British Cardiac Society
BCS Working Group on Cardiology Workforce Requirements

We advise and recommend that the UK currently requires:

- **35 cardiologists per million population in England**
- **40-60 cardiologists per million population in Wales, Scotland & N Ireland**
- **35-40 cardiologists per million population overall in UK**

Introduction

1. Prof John Camm, President BCS, commissioned this Working Group on Cardiology Workforce Requirements to provide advice to the Dept of Health in England. Our advice is for the medical workforce required for the provision of all cardiac services, not just for the delivery of the NSF for CHD. Our advice is for all of the UK including Northern Ireland; but we recognise that advice made to Dept of Health (England) will be used for England only.

2. The Working Group agreed that an annual planning cycle required annual advice from British Cardiac Society, currently in March each year, to feed into the Dept of Health CHD Care Group Workforce Team, in turn reporting to the Workforce Numbers Advisory Board. This year the CHD Care Group Workforce Team meet on 7 May 2003, to report to the Workforce Numbers Advisory Board for their June 2003 meeting.

3. The timescale for this submission was short and we have been unable to make a thorough assessment of the future needs for cardiologists. Therefore our estimates are based on what we believe to be required immediately to satisfy present needs. The expected developments in cardiac intervention, electro-physiology and heart failure services, together with an increasingly aged population and factors such as implementation of the European Working Time Directive and changes in training, will result in a considerable increase in the workforce requirements in the future. We will attempt to quantify these during the next year.

4. For planning purposes, our recommendations are our estimates for immediate workforce requirements, based on present needs, to be achieved as soon as the training requirements and implications allow. The workforce requirements are expressed as WTE cardiologists per million population (pmp). We have not considered forecasted population or demographic changes in our estimates of need; although an aging population will certainly require more cardiac care and therefore more cardiologists. Our individual recommendations cannot be absolutely precise, and should be regularly reviewed, and may require changing in the near future. But we have no doubt that there is a need for the overall indicated numbers of cardiologists required, in order to deliver modern and appropriate cardiac services.

5. BCS Working Group on Cardiology Workforce Requirements included: Dr David Hackett (Chairman), Dr Keith Dawkins, Dr Jane Flint, Dr Peter Mills, Prof Robert Wilcox, Dr Jamil Mayet, Ms Rosemary Weston from BCS and Dr Roger Boyle & Ms Helen Causley from Dept of Health. The Working Group met at 9 Fitzroy Square on 25 March 2003. We reviewed the following documents:
   - Fifth Report on the provision of services for patients with heart disease
   - Working Party to Discuss Consultant Workload in Cardiology Meeting at the British Cardiac Society, 10 September 2002 (Chr Robert Wilcox)
   - Manpower in cardiology II in western and central Europe (1999–2000). P. Block, H. Weber, P. Kearney. Eur Heart J 2003; 24: 299-310.
   - British Cardiac Society Cardiology workforce needs, developments and supply. Dr David Hackett, March 2003
   - Letter from Dr Peter Mills to Prof John Camm, President BCS, 25 February 2003
   - Cardiology workforce: Letter addressed to Prof John Camm, President BCS, from Dr Janet McComb, President BPEG, 10 February 2003

6. This version of this document has been written after a previous version was discussed at the Council meeting of The British Cardiac Society on 28 April 2003; suggested amendments have been incorporated here. It is intended that this version of this document will be reviewed with a view to ratification by the Officers and Board of BCS at their meeting in June 2003, and so this version remains a draft recommendation.

7. Our estimates do not include the needs of paediatric cardiology. These requirements have been proposed by the Report of the Paediatric and Congenital Cardiac Services Review Group, Dept of Health, London, November 2002. http://www.doh.gov.uk/childcardiac/reviewnov02.pdf

Trainee implications for workforce requirements

8. With the introduction of competency-based training and objective assessment, it is expected that substantially more time will have to be devoted by consultant cardiologists to the needs of training the trainees.

9. It is difficult to plan workforce requirements when there are no national data on numbers of trained cardiologists who have not taken up substantive career posts ("wastage"), and there is no national data on available and funded but unfilled substantive career posts ("unpopular"). We agreed it is imperative that such data be collected and maintained nationally for workforce and service planning. The RCP/BCS could and should have an appropriate role in collecting essential robust data for this planning.

10. Competition for substantive career posts is desirable. The Working Group unanimously agreed that it would be desirable to have a surplus (10-20%?) of trained candidates over the expected number of substantive career posts available. An even balance of supply and demand cannot be exactly achieved, and is likely to result in less popular posts remaining unfilled; a deficit of trained candidates can easily arise. A surplus supply of candidates for posts will also tend to result in more appropriately balanced choices of subspecialty training interests, e.g. to avoid an excessive proportion of trainees wishing to train in coronary intervention.

11. In 2001, 7.4% of consultant cardiologists in England were women, and 18.5% of specialist registrars were women. Yet >60% of medical school graduates are women. There are disproportionately fewer women in cardiology than in medicine as a whole; fewer women enter training in cardiology than almost all other specialties; and so the working group see no early prospect of this situation being corrected. The working group all agreed that we badly need the full contribution of >60% (women) of our medical graduates which we are not getting, and that if the current trend continues it will be to the longer-term detriment of the specialty.

12. It seems likely that the distinction between full-time and maximum part-time consultants will disappear. On the other hand, we expect more part-time working in the future, especially to attract more women into substantive career posts in cardiology. There should be a relatively greater increase in the number of training posts to allow for a proportionally greater increase in the numbers of part-time cardiologists in the future.

Current 2001 cardiac services:

13. **Acute secondary care units**: MINAP lists 217 acute hospitals (tertiary and secondary) in England and 19 in Wales, which receive acute myocardial infarction cases. There are 6 cardiac units not listed in MINAP (all tertiary units: Papworth, Freeman, Castle Hill Hull, Royal Brompton, Harefield, & Barts), so the sum of cardiac units and acute secondary centres does not necessarily add up to the total. The European Working Time Directive, and other developing trends, are expected to result in some smaller acute secondary care units closing and merging in to larger acute secondary care hospitals.

14. **Cardiac surgical units:** At present there are 36 Trusts performing cardiac surgery in 38 hospital units in UK. It is planned that mergers (Royal Brompton, Harefield, & St Mary's to Paddington, and Barts/Royal London & London Chest to Barts) will result in three fewer cardiac

surgical units; but two new cardiac surgical units are planned to open (Wolverhampton & Essex, although the Essex scheme is not yet fully approved); and there may be other new cardiac surgical units planned in the future, such as in Kent. For future planning purposes, we assume that the overall number of cardiac surgical units will be 37 in the UK (30 in England).

Table 1

	NHS data 2001	England	Wales	Scotland	N Ireland	Total
1	Population 2001	49138831	2903085	5062011	1685267	58789194
2	% Population	83.6	4.9	8.6	2.9	100
3	NHS administration	Strategic Hlth Authorities (28)	Local Health Boards (22)	Health Boards (15)	Health Boards (4)	
4	Acute Hospital Trusts	160	12	12	10	194
5	Total acute hospitals	217 (MINAP)	19 (MINAP)	25	13	274
6	Card Surgical units	31	2	4	1	38
7	PCI units w/o surg	7	0	2	1	10
8	Total PCI units	38	2	6	2	48
9	Other acute cardiac units (non-surg/PCI)	186	17	19	9	231
10	Cardiologists (DoH)	576				
11	Cardiologists (RCP)	563	35	66	25	689
12	WTE Cardiols (DoH)	512				
13	WTE Cardiols (RCP)	546	33	54	23	656
14	Cardiologists pmp	10.4 – 11.7	11.4 – 12.1	10.7 – 13.0	13.6 – 14.8	11.2 – 11.7

15. We are aware of 10 NHS hospitals in the UK (7 in England) performing PCI in 2001 without on-site cardiac surgery: Airedale, Birmingham City, Birmingham Heartlands, Eastbourne, Exeter, Taunton, Truro, Edinburgh Western, Hairmyres, Belfast City.

Planning future workforce requirements:

16. Fifth report on the Provision of Services for Patients with Heart Disease:

Table 2: Estimated future NHS requirements for cardiologists:
Fifth report recommendations applied to 2001 cardiac units in the NHS:

Cardiologists	England	Wales	Scotland	N Ireland	Total
No of acute non-PCI units	186	17	19	9	231
2º non-PCI units (5)	930	85	95	45	1155
No of PCI units incl surg	37	2	6	2	47
Interventionists (5-6)	185 - 222	10 - 12	30 - 36	10 -12	235 – 282
Electro-physiologists (2-3)	74 -111	4 - 6	12 - 18	4 - 6	94 – 141
Non-interventional (1-2)	37 - 74	2 - 4	6 -12	2 - 4	47 – 94
Total tertiary centres	296 - 407	16 - 22	48 - 66	16 - 22	376 – 517
Total 2º & 3º centres	1226 - 1337	101 – 107	143 - 161	61 - 67	1531 – 1672
Cardiologists pmp	24.9 – 27.2	34.8 – 36.9	28.2 – 31.8	36.2 – 39.8	26.0 – 28.4

Secondary centers:
"The additional impetus provided by the NSF for cardiologists to assume responsibility for all patients with acute coronary syndromes means that responsibilities for other "acute take" patients without cardiac disease must be reduced commensurately. We should now aim for a "next working day" cardiological service for cardiac patients, and work as quickly as possible towards staffing levels which would allow a 24 hours a day, seven days a week, cardiologist led cardiology service for acute coronary syndromes and other cardiac conditions. It must be the long-term aim of the specialty that there will be appropriate cardiological input into the care of all

patients with significant heart disease. With the advent of the new European Working Time Directives, the average acute secondary care hospital will require **at least five cardiologists** to allow legal cardiology on-call rotas."

Tertiary centers:
"For each tertiary cardiac centre/hospital there should be 8-12 consultant cardiologists comprising 5-6 interventionists, 2-3 electro-physiologists, & 1-2 for non-invasive services"

Cardiologists providing secondary care:

17. Patients are increasingly and rightly demanding specialist cardiological care. Patients with acute cardiac conditions have better care and outcomes when managed by cardiologists; cardiologists should be available to advise and manage patients with acute cardiology conditions. Hospitals receiving acute cardiology patients should have a cardiologist on-call rota. There should be formal links within the clinical cardiac network between each acute secondary care hospital unit receiving acute cardiology patients and a 24h/7d PCI and cardiac surgical centre.

18. Working Group agreed that we should move to a cardiology on-call rota in secondary care, requiring a minimum of 6 cardiologists for each cardiac unit to comply with the European Working Time Directive. This would require such cardiologists to relinquish acute general medicine responsibilities; the proportionally greater increase in acute cardiac workload for cardiologists would be counterbalanced by less acute workload for other general acute physicians. There would be obvious difficulties in cardiologists relinquishing acute medicine, and in general physicians relinquishing cardiology; but such difficulties should not be used to prevent the re-organisation of acute medicine for the benefit of patients and their medical care. Much elective cardiac care is currently provided by physicians who are not cardiologists, such as in elderly care; we expect that this provision of care will appropriately and gradually change from generalists to specialists (cardiologists). In very small acute hospital units serving a small population size with few consultant physicians, it may not be practical to have 6 cardiologists on an on-call rota; on the other hand, in acute hospital units serving larger population sizes, or deprived populations with a high incidence and prevalence of cardiac mortality and morbidity, there will be a need for more than 6 cardiologists to provide appropriate on-call care and equity of access to cardiac care. We advise that *an average* of 6 cardiologists are required for acute cardiac care in each acute secondary care hospital unit receiving acute cardiac patients.

19. Working group agreed that there should be one cardiologist to take lead responsibility for PCI in each acute secondary care clinical cardiac network.

20. The British Pacing and Electrophysiology Group advise that the need for pacemaker implants will be 450 new and 150 replacement systems, 600 in total per million population, approximately double the current volume of practice. Each cardiac centre should have two cardiologists with a specific interest in pacemaker implantation. (At present approximately 170 cardiac units in the UK perform pacemaker implantation.) As the implantation of cardiac defibrillators devolves from tertiary centres to secondary centres, there will be a specific need for 2 cardiac electro-physiologists in each secondary care unit for ICD implantation, as well as standard pacemakers, working with their colleagues in cardiac electro-physiology in their tertiary centre. Biventricular pacing or cardiac resynchronisation therapy is beneficial in heart failure, and may be indicated in up to 10% of patients with heart failure. This will require a major increase in cardiologists for implantation. The Working Group advise that 2 cardiac electro-physiologists are required in each secondary care unit for current planning needs, but that this may well be a conservative underestimate, and that requirements should be re-reviewed in the near future.

21. Working group agreed that there should be one cardiologist to take lead responsibility for heart failure services in each secondary care cardiac unit. Publication of NICE guideline on Heart Failure in August 2003 is expected to require more input and specification for heart failure services, many of which will be nurse run, but require cardiologist to lead.

22. Working Group agreed that there should be one cardiologist to lead on cardiac imaging in each cardiac unit: echo-cardiography, Trans-oesophageal echo-cardiography, stress echo-cardiography, nuclear cardiology, cardiac magnetic resonance imaging.

23. Thus in an average secondary care acute cardiac unit, there should be at least 6 cardiologists: 4 cardiologists with interests in CHD and pacing, 1 with interest in heart failure, and 1 with interest in imaging.

24. DH has previously estimated that it will require 12 to 29 WTE cardiologists pmp to provide diagnostic cardiac catheterization & angiography, pacemaker and defibrillator implants (to NICE recommended volumes of procedures), depending on the amount of time spent in the cardiac catheterisation & angiography laboratory performing these procedures (see DH paper).

25. Tertiary centres also provide emergency and elective secondary cardiac care for their local population, which is in addition to their tertiary care responsibilities. This additional workload needs to be acknowledged and assessed when estimating the numbers of cardiologists required for individual tertiary centres.

Percutaneous Coronary Intervention (PCI):

26. We agreed that proposed NSF rates of at least 750 PCI and 750 CABG procedures pmp are no longer appropriate. We agreed that we should *immediately* plan for 1400 PCI procedures pmp. This would be an increase of 211% from 38992 procedures in 2001 (= 663 PCI pmp) to 82663 procedures (= 1406 PCI pmp) in the UK. Various different models and patterns of care could deliver such increases in PCI activity: e.g. regional centres with >5 on site interventionists; e.g. regional centres with >10 interventionists, comprising both on site and visiting cardiologists; and e.g. PCI devolved to secondary care centres with ≥5 interventionists.

27. In 2001, France & Switzerland undertook 1500 PCI pmp, and Germany 2300 PCI pmp; we expect these numbers to grow in the next few years, perhaps substantially. Our best estimates for current planning requirements for PCI in the UK for the future should be within a range of 2000-3000 procedures pmp. This will have implications for the numbers of interventionists and interventional centres, taking into account the need for 12h/24h/7d working patterns, and effect of European Working Time Directive on working time and rotas, for volumes of 2000 and 3000 PCI procedures pmp.

28. **Expansion of PCI (see Appendix for calculations).** Expansion of PCI to 1400 procedures pmp should be within the capacity of the workforce numbers advised in this document (see below), providing that currently employed interventionists had the time available to undertake PCI procedures. Expansion of PCI to 2000 procedures pmp could be within the capacity of the workforce numbers indicated in this document; but planning for more interventionists would seem prudent; approximately 20% more interventionists would be required. This could be achieved by an increase from 5-6 to 6-7 interventionists per PCI unit, translating into 50-70 additional interventionists in the UK (40-50 in England); or by increasing the number of planned PCI units by 20%-40% from an illustrative 57-67 to a total of 80 for the UK with 5-6 interventionists per unit.

29. Expansion of PCI to 3000 procedures pmp would be unlikely to be within the capacity of the workforce numbers indicated in this document, and would require more interventionists; approximately 50% more than proposed in this paper would be required. This could be achieved by an increase from 5-6 to 7-9 interventionists per PCI unit translating into 100-200 additional interventionists in the UK (75-150 in England); or by increasing the number of planned PCI units by 50%-75% from an illustrative 57-67 to a total of 100 for the UK with 5-6 interventionists per unit.

30. **Emergency PCI in MI (see Appendix for calculations).** Emergency primary PCI is undertaken for MI in most other developed countries**.** If emergency PCI for MI is undertaken in the UK, it is estimated that approximately an additional 100-200 cardiac interventionists would be required for a resident shift system on-call, or 50 to 150 for an on-call system from home.

For planning purposes, it would seem appropriate to plan for an additional 150 inter-ventionists in the UK (100 for England) to provide an emergency 24h/7d PCI service for MI.

31. **Conclusion for PCI**: It would seem prudent to plan for additional interventionists in the UK over and above those recommended in the fifth report. An additional 2-3 interventionists in each PCI unit in the UK are required to achieve expansion of PCI up to 2000-3000 procedures pmp, deliver emergency 24h/7d PCI service for MI, and for application of the European Working Time Directive.

Cardiac electro-physiologists

32. BPEG has indicated that to achieve NICE recommendations for ICD implants of 50 pmp would require an increase from 43 at present to 84 cardiac electro-physiologists. More recent evidence indicates that 400 patients pmp (*eight times more than NICE have advised*) would benefit from ICD implantation. We also require more cardiologists to implant bi-ventricular pacemakers, and to undertake the increasing numbers and demands of electro-physiological mapping procedures and ablation treatments. We suggest that, for current planning purposes, we require a total of 200-300 cardiac electro-physiologists to supply this need; but these may well be unduly conservative estimates. Review of the previous NICE guidance for ICDs is due in September 2003, and should be available within two years; NICE is due to provide guidance on dual chamber pacing in the next cycle of reviews. The planned requirements for cardiac electro-physiologists should be reviewed again within the next two years.

33. The Working Group agreed that there should be one cardiac electro-physiologist to lead on implantable defibrillators, and one cardiac electro-physiologist to lead on bi-ventricular pacemakers, in each clinical cardiac network. Should have 2-3 (at least 2) cardiac electro-physiologists implanting ICDs and bi-ventricular pacemakers for each clinical cardiac network. There will be a need for 4-5 cardiac electro-physiologists in each tertiary cardiac electro-physiology centre.

Adults with Congenital Heart Disease (ACHD)

34. The requirements for consultants in ACHD have been estimated by the Report of the Paediatric and Congenital Cardiac Services Review Group, Dept of Health, London, November 2002. http://www.doh.gov.uk/childcardiac/reviewnov02.pdf This report has recommended “there will need to be an increase of around 25% in the number of consultant congenital cardiologists by 2010 in order to meet demand. This will mean approximately 20 more cardiologists.” These numbers indicate an increase from 80 to 100 consultants in ACHD for England, Wales & NI (= 1.9 consultants pmp). We agree, and support the call from the BCS Working Party Report (November 2002) for ACHD care to be arranged in regional ACHD units. There should be specific unit and individual cardiologist links with each clinical cardiology network. The numbers of cardiologists required in ACHD, and the numbers of trainees needed, are separate to, and over and above, our other workforce estimations and recommendations in this paper.

Sensitivity analyses

35. Sensitivity analyses indicate that the estimated number of cardiologists required is most dependent on:
    - Number of cardiologists per each acute secondary care unit receiving acute cardiac patients (rota of 1 in 6 or greater)
    - Number of cardiologists per each tertiary care or PCI unit (PCI rota of 1 in 7 or 9 or greater)
    - Potential required increases in cardiac electro-physiologists with the expected major increases in ICD and bi-ventricular pacemaker implants
    - Application of European Working Time Directive (for 24h/7d work)

36. Sensitivity analyses indicate that the estimated number of cardiologists required is relatively independent of:
    - Overall number of secondary care hospitals units receiving acute cardiac patients (trend towards fewer but larger acute secondary care hospitals units)
    - Number of new non-surgical PCI units (trend towards more secondary care, non-surgical PCI)
    - Expansion of PCI up to 1400 procedures pmp
    - Number of units undertaking emergency PCI (regional versus local services)
    - Number of emergency PCI procedures
    - Number of ICD & bi-ventricular pacemaker implant centres

Conclusions:

Table 3: Estimated future NHS requirements for cardiologists with extra 10 new non-surgical PCI units:

Cardiologists	England	Wales	Scotland	N Ireland	Total
No of acute non-PCI units	174	15	15	7	211
2º non-PCI units (6)	1044	90	90	42	1266
No of PCI units incl surg	43	3	8	3	57
Interventionists (7-9)	301 - 387	21 - 27	56 - 72	21 –27	399 – 513
Electro-physiologists (4-5)	172 - 215	12 - 15	32 - 40	12 – 15	228 – 285
Non-interventional (2-3)	86 – 129	6 - 9	16 -24	6 - 9	114 - 171
Total tertiary centres	559 – 731	39 - 51	104 - 136	39 - 51	741 – 969
Total for 2º & 3º centres	1603 – 1775	129 – 141	194 - 226	81 - 93	2007 – 2235
Cardiologists pmp	32.6 – 36.1	44.4 – 48.6	38.3 – 44.6	48.1 – 55.2	34.1 – 38.0

The above table assumes that:
- Overall number of cardiac surgical units remains at 37.
- There are an additional 10 new (6E, 1W, 2S, 1NI, = 20 in total) non-surgical PCI units; & all 57 PCI units can manage required volume of PCI procedures.
- There are 10 fewer (6E, 1W, 2S, 1NI) acute secondary units receiving acute cardiac patients.

Table 4: Estimated future NHS requirements for cardiologists with extra 20 new non-surgical PCI units:

Cardiologists	England	Wales	Scotland	N Ireland	Total
No of acute non-PCI units	162	13	11	5	191
2º non-PCI units (6)	972	78	66	30	1146
No of PCI units incl surg	49	4	10	4	67
Interventionists (7-9)	343 - 441	28 - 36	70 – 90	28 –36	469 – 603
Electro-physiologists (4-5)	196 –245	16 – 20	40 – 50	16 – 20	268 – 335
Non-interventional (2-3)	98 – 147	8 - 12	20 -30	8 - 12	134 – 201
Total tertiary centers	637 - 833	52 - 68	130 - 170	52 – 68	871 – 1139
Total for 2º & 3º centres	1609 - 1805	130 – 146	196 - 236	82 - 98	2017 – 2285
Cardiologists pmp	32.7 – 36.7	44.8 – 50.3	38.7 – 46.6	48.7 – 58.2	34.3 – 38.9

The above table assumes that:
- Overall number of cardiac surgical units remains at 37.
- There are an additional 20 new (12E, 2W, 4S, 2NI, = 30 in total) non-surgical PCI units; & all 67 PCI units can manage required volume of PCI procedures.
- There are 20 fewer (12E, 2W, 4S, 2NI) acute secondary units receiving acute cardiac patients.

New ways of working:

37. New ways of working were considered at the Working Party to Discuss Consultant Workload in Cardiology Meeting on 10 September 2002 (see paper by Dr R Wilcox). Dr Ranjit More is preparing a discussion paper on new ways of working in cardiology for the BCS Guidelines & Medical Practice Committee. Various new ways of working could include:
    - GP open access to cardiac investigations for their patients

- Cardiac sonographer/echocardiographer run echocardiography services
- GPs with special interest (GPSIs) in cardiology
- Cardiac physiologist/nurse run RACPCs
- Ambulance paramedical staff diagnosing MI and treating with thrombolytics
- Acute chest pain cardiac nurses; diagnose STEMI and NSTEMI; administer thrombolysis
- Nurse run post MI review clinics
- Nurse run risk factor & prevention clinics
- Nurse/echocardiographer run heart failure diagnostic echo clinics
- Nurse run heart failure treatment clinics
- Nurse run cardio-version services
- Cardiac physiologist run pacemaker follow-up clinics
- Cardiac physiologist run ICD follow-up clinics
- Generic catheter laboratory staff
- Physicians assistants

38. Extra staff to provide new ways of working will be expected to result in improvement in the consistency and quality of care that patients receive. These new ways of working may reduce the demands on cardiologists, and their time; although in some cases, supervision of the new ways of working may increase the demands on cardiologists, who will be responsible for the running of these services. But non-medical staff will not be able to become competent in and undertake all of the current duties of medical staff. Furthermore, all of the above new ways of working will not diminish the estimated requirements for cardiologists undertaking the assessment and clinical care of patients, especially emergency and acute cases, and performing invasive procedures, as outlined in this paper. If these changes in medical working practices are to be successfully delivered, there remains widespread concern within the cardiological community with regard to the availability of these additional nurses and other non-medical professional clinical staff required.

Conclusion:

The above estimates consistently indicate that the UK currently requires approximately:

- **35 cardiologists pmp in England**
- **40-60 cardiologists pmp in Wales, Scotland & N Ireland**
- **35-40 cardiologists pmp overall in UK**

39. The requirements for Wales, Scotland and N Ireland are greater than England because of less population density, with hospitals serving smaller population sizes, and thus relatively more cardiac units per million population. Furthermore, these countries have a higher incidence & prevalence and mortality & morbidity from cardiovascular disease, requiring more cardiologists.

40. Even if these predicted numbers of required cardiologists are achieved, we will still have a consultant cardiologist workforce approximately only two-thirds of that currently in Europe (EU/EFTA countries 58 cardiologists pmp) and the USA (50 cardiologists pmp and currently increasing). Implementation of the European Working Time Directive for both trainees and consultants will significantly reduce their ability to deliver the workloads currently accepted as part of routine working practice, and will inevitably lead to the need for more cardiologists.

David Hackett
01 May 2003

Appendix:

Workforce implications of PCI expansion, and emergency PCI in MI

A. Table A1. PCI expansion: volume of procedures per unit

PCI per centre	England	England	England	Total UK	Total UK	Total UK
PCI centres	37	43	49	47	57	67
PCI/unit @750 pmp	996	857	752	938	774	658
PCI/unit @1400 pmp	1859	1600	1404	1751	1444	1228
PCI/unit @2000 pmp	2656	2286	2006	2502	2063	1755
PCI/unit @3000 pmp	3984	3428	3008	3753	3094	2632

B. Table A2. PCI expansion: Volume of PCI procedures per interventionist (If 5-6 interventionists per centre as recommended in Fifth report)

PCI per interventionist	England	England	England	Total UK	Total UK	Total UK
PCI centres	37	43	49	47	57	67
PCI/interv @750 pmp	166-199	143-171	125-150	156-188	129-155	110-132
PCI/interv @1400 pmp	310-372	267-320	234-281	292-350	241-289	205-246
PCI/interv @2000 pmp	443-531	381-457	334-401	417-500	344-413	292-351
PCI/interv @3000 pmp	664-797	571-686	501-602	625-751	516-619	439-526

Workforce capacity for expansion of PCI:

C. If PCI is expanded to 1400 procedures pmp, there would be an average of 1000 to 2000 cases per PCI unit, and 200 to 400 cases per interventionist (4-8 cases per week). This volume should be within the capacity of the workforce numbers indicated in this document.

D. If PCI is expanded to 2000 procedures pmp, there would be an average of 2000 to 3000 cases per PCI unit, and 300 to 500 cases per interventionist (6-10 per week). This volume could be within the capacity of the workforce numbers indicated in this document; but planning for more interventionists would be prudent. Approximately 20% more interventionists would be required. This could be achieved by an increase from 5-6 to 6-7 interventionists per PCI unit; or by increasing the number of planned PCI units by 20%-40% from an illustrative 57-67 to a total of 80 for the UK with 5-6 interventionists per unit.

E. If PCI is expanded to 3000 procedures pmp, there would be an average of 3000 to 4000 cases per PCI unit, and 500 to 800 cases per interventionist (10-16 per week). This volume would not be within the capacity of the workforce numbers indicated in this document, and would require more interventionists. Approximately 50% more interventionists would be required. This could be achieved by an increase from 5-6 to 7-9 interventionists per PCI unit; or by increasing the number of planned PCI units by 50%-75% from an illustrative 57-67 to a total of 100 for the UK with 5-6 interventionists per unit.

Emergency PCI in MI:

F. It is estimated that the requirements for emergency PCI might be two to five cases per PCI unit per day; thus an average of perhaps one or three cases of emergency PCI out-of hours per unit per day. It is reported from MINAP that the incidence of STEMI is declining, and therefore these estimates might need to be revised downwards in the future (unless all NSTEMI cases would benefit from routine emergency PCI, as opposed to urgent PCI performed next working day).

G. Table A3: emergency PCI in MI:

	Engl	England upper limit	UK	UK upper
STEMI	37000	Birkhead/MINAP	137000	est by Dawkins
Total STEMI	40700	Birkhead/MINAP+10%		
NSTEMI	40700	Birkhead/Est by MINAP 2002		
Say 75%-90% of MINAP STEMI for emerg PCI	30525	36630	34250	KD:25% for emerg PCI
Say 10%-25% NSTEMI for emerg PCI	4070	10175	3425	8563
Total emergency PCI	34595	46805	37675	42813
Emerg PCI/regional card unit (n=32 UK)	1331	1800	1177	1338
Emerg PCI/regional card unit/day	3.6	4.9	3.2	3.7
Emerg PCI/card surg unit (n=37 UK)	1153	1560	1018	1157
Emerg PCI/card surg unit/day	3.2	4.3	2.8	3.2
Emerg PCI/PCI unit (n=47 UK)	935	1265	802	911
Emerg PCI/PCI unit/day if 47 PCI units	2.6	3.5	2.2	2.5
Emerg PCI/PCI unit/day if 57 PCI units	2.2	3.0	1.8	2.1
Emerg PCI/PCI unit/day if 67 PCI units	1.9	2.6	1.5	1.8

H. European Working Time Directive effective from 2009:

- ≤48h/w work (averaged over a reference period of <4m)
- ≥11h continuous rest per 24h
- ≥24h continuous rest per 7d, or ≥48h per 14d
- >20min break in work periods >6h
- Night work: an average of <8h work in 24h (averaged over a reference period of <14d)
- Resident = work even when not working
- Home = work only when providing services (eg telephone calls, working in hospital, & travel)

Shifts: with a total of 168h per week:

- If each interventionist spends 48h per week in catheter laboratory and is available for 40 weeks per year, then 168/48 = 3.5 x 52/40 = 5 cardiologists would be required to run a 24h/7d/365d resident intervention rota.

I. Table A4: Resident shifts:

Resident shift rota (example 1A)					**Resident shift rota (example 1B)**				
Cardiol	start	end	week	hours/w	Cardiol	start	end	week	hours/w
A Mon-sun	08:30	15:15	6.75h x 7d	47.25	A Mon-Fri	08:30	18:00	9.5h x 5d	47.5
B Mon-sun	14:45	21:30	6.75h x 7d	47.25	B Mon-Fri	17:30	22:00	4.5h x 5d	22.5+
C Mon-sun	21:00	09:00	12h x 7d	84 + week off	B Sat-Sun	09:00	21:00	12h x 2d	+24 =46.5 total
D	Week off				C Mon-sun	21:00	09:00	12h x 7d	84 + week off
E	To cover weekend work & leave				D	Week off			
F	To cover weekend work & leave				E	To cover weekend work & leave			

J. Summary (1A + 1B): 5-6 cardiologists *performing PCI only* are required to provide a *resident* emergency on-call 24h service; if it is assumed that existing interventionists will provide emergency service within usual daytime hours (cardiologist A), then 4 *additional* cardiologists per unit would be required.

These 4 would be *in addition* to other cardiologists required to provide other tertiary services, including elective intervention. Emergency capacity = 5-6 cardiologists working 168h/week performing 17-34 cases/week.

K. 3. On-call from home:

Example 2A: Regional system of cardiac surgical centres (32-38 units in UK) only provide emergency PCI service
Average of 2-5 cases per 24h, = 1-3 cases out-of-h, = say *average* 5 hours out-of-h incl telephone calls & travel
If *average* 5h out-of-h = 35h per week = next morning off & ~2h/d available for work x7d
Summary 2A: 1 cardiologist performing PCI out-of-hours is required to provide on-call night service from home; and 2 cardiologists to provide 7d emergency PCI day service 09:00-21:00 for 7d days per week. If it is assumed that existing interventionists will provide emergency service within usual daytime hours, then 2 *additional* cardiologists would be required.

Example 2B: All PCI units, including non-surgical (47-67 units in UK) all provide emergency PCI service:
Average of 2-4 cases per 24h = 0-2 cases out-of-h, = say *average* 2.5 hours out-of-h incl telephone call & travel
If *average* 2.5h out-of-h = 18h per week = next morning off & ~4h/d available for work x7d
Summary: 1 cardiologist performing PCI out-of-hours is required to provide on-call service from home; and 1 cardiologist to provide day service 09:00-17:00 for 5 days per week. If it is assumed that existing interventionists will provide emergency service within usual daytime hours, then 1 *additional* cardiologist would be required.

L. Conclusion: 2-3 cardiologists are required to provide emergency PCI with on-call from home system; an *additional* 1-2 cardiologists per unit would be required.
This would be in addition to other cardiologists required to provide other cardiac services, including elective intervention. Emergency capacity = 2-3 cardiologists working 58h-64h/week performing13-24 cases/week.

M. Table A5: estimated numbers of *additional* interventionists required for emergency PCI service

Additional interventionists	England	Engl upper	Total UK	Total UK upper	Total	Total upper
Resident 24h/7d/365d (4):					additional cardiologists pmp	
Regional units (n=32 UK)	104		128		2.2	
Cardiac surgical units (n=38 UK)	128		148		2.5	
All PCI units (n=47 UK)	148		188		3.2	
On-call from home from 17:00 or 21:00 to 09:00 (1-2):						
All PCI units (n=47 UK)	37	74	47	94	0.8	1.6
All PCI units (n=57 UK)	43	86	57	114	1.0	1.9
All PCI units (n=67 UK)	49	98	67	134	1.1	2.3

The above table assumes that emergency work during day-time is undertaken by usual day-time staff.

N. If emergency PCI for MI is undertaken nationally, it is estimated that an additional 100-200 cardiac interventionists would be required for a resident shift system on-call, or 50 to 150 for an on-call system from home, for the UK. This equates to an additional 2-3 cardiac interventionists pmp for a resident shift system on call, or 1-2 cardiac interventionists pmp for an on-call from home system. For planning purposes, it would seem appropriate to plan for an additional ~150 interventionists in the UK (~100 for England) to provide an on-call emergency PCI service.

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