numbers to meet the Authority's strategic objectives in this field.
- That detailed discussions proceed with hospital providers to explain the wide apparent cost variance in procedures between hospitals.
- That estimating the current and future costs of the cardiology catheter laboratory services is problematic. In terms of current costs there is no agreed standard methodology for apportioning costs for a complex service that is currently funded across many different budget lines. This means that future costs are likely to be higher than those estimated based on current costs.
- That a model for a 24-hour service be developed.
- That, given the high cost of consumables, discussions should taken place with providers to ensure that maximum savings are achieved through central purchasing arrangements.
- Given the nature of the equipment it may be appropriate to assume that equipment will need to be replaced after a ten-year period. A figure of €1,800,000 has been used to represent the cost of replacing equipment in a single laboratory.

- That the Monitoring and Evaluation Directorate develop with provider hospitals a system of activity information that is more timely and more useful than the current systems. This would include waiting times for interventional cardiology catheter services.
- That an early warning system be developed concerning innovations and that appropriate measures are in place to assess the cost effectiveness of innovations prior to their being introduced.
- Given the brevity of this children's review, the fact that there are different issues concerning children compared with adults, and as a national service that key stakeholders exist beyond the Eastern Region, it is important that a more detailed review take place.