National variations in the provision of cardiac services in the United Kingdom

We publish in full this report by a working group of the British Cardiac Society which shows large disparities in cardiac services between England, Scotland, Wales and Northern Ireland.

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Background

International comparisons show that the provision of services for the management of heart disease in the United Kingdom (UK) has, for many years, fallen far below that of comparable European nations.[1,2]

This was recognised and addressed through the National Service Framework (NSF) for coronary heart disease (CHD),[3] which identified the key elements of cardiac services requiring attention. The ensuing four years have witnessed a progressive improvement in many areas of cardiological activity as a result of the impact of this agenda. Importantly, however, the NSF has no direct mandate in Scotland, Wales or Northern Ireland and has, accordingly, addressed NHS practice only in England.

Concern has emerged that the resulting improvements have largely been confined to England and that, elsewhere in the UK, service provision has fallen behind.

Accordingly, a working group was appointed by the Council of the British Cardiac Society to examine variations in the provision of cardiac services within the UK. Members of the working group included representatives from all four devolved nations and from cardiac surgery.

Scope of the report

The working group did not attempt to collect data covering every aspect of cardiac services. Rather, attention was focused on selected, readily available and reliable information on consultant staffing, facilities and activity which are valid across national boundaries and which can be regarded as reasonable surrogates for overall provision. The most contemporary of the available information was collated but, with a single exception (i.e. drug-eluting stents), comparisons between nations were made only from data derived from the same time-period.

The report incorporates an index of need as well as measures of service provision. Thus, in addition to the CHD mortality, numbers of cardiologists, cardiac surgeons and catheterisation laboratories; waiting times and targets for cardiac consultation, diagnostic angiography and revascularisation (surgical and percutaneous); and the volumes of coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI) and pacing for bradycardia are included. In order to assess the degree to which new or emerging evidence-based technologies are being implemented, the use of drug-eluting stents (DES) and implantable cardioverter-defibrillator (ICD) implantation rates were examined. Throughout the report facilities, personnel and numbers of procedures are corrected for population. Population assumptions are: 50, 5.1, 3.0 and 1.67 million for England, Scotland, Wales and Northern Ireland, respectively, based on estimates following the 2001 census.[4]

> ***'The British Cardiac Society believes that such large disparities are unfair and unacceptable to the citizens of Great Britain and Northern Ireland'***

A potentially confounding factor relates to patients who cross national borders for investigation or treatment and who are consequently represented as activity in the host nation. This process is confined largely to Wales and Northern Ireland, from where many patients are managed in centres in England and Scotland. Where possible these movements, which could give a misleading impression of levels of provision to individual populations, have been accounted for.

Mortality from CHD

Age-standardised death rates from CHD per 100,000 population for men and women aged 35–74 are shown for the year 2002 in figure 1.[5-7] Of the four nations the value for England is the lowest and that for Scotland the highest.

Numbers of cardiologists

None of the available data sources provide actual whole time equivalents, nor identify and account for consultants who spend some of their time in general medicine (or other

Figure 1. Age-standardised mortality from CHD per 100,000 population for **a**) men and **b**) women aged 35–74 years (2002)

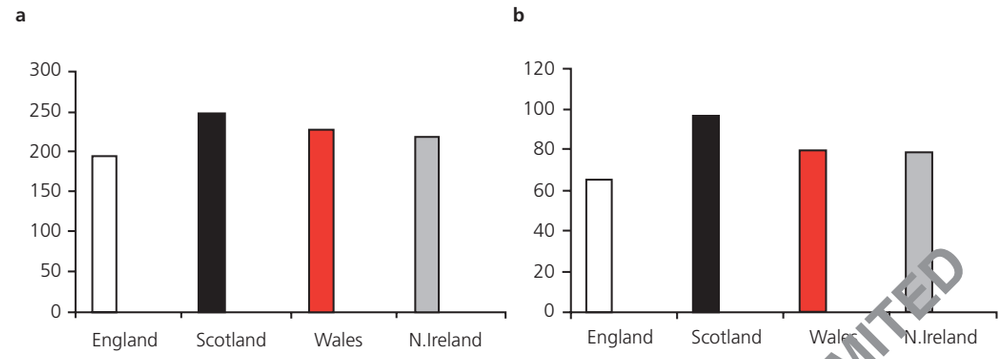


Figure 2. Number of cardiologists in post, per million population 2003/2004

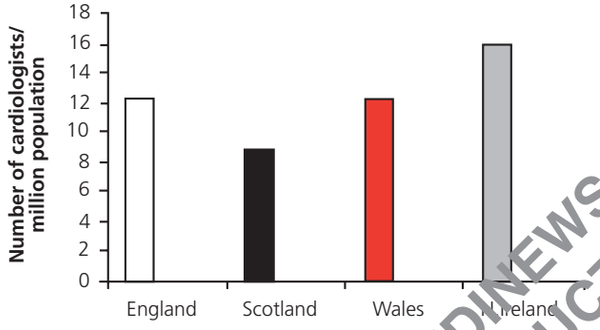
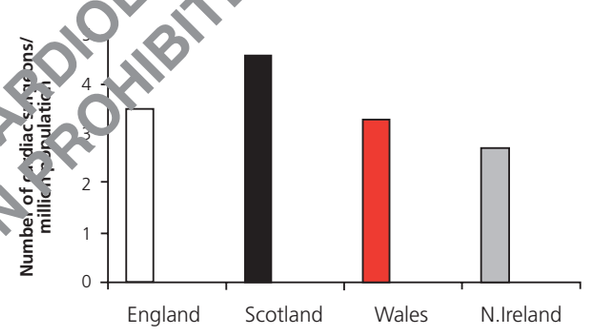


Figure 3. Number of cardiac surgeons in post, per million population 2003/2004



specialties). It was assumed that the proportion of cardiologists with a general medical commitment and of those working part-time is similar across the UK. For the purposes of this report therefore, every consultant identified as a cardiologist, working either full or part time in the specialty, was counted. The data refer only to posts which are currently filled; vacant posts were excluded.

In 2003/04, there were 609, 45, 37 and 26 consultant cardiologists in England, Scotland, Wales and Northern Ireland, respectively.[8,9] Corrected for population, England had 12.2, Scotland 8.8, Wales 12.2 and Northern Ireland 16 cardiologists per million (figure 2).

Numbers of cardiac surgeons

As for consultant cardiologists, it was assumed that the proportion of whole time cardiac, as opposed to cardiothoracic, consultant surgeons is comparable across the UK and all were, accordingly, counted.

Numbers of consultant cardiac surgeons in 2003/04 were: England 178 (3.5 per million); Scotland 23 (4.6 per million); Wales 10 (3.3 per million) and Northern Ireland 4.5 (2.7 per million) (figure 3).[10]

Cardiac catheterisation laboratories

Data from the British Cardiovascular Intervention Society (BCIS) indicate that in 2003 England had 238 NHS cardiac catheterisation laboratories undertaking either diagnostic or interventional procedures, or both.[11] The figures for Scotland, Wales and Northern Ireland were 19, 8 and 6, respectively. Adjusting for the populations, the numbers of laboratories per million were 4.8, 3.7, 2.7 and 3.4, respectively (figure 4).

Diagnostic coronary angiography

In 2002, a total of 165,173 angiograms were undertaken throughout the UK in both NHS and private institutions.[12] This volume included 144,563 cases in England (of which 950 were on Welsh patients), 11,072 in Scotland, 4,517 in Wales and 5,021 in Northern Ireland. Rates per million of population were 2,891; 2,171; 1,505 and 3,006, respectively (figure 5). Allowing for the patients investigated in England, the rate for Wales was 1,822 per million, still far below the volumes achieved elsewhere in the UK.

Waiting times and targets

In England the current target for the maximum waiting

Figure 4. Number of catheterisation laboratories per million population (2003)

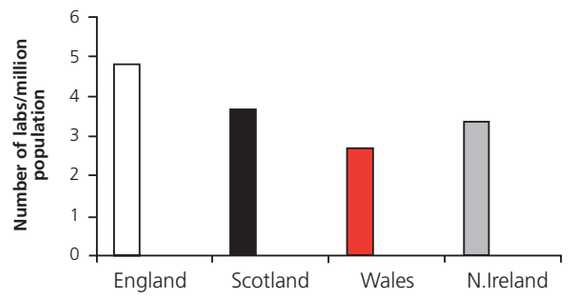


Figure 6. PCI activity per million population (2003)

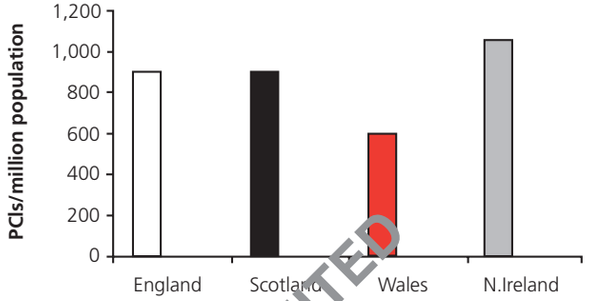


Figure 5. Diagnostic coronary angiograms per million population (2002)

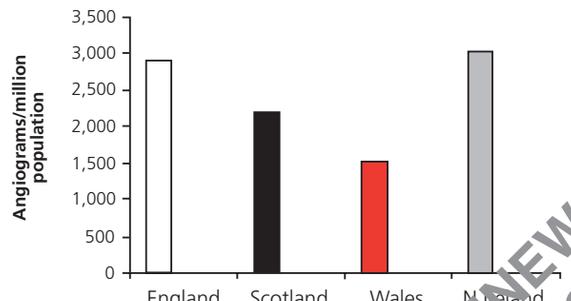
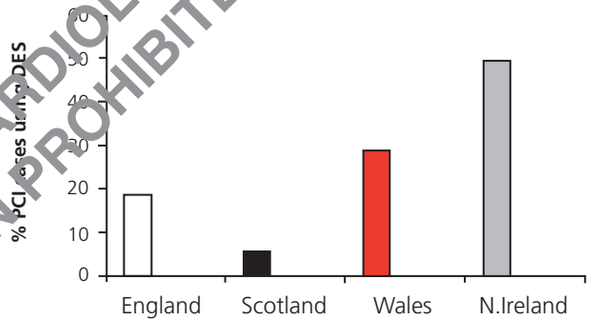


Figure 7. Proportion (%) of PCI procedures incorporating drug-eluting stents (2003)



time for an out-patient appointment with a cardiologist is 13 weeks. For diagnostic coronary angiography since March 2004 no patients have had to wait for longer than nine months and, from December 2005, the target is for a maximum wait of no more than six months. By April 2005, no patients should be waiting longer than three months for PCI or surgery. The next national target is: "to ensure that by 2008 no-one waits more than 18 weeks from GP referral to hospital treatment".[13] This maximum 18-week period will have to encompass waiting for an out-patient appointment with a cardiologist, waiting for a diagnostic coronary angiogram and any wait for PCI or heart surgery.

In Scotland a maximum waiting target for angiography of 12 weeks came into effect from March 2003, at which time 27% of patients were waiting for longer than eight weeks. Current waiting time targets for PCI and CABG are 18 weeks.[14]

In Wales the target for an out-patient consultation is 18 months,[15] whilst for diagnostic angiography and revascularisation (PCI or CABG) the targets are 26 and 32 weeks, respectively.[16]

For Northern Ireland proposed targets in the Joint Cardiology and Cardiac Surgery Action Plan, to be effective from April 2005, are that all patients referred to the out-patient clinic should be seen within eight weeks, that those requiring angiography should not wait for longer than 13 weeks, and that the maximum wait for revascularisation – surgery or PCI – should be three months.[17] However, these targets have not yet been agreed by the Regional Medical Services Consortium or the trusts because of insufficient funding.

Revascularisation – PCI

Total UK PCI activity for 2003 was 53,261.[11] The volumes undertaken for England, Scotland, Wales and Northern Ireland were 42,234; 4,438; 1,308 and 1,775, giving rates per million of 903, 899, 592 and 1,044, respectively (figure 6). These figures take into account Welsh patients who underwent PCI in English interventional centres.

Drug-eluting stents (DES)

Whilst implantation of bare metal stents (BMS) is a well established and universal adjunct to PCI, DES have been introduced relatively recently. In England and Wales, the National Institute for Clinical Excellence (NICE)

Figure 8. Isolated CABG activity per million population, (2002/03)

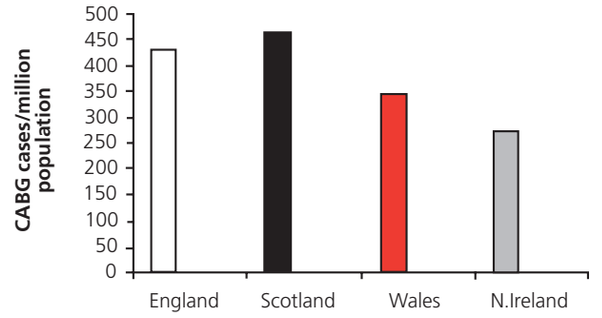
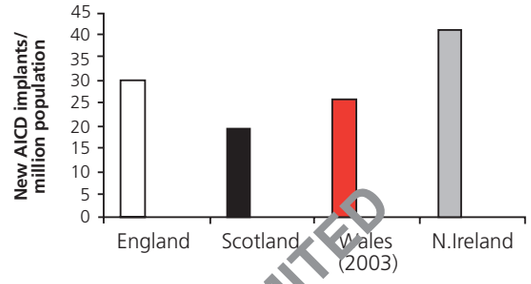


Figure 9. New AICD implant rates per million population (2002)



has provided guidance on the use of these expensive devices,[18] but across the UK as a whole there are clear differences in the implementation of the new technology.

Analysis of audit data from the British Cardiovascular Intervention Society[11] indicate that the percentages of drug-eluting stents (per procedure) utilised in 2003 were 18.3%, 5.3%, 28.6% and 49.8%, respectively, for England, Scotland, Wales and Northern Ireland (figure 7). These figures agree closely with those derived from commercial sources (personal communication).

Revascularisation – CABG

In the 12-month period from 1st April 2002 to 31st March 2003, a total of 25,277 isolated CABG procedures were undertaken in NHS hospitals in the UK, an overall rate of 423 per million. The numbers for England, Scotland, Wales and Northern Ireland were 21,422 (428 per million), 2,368 (464 per million), 1,032 (344 per million) and 455 (273 per million) (figure 8).[10]

During the same time period, combined valve and CABG procedures were carried out in England on 2,804 patients (56 per million), in Scotland on 306 (60 per million), in Wales on 161 (54 per million) and in Northern Ireland on 62 (37 per million). Addition of these figures to those for isolated CABG gives the totals per million of population for all coronary surgery of: England 485, Scotland 524, Wales 398 and Northern Ireland 310.

Pacemaker implantation

Rates of pacemaker implantation for bradycardia vary less than other clinical activities examined for this report. In 2003 there were 19,532 new implants in England (390 per million), 1,871 (367 per million) in Scotland, 963 (317 per million) in Wales and 546 (298 per million) in Northern Ireland.[19] The current planning requirement for pacemaker implantation in the United Kingdom is for 450 new systems per million per year.[20]

ICD implantation

Rather than total ICD implant rates, the number of first implants was considered to be the most appropriate indicator of the implementation of the new technology. In 2002, 83% of implants in the UK were first procedures[19] and it was assumed that this proportion is representative of activity in all the devolved nations.

As with revascularisation, some patients from Wales were treated in English centres. New implant rates in 2002 were 30, 19.4 and 41.2 per million for England, Scotland and Northern Ireland, respectively (figure 9). No data are available on the number of implants in Wales in 2002 but 26 per million were implanted in 2003.

What are the processes by which individual countries commission cardiac services?

The mechanisms by which cardiac services are commissioned and implemented differ across the UK. These variations may underlie some of the disparities in provision revealed by this report.

In England the NSF was introduced with the explicit intention of involving clinicians in the commissioning of cardiac services, and of channelling their contributions through networks and local implementation groups. This arrangement was further strengthened by involvement with the CHD Collaborative. These organisations require clinicians and managers from all stakeholders, including acute and primary care trusts (PCTs), to be involved in planning and monitoring the care of patients with heart disease. Planning is directed towards the implementation of the NSF targets and guidance from NICE appraisals and the Myocardial Infarction National Audit Project (MINAP). Although these structures are not directly accountable for patient care, they serve to guide the planning of strategies for investment in the increased capacity necessary for the implementation of the expanding services.

Following devolution, Scotland has not followed a NSF path. Similarly, MINAP and NICE, integral and essential components of cardiac service planning and commissioning in England, do not operate north of the border. NICE appraisals are reviewed by Quality Improvement Scotland and there is no mandate, in contrast to the situation in England, for guidelines derived from this reassess-

ment to be funded by the PCTs. Different rules apply for the use of New Opportunities Funding, which cannot be utilised to support existing though hard pressed facilities, and Scotland is remote from initiatives, such as the introduction of cardiac liaison nurses and specialist heart failure nurses in primary care, that have been sponsored in England by the British Heart Foundation (BHF).

Wales has its own national strategy to tackle CHD,[16] but whilst both NICE guidelines and MINAP targets are acknowledged, their implementation has not had the focus that is apparent in England. Commissioning of primary and secondary services is the responsibility of Local Health Boards, whilst tertiary services are commissioned by Health Commission Wales (HCW). The latter organisation has grown, but without adequate funding, and the respective commissioning responsibilities of the two bodies can be indistinct. Whilst six new cardiac catheterisation laboratories have been partially funded by the Big Lottery Fund, HCW does not have the resources fully to commission their activities or the additional PCI that will, inevitably, result. The Regional Offices and Networks have no budget, and the way in which they can influence commissioning is unclear. There are no Strategic Health Authorities in Wales. A recent publication has suggested that "the current situation is not sustainable".[21]

Northern Ireland is also disadvantaged by exclusion from the NSF, MINAP and NICE. In particular, the NICE recommendations for DES are not universally accepted and often a special case has to be made for their use in individual patients. At the time of data collection for this report the strategy appeared to have been the most successful of the nations of the UK but it is time-consuming, unsatisfactory as a means of planning and is unlikely to continue indefinitely. Many other activities, including the provision of heart failure nurses, have been funded from soft money sources and their future security cannot be guaranteed.

Limitations of this report

Though highly selected and reflecting predominantly services linked to the invasive investigation and treatment of CHD, the measures in this report can (since CHD is responsible for a large component of the heart disease burden) reasonably be extrapolated to reflect overall levels of the provision of cardiac services to the population. Whilst there are limitations in the use of age-standardised CHD mortality as an index of need, it is used widely as a measure of disease burden, and is likely to be as reliable as any other generally available indicator. Even without correction for SMR, however, the findings of the working group point to large differences in the provision of services between the devolved nations of Great Britain and Northern Ireland.

Available data sources do not enable the exact number of whole-time equivalent consultant staff to be determined since many do not spend all their time working in the single specialty. A general physician with a cardiological interest, or a surgeon who undertakes both cardiac and other thoracic operations, are illustrative examples. Nevertheless, the proportion of consultants with such varying responsibilities is likely to be similar across the UK and any error inherent in the analysis can be expected to apply equally across all countries.

> **'Even the highest levels of provision identified in this report fall far below those in other European countries'**

Waiting list measures are difficult to define and interpret. The time to wait for a consultation or procedure is more relevant to patients than the total number on a waiting list. However, the target waiting time is the most revealing of the aspirations and expectations of individual nations and of the way in which their services are planned. Since patients with suspected heart disease should not, ideally, have to wait for a consultation with a cardiologist the very existence of targets acknowledges the existence of limited facilities.

The working group encountered some difficulty in obtaining data that are complete, valid across borders, that separate NHS from private activity and reflect comparable time periods. Sources from specialist societies, including the British Cardiovascular Intervention Society (BCIS), the Society of Cardiothoracic Surgeons and the British Pacing and Electrophysiology Group were considered to be the most reliable for data on catheter laboratory numbers and workloads, revascularisation volumes, DES usage and pacemaker and AICD implant rates.

Since the time periods during which comparative facilities and activity were gathered for this report, several initiatives have been proposed or implemented. In Northern Ireland, in 2003, an additional 1.5 whole time equivalent cardiac surgeons were appointed. This enabled a total of 582 CABGs to be carried out during the calendar year (350 per million) and an additional 307 patients had operations in England and Scotland as a waiting list initiative. Additional cardiac catheterisation laboratories are planned in Wales, though funding for the increased activity that will result has not been identified. Wales has also shortened the target for an out-patient appointment to a maximum of one year. In England a NSF for arrhythmias is due to be published. Despite these developments, however, it is clear that a large investment in training and resources is still necessary to achieve a reasonable level of uniformity of provision across the UK and to approach the standards of comparable European countries.

A significant reduction in the death rate from coronary heart disease among all age groups up to 75 years has been recorded since 1980.[22,23] This has been due partly to

Executive summary of the report 'National variations in the provision of cardiac services in the United Kingdom'

- Investment to support the National Service Framework (NSF) for Coronary Heart Disease (CHD) has facilitated tangible improvements in the provision of cardiac services in England. Concern exists, however, that comparable improvements have not occurred in all parts of the United Kingdom (UK). Analysis by the working group has exposed substantial differences between the four devolved nations.
- The burden imposed by CHD, as assessed by age-standardised mortality, is lower in England than in Scotland, Wales and Northern Ireland. Despite this, many measures of access to cardiac investigation, treatment and the implementation of new technologies in these countries disclose lower levels of activity than in England.
- The number of cardiologists in post in 2003/04 ranged between 8.8 per million of population in Scotland and 16 per million in Northern Ireland.
- Wales and Scotland have proportionately fewer cardiac catheterisation laboratories than England and Northern Ireland and, correspondingly, their populations have less access to diagnostic angiography.
- Waiting time targets for out-patient consultations, coronary angiography and revascularisation should reflect public aspirations of a service. England has a 13-week target for out-patient consultation, whilst in Wales the target is 18 months. Similarly, current target waiting times for diagnostic coronary angiography, percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) are consistently longer in Wales than elsewhere in the UK.
- Rates of revascularisation vary widely across the UK for both PCI and CABG. In general, the variations correspond with consultant numbers and facilities, emphasising the important influence of investment in resources in determining clinical activity. Northern Ireland, with proportionately the highest number of cardiologists and the lowest number of cardiac surgeons, reports the highest number of PCIs and the lowest number of CABGs and Wales, with the lowest rate of coronary angiography, also has the lowest PCI rate.
- The implementation of new and emerging technologies reflects the planning of health care provision and the anticipation of future need. Of two such indicators, for which data were available to the working group, marked differences were identified. Almost 50% of PCIs in Northern Ireland utilised drug-eluting stents (DES) in 2003, compared with just over 5% in Scotland. Implantable cardioverter defibrillator (ICD) implantation rates in 2002 were also lowest in Scotland – about half the rate of Northern Ireland and two thirds of the rate achieved in England.
- In addition to the investment of resources, the working group presents evidence that the disparities identified in this report are a result, in part, of differences in the approach to the management of services and to the acceptance and implementation of guidelines between the four nations.
- As the organisation that represents all the professional groups and patients with a commitment to the prevention and treatment of heart disease in the UK, the British Cardiac Society believes that such large disparities are unfair and unacceptable to the citizens of Great Britain and Northern Ireland. The health departments of all four nations should strive to provide uniform and appropriate policies to reduce the demonstrable inequalities in access to cardiac services for their respective populations.

improvements in treatment and partly to healthier lifestyles.[24] Whilst government and health professionals clearly have a responsibility to promote healthier living, and it has been argued that such measures will reduce the need for the investigation and treatment of CHD, serious doubts have been raised about the effectiveness of major primary prevention campaigns.[25,26] It is important to point out that 'prevention', in terms of CHD is, to a significant extent, postponement. Healthier lifestyles such as smoking cessation[27] will result in fewer premature deaths and more people surviving to develop heart disease, and the ageing population will have a greater need for cardiac services.

Discussion and conclusions

The findings set out in this report confirm the existence of large differences in consultant staffing, facilities and clinical activity between the devolved nations of the UK. The striking correspondence between the numbers of cardiac catheterisation laboratories and of angiograms and (with the exception of Scotland) PCIs; and between the numbers of cardiac surgeons and of CABG operations is compelling evidence that the variations in clinical activity result, primarily, from differences in resources rather than of efficiency. In contrast to the core activities of angiography and revascularisation, however, the introduction of new technologies is not obviously related to staffing or catheterisation laboratory numbers, pointing to a larger role of management and commissioning than of facilities in determining the observed differences.

Pacemaker implantation was not included in the NSF for CHD and this may explain, in part, both the relatively small variation and the low levels of activity across the UK compared with the predicted need.

One apparent paradox requires explanation. Despite having the highest CHD burden combined with relatively low numbers of cardiologists, catheterisation laboratories and coronary angiographic activity, waiting times for angiography are shorter and the number of PCIs is higher in Scotland than in England or Wales and more CABGs were performed than in any of the other three countries. These observations imply that a smaller proportion of CHD patients are presenting to secondary and tertiary care than in other parts of the UK but of

those who do present, a greater proportion are being revascularised. This suggests that patients in Scotland present later and with more advanced disease than elsewhere in the UK. Possible explanations are: a higher mortality among previously asymptomatic CHD patients, a greater tendency for patients to present acutely, more stoical patients, perhaps with reservations about high-technology medicine, reluctance of general practitioners to refer because of the limited facilities, or lack of awareness amongst general practitioners of the potential benefits from revascularisation are worthy of further study.

A result of devolution has been that initiatives and policies developed in England (but with input from cardiologists from all parts of the UK) have lost momentum as they cross national borders. Differences in health service priorities and commissioning processes have resulted in disparities affecting many aspects of service provision. Despite having the greatest need for cardiac investigation and treatment, both Scotland and Wales fall below the service levels achieved in England and Northern Ireland.

The variations reflect the availability of resources and differences in the planning, organisation and commissioning of health services. England has benefited from the NSF for CHD and from the Government commitment to funding both the NSF targets and guidelines derived from NICE appraisals, but separate policies have been developed in Scotland, Wales and Northern Ireland. Even the highest levels of provision identified in this report, however, fall far below those in other European countries.[1,2] Moreover, the British Cardiac Society has estimated that, in order to provide services to meet the requirements of the UK population, more than four times as many cardiologists are required as were in post in 2003.[28]

Whilst it is acknowledged that the purpose of devolution is to allow greater control over domestic policies and expenditure, the British Cardiac Society, which represents the UK as a whole, considers that such major discrepancies in a vital area of healthcare are unacceptable.

Recommendations

The individual assemblies and parliaments of the devolved nations should acknowledge the deficiencies in the level of service provision for the management of heart disease and the wide disparities across the UK that bear little relation to need.

Cardiologists from across the UK contribute to the organisations that produce standards and guidelines. Logically, therefore, all the individual countries should accept the recommendations produced by specialist societies and authoritative agencies, without the requirement for further analysis or clinical justification. Strategies should be developed to ensure that these core standards are funded and implemented equally, with planned variations only in specific circumstances that might be identified in relation to specific populations.

Devolved assemblies and parliaments should address the varied administrative processes that exist in the commissioning and funding of cardiac services to ensure equality of access for all citizens of the UK.

This review should be repeated in 12 months.

References

1. M Simoons, for the Euro Heart Survey Programme. The European Heart Survey. Inventory of the care of cardiovascular diseases in Europe (Data showing the situation prior to the year 2000).
2. Block P, Weber H, Kearney P. Manpower in cardiology II in western and central Europe. *Eur Heart J* 2003;**24**:299-310.
3. Department of Health. The National Service Framework for Coronary Heart Disease. London: Department of Health, 2000.
4. Office for National Statistics (England & Wales). www.statistics.gov.uk/STATBASE
5. Office for National Statistics (England & Wales). www.statistics.gov.uk
6. General Register Office for Scotland. www.gro-Scotland.gov.uk
7. Northern Ireland Statistics and Research Agency. www.nsira.gov.uk
8. www.publications.doh.gov.uk.STATS
9. Scottish Cardiac Intervention Network: planning considerations. November 2003.
10. Society of Cardiothoracic Surgeons of Great Britain and Ireland. 5th National Adult Cardiac Surgical Database Report, 2003. www.scts.org
11. BCIS Audit returns, 2003. www.bcis.org.uk
12. BCIS Audit returns, 2002. www.bcis.org.uk
13. Department of Health. National standards, local action: health and social care standards and planning framework 2005/06-2007/08. Annex B, Priority III. London: DoH, 2004. www.dh.gov.uk
14. Scottish Executive 2004. Fair to all. Personal to each.
15. Welsh Assembly Government Welsh Health Circular WHC (2003) 127. Annual priorities and planning guidance for the Service and Financial Framework 2004-05. Cardiff: Welsh Assembly Government, 2005. www.wales.nhs.uk
16. Welsh Assembly Government Tackling CHD in Wales; implementing through evidence. Cardiff: Welsh Assembly Government, 2001.
17. The Joint Cardiac Surgery and Cardiology Action Plan of the Department of Health and Personal Social Services and its Needs and Effectiveness Review of Cardiac Surgery Services in Northern Ireland.
18. National Institute for Clinical Excellence. Guidance on the use of coronary artery stents. NICE Technology Appraisal Guidance 71, October 2003. London: NICE, 2003. www.nice.org.uk
19. National Pacing Database/Central Cardiac Audit Database. AD Cunningham 2005. www.ccad.org.uk
20. Hackett D. Clinical and laboratory cardiac facilities required in the UK. London: British Cardiac Society, 2005. www.bcs.com
21. Welsh Assembly Government. The Wanless Report: The Review of Health and Social Care in Wales. Cardiff: Welsh Assembly Government, 2003. www.wales.gov.uk/subieconomics/hsc-review-e.htm
22. Department of Health. Winning the War on Heart Disease. The National Service Framework for Coronary Heart Disease. Progress report 2004. London: Department of Health Publications, 2004.
23. CHD 2004: British Heart Foundation coronary heart disease statistics. Mortality chapter. www.heartstats.org
24. Unal B, Critchley JA, Capewell S *et al*. Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. *Circulation* 2004;**109**:1101-07.
25. Salonen JT. Did the North Karelia Project reduce coronary mortality? *Lancet* 1987;**2**:269.
26. Tudor-Smith C, Nutbeam D, Moore L, Catford J. Effects of Heartbeat Wales programme over 5 years on behavioral risks for cardiovascular disease: quasi-experimental comparison of results from Wales and a matched reference area. *BMJ* 1998;**316**:818-22.
27. West RR. Smoking: its influence on survival and cause of death *J R Coll Physicians Lond* 1992; **26**:357-66.
28. Hackett D. Cardiac workforce requirements in the United Kingdom. British Cardiac Society workforce working group, April 2004 www.bcs.com