Non-medical catheter laboratory staffing working group report

March 2007

Report commissioned by Dr. Nicholas Brooks, President, British Cardiovascular Society, to establish the extent of non-medical cardiac catheter laboratory staff shortages and to suggest possible solutions.

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1. **Executive Summary**

1.1. Demand for cardiac catheter laboratory capacity in the United Kingdom is increasing due to an ageing population, the impact of the National Service Framework for coronary heart disease, and a growing demand for percutaneous cardiac interventions.

1.2. In response the number of cardiac catheter laboratories has increased across the United Kingdom. In England cardiac catheter laboratory capacity has increased by 50% over five years, but this additional capacity can only be fully utilised if it is supported by adequate numbers of appropriately trained non-medical catheter laboratory staff.

1.3. There is no requirement for any specific professional group to be represented in the cardiac catheter laboratory, but all services must comply with the Ionising Radiation [Medical Exposure] Regulations (2000) and their amendments (2006).

1.4. Reliable information about the non-medical catheter laboratory workforce is limited. A survey of United Kingdom hospitals with cardiac catheter laboratories estimated that there are currently around 2,000 whole time equivalent professional non-medical catheter laboratory staff, compared with a projected need for 3,000-3,600 staff. In the survey 54% of participating hospitals reported non-medical catheter laboratory staff vacancies. In total 185 vacant posts were identified and the vacancy rate across the United Kingdom was estimated at 12%.

1.5. There is a particular shortfall in the number of physiologists and training capacity for this profession is insufficient to meet the growing demand. Nationally there are small surpluses of newly qualified nurses and radiographers but these staff are not trained to work in cardiac catheter laboratories. Non-registered staff also contribute to the cardiac catheter laboratory workforce, but the use of this staff group varies widely across the United Kingdom.

1.6. There are no nationally agreed training standards for catheter laboratory staff and educational and career
development opportunities for these workers are very limited. Skills for Health are currently defining competences and national occupational standards relevant to cardiac catheter laboratory staff, which could be used for future training programmes.

1.7. There is a need to expand the non-medical catheter laboratory workforce and to explore new workforce models for catheter laboratory staffing, including multi-skilling of the existing workforce and the future development of generic worker programmes. Training programmes to support these workforce models should lead to transferable qualifications or competences and could be provided by higher education institutions or by further development of local or regional courses, perhaps supported by the use of e-learning programmes.

1.8. **Headline recommendations**

The Working Group recommends that British Cardiovascular Society council:

- establishes a national database of the non-medical cardiology workforce
- recognises the urgent need to address the imbalance between current training capacity and likely future demand for cardiac physiologists
- actively explores options to increase the size and flexibility of the non-medical catheter laboratory workforce
- recognises the need for investment in training programmes for the non-medical catheter laboratory workforce
- supports the development of such training programmes.
2. Abbreviations

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<tr>
<th>Abbreviation</th>
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<tr>
<td>BANCC</td>
<td>British Association for Nursing in Cardiac Care</td>
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<td>BCS</td>
<td>British Cardiovascular Society</td>
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<td>BHF</td>
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<td>BSE</td>
<td>British Society of Echocardiography</td>
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<td>CHD CGWT</td>
<td>Coronary Heart Disease Care Group Workforce Team</td>
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<td>CSO</td>
<td>Chief Scientific Officer</td>
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<td>DOH</td>
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<td>EWTR</td>
<td>European Working Time Regulations</td>
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<td>HEI</td>
<td>Higher Education Institution</td>
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<td>HPC</td>
<td>Health Professions Council</td>
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<td>ISTC</td>
<td>Independent Sector Treatment Centre</td>
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<td>IR(ME)R</td>
<td>Ionising Radiation (Medical Exposures) Regulations</td>
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<td>KSF</td>
<td>Knowledge and Skills Framework</td>
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<td>LSBU</td>
<td>London Southbank University</td>
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<td>NMC</td>
<td>Nursing and Midwifery Council</td>
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<td>NOS</td>
<td>National Occupational Standard</td>
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<td>National Workforce Competence</td>
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<td>RCCP</td>
<td>Registration Council of Clinical Physiologists</td>
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<td>RCN</td>
<td>Royal College of Nursing</td>
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<td>R-ITI</td>
<td>Radiology – Integrated Training Initiative</td>
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<td>SCST</td>
<td>Society for Cardiological Science and Technology</td>
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<td>SHA</td>
<td>Strategic Health Authority</td>
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<td>SOR</td>
<td>Society of Radiographers</td>
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<td>wte</td>
<td>whole time equivalent</td>
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3. Objectives

3.1. This report was commissioned by Dr. Nicholas Brooks, President, British Cardiovascular Society (BCS), to establish the extent of cardiac catheter laboratory staffing shortages and to suggest possible solutions.

3.2. The BCS Non-medical Cardiac Catheter Laboratory Staffing Working Group was established in September 2005. The objectives of the Working Group were:

- To assess the extent and implications of national non-medical cardiac catheter laboratory staff shortages
- To establish the reasons for recruitment and retention difficulties and consider possible solutions
- To examine different models of catheter laboratory working and agree competences for non-medical catheter laboratory staffing
- To present recommendations to the British Cardiovascular Society Council.

4. Background

4.1. Over the last thirty years there have been rapid advances in the investigation and treatment of patients with cardiovascular disease. These advances have improved outcomes for patients, but have placed an increasing burden on cardiac services at all levels.

4.2. In 2000 the NHS plan identified staff shortages as the biggest constraint faced by the NHS. The Fifth Report on the provision of services for patients with heart disease, published in 2002, also identified a severe shortage of trained health care professionals and support staff as a major impediment to the provision of a modern and effective cardiovascular service.

4.3. In 2004 the Coronary Heart Disease Care Group Workforce Team (CHD CGWT) recognised that demand for non-
medical cardiology workforce for cardiac catheter laboratory work is outstripping supply, and that there is little likelihood of a balance being achieved with current service delivery models.³

4.4. A number of factors have contributed to a rising demand for cardiac catheter laboratory capacity within the NHS.

4.4.1. The United Kingdom has an ageing population with an increasing prevalence of cardiovascular disease and rising expectations of medical care. For example the number of people aged 50 and over increased from 13.8 million in 1951 to 20 million in 2003, and is projected to rise to 27.2 million by 2031. The largest increase has occurred among the very elderly and the proportion of the UK population aged 85 or over has more than doubled from 0.9% in 1971 to 1.9% in 2004.⁴

4.4.2. The National Service Framework (NSF) for Coronary Heart Disease was published in March 2000 and set out a strategy to modernize heart disease services in England over ten years.⁵ The NSF described standards for patients with coronary heart disease, and estimated the need for myocardial revascularisation procedures to be at least 750 percutaneous coronary interventions and 750 coronary artery bypass operations per million population. An additional chapter to the NSF (chapter 8), published in March 2005 set standards for the management of patients with arrhythmia.⁶

4.4.3. The emergence of catheter-based cardiac interventions as effective treatments for patients with cardiovascular disease has led to substantial increases in demand for these procedures. For example the rate of percutaneous coronary interventions in the United Kingdom increased four-fold from 304 per million in 1995 to 1,165 per million in 2005. The number of centres carrying out percutaneous coronary intervention increased by 54% over a similar period (from 54 in 1995 to 83 in 2005). In total in 2005 over 270,000 diagnostic or invasive cardiac procedures were carried out in 170 hospitals.⁷ These cardiac intervention rates are lower than rates in many
Western European countries and further increases in United Kingdom interventional activity are anticipated.8

4.4.4. Similar increases in activity have also occurred in pacing and electrophysiology. In 2004 there were 31,414 pacemaker, 2,701 implantable defibrillator, 1,466 cardiac resynchronisation and 5,648 radiofrequency ablation procedures in the United Kingdom.9

4.5. Following publication of the NSF a major programme to expand catheter laboratory capacity was initiated. From 2002 to 2007 over 90 new or replacement catheter laboratories will be installed in England, resulting in a 50% increase in catheter laboratory capacity.10 In 2005 there were 266 catheter laboratories in the United Kingdom, including 90 laboratories at 87 NHS non-interventional centres, 155 laboratories at 65 NHS interventional centres and 21 laboratories at 18 private hospitals.7

4.6. Cardiology services in Wales, Scotland and Northern Ireland are not covered by the NSF. Catheter laboratory capacity has increased at a slower rate in these countries, and this may contribute to national variations in provision of cardiac services.11

5. **Impact of IR(ME)R**

5.1. The Ionising Radiation (Medical Exposure) Regulations [IR(ME)R] 2000 and their amendments in 2006 describe the governance of a patient pathway through a radiation exposure and are relevant to all cardiac catheter laboratories.12,13 The regulations define responsibilities of all staff that refer for, justify, or carry out the practical aspects of radiation exposures. The regulations also define responsibilities of employing institutions at which radiation exposures are carried out and identify staff training requirements.

5.2. IR(ME)R defines a practitioner as the registered healthcare professional who judges that a radiation exposure is clinically indicated and who justifies the exposure. The practitioner must be “adequately trained” (detailed in
Schedule II of the Regulations), entitled by the Employer to act in this role, and is criminally liable for acts and omissions. In cardiology the practitioner has historically been the consultant cardiologist responsible for the patient’s clinical care.

5.3. IR(ME)R defines an operator as the person who undertakes the ‘practical aspects’ of a radiation exposure. The definition allows staff with adequate training and entitlement from the Employer to carry out an exposure, which may include checking patient identification, choosing the imaging mode and pressing the exposure button/footswitch. Under IR(ME)R radiographic exposures in the cardiac catheter laboratory can be carried out by any healthcare worker with appropriate training, which must include theoretical knowledge and practical experience (as defined in Schedule II of the Regulations). The operator has a central role in patient dose control and must collaborate with the practitioner to ensure an optimised balance between patient dose and image quality. An operator is criminally liable for acts and omissions. In cardiology the operator has historically been a radiographer.

5.4. IR(ME)R defines the duties of the employer, which include responsibility for implementation of the regulations. The employer must ensure that only “adequately trained” staff undertake IR(ME)R roles and that up-to-date training records are maintained. In addition the employer must ensure that a procedural framework describing the patient pathway through the radiation exposure, and the concomitant roles and responsibilities is in place. The employer must also ensure that the IR(ME)R procedural framework is audited. This system must include processes for patient dose control and the reporting of radiation incidents where doses to the patient are “much greater than intended”.

6. Cardiac Catheter Laboratory Workforce

6.1. Historically cardiac catheter laboratory work in the United Kingdom has involved contributions from medical, nursing, physiology and radiography staff. There are perceived
shortages of appropriately trained staff in all of these professional groups.

6.2. There is a legal requirement for roles and responsibilities within the catheter laboratory to be clearly defined and for relevant staff to be appropriately trained, but there is no requirement for any particular professional group to be represented in the cardiac catheter laboratory team.

6.3. In 2005 the BCS Cardiac Workforce Committee estimated the requirement for non-medical cardiology workforce in the United Kingdom to be 168-211 whole-time-equivalent (wte) staff per million population (range is minimum and ideal future requirement). Assuming a United Kingdom population of 58.789 million the total national requirement is 10,080-12,660 wte staff. Further, it was estimated that the UK requires 50-61 invasive clinical staff (nurses, physiologists, and radiographers) per million population (3,024-3,660 total wte) to provide a service delivering 2,200-3,000 PCI and 350-700 electrophysiology procedures per million population (assuming four non-medical catheter laboratory staff per case).  

7. **Nursing Workforce**

7.1. In August 2005 there were 672,897 individuals on the Nursing and Midwifery Council (NMC) register of whom 623,486 are qualified to practise in adult/general nursing.  

7.2. The size of the United Kingdom NHS nursing workforce has increased from 309,569 wte staff in 1997 to 374,003 wte in 2004 (an increase of 20.8%). This increase was higher in England (23% increase) than in the three other United Kingdom countries. In 2005 the NHS in England employed 307,744 wte (381,257 headcount) qualified nursing, midwifery and health visiting staff, of which 168,759 wte (205,611 headcount) were employed in acute, elderly or general areas of work.

7.3. The increase in the NHS nursing workforce is partly due to an increase in the number of new trainees entering the profession. After a marked drop in the 1990s the annual
number of new NMC registrants has risen substantially. In 2004/2005 there were 20,587 new entrants to the register from national training programmes and in July 2004 there were 87,115 students on full-time nursing courses across the United Kingdom. There has, however, recently been concern that some Strategic Health Authorities have reduced the number of commissioned places for student nurses and that there will be a shortfall in trained nursing staff in England by 2011.18

7.4. Overseas staff have also contributed to the increase in the size of the nursing workforce. The number of new overseas registrants with the NMC increased rapidly in the late 1990s and in 2004/5 there were 12,670 such new registrants. In the last four years overseas countries have contributed about 45% of the annual number of new registrants.17

7.5. The United Kingdom nursing workforce is ageing, reflecting reduced training capacity in the 1990s, an increase in the number of mature students entering the profession, and schemes to encourage return to NHS employment. In 2005 over 180,000 (28%) of NMC registrants were aged 50 or over. Moreover 2005 NHS workforce statistics indicate that only 3.3% of the nursing workforce were aged under 25 but 36.8% were aged 45 or over. Uncertainties about retirement intentions of NHS nurses compound workforce projections.

7.6. Recent financial pressures within the NHS have created uncertainty about the future employment prospects for the nursing workforce. In a recent survey of 507 newly qualified nurses 71% were still searching for a job at band 5 (starting) level. This sample may not be representative of the total number of new nurses seeking work but recruitment freezes imposed by NHS Trusts may result in nursing unemployment in the short term.19

7.7. The National Workforce Review Team Recommendations 2007/08 also suggested that financial pressures may lead to nursing unemployment in England. On the other hand reductions in international recruitment and higher retirement levels were projected to reduce growth in the nursing workforce, and sustained growth in training capacity was
recommended. The Workforce Review Team also highlighted a continuing need for post-registration training, and development of new roles and skill mixes with other professions. This will require nurses to take on new responsibilities, and effective use of healthcare assistants and other support workers to enable back filling of roles.\textsuperscript{20}

7.8. There are no national statistics on the number of nurses working in cardiology or in cardiac catheter laboratories. As nurses are generally employed to work on a ward or within a directorate this information is difficult to obtain reliably.

8. Physiology Workforce

8.1. In 2005 the NHS in England employed 5,188 (4596 wte) physiological measurement staff, but these clinicians provide services to a number of disciplines including audiology, gastrointestinal physiology, respiratory physiology, neuro-physiology, and cardiology.\textsuperscript{16}

8.2. In 2006 there were around 4,100 clinical physiologists on the voluntary register of the Registration Council for Clinical Physiologists (RCCP), of which 1,642 were cardiac physiologists. The register probably underestimates the total number of clinical physiologists currently working in the United Kingdom and compulsory registration with the Health Professions Council is planned for 2007.\textsuperscript{21}

8.3. The Society for Cardiological Science and Technology (SCST) carried out a survey of cardiac physiology staffing in 2003. The response rate was 60% and the survey identified 1,812 trained staff currently working in the United Kingdom and 320 vacant posts. Extrapolation of these data suggests that around 3,020 trained cardiac physiologists are employed in the United Kingdom with 533 vacant posts.\textsuperscript{22} The SCST has no information about the number of physiologists involved in cardiac catheter laboratory work.

8.4. In 2004 the CHD CGWT recognised an acute shortage but growing demand for trained cardiac physiologists. Joint work between the profession, Workforce Review Team, and CHD CGWT estimated that there are around 3,000 wte
cardiac physiologists in the United Kingdom, and this group recommended an increase to 4,000 wte. The CHD CGWT also acknowledged the Fifth Report, which recommended national workforce expansion to at least 4,000 wte cardiac physiologists.

8.5. In October 2006 the Workforce Review Team recommendations noted that there are 1,936 cardiac physiologists in England and commented that growth in the workforce would not be possible within existing resources.

8.6. The United Kingdom requirement for cardiac physiologists can be estimated from the 2005 BCS workforce paper to be 64-81 wte per million population (range is minimum and ideal future requirement) or a total of 3,874-4,857 wte staff (based on a United Kingdom population in mid-2005 of 60.209 million). These data indicate a major shortfall in the number of cardiac physiologists and conservatively it can be estimated that the United Kingdom currently requires at least 800-1,800 additional wte physiology staff.

8.7. From 1st September 2007 the expected route to RCCP registration will be a university degree in clinical physiology, satisfactory completion of training over a period of not less than four years, and the successful attainment of professional body examinations. The training currently includes a requirement to complete over two years in clinical placements. The training programme for clinical physiologists is currently under review by the Chief Scientific Officer as part of the Skills For Health Modernising Healthcare Sciences programme, and in the future clinical physiology training may change to a full-time three year degree course.

8.8. Across the United Kingdom 12 Higher Education Institutions (HEIs) provide RCCP accredited degree courses in cardiac clinical physiology. In the academic year 2005/2006 there were 585 students registered on these courses including 106 in year one but 164, 170, and 145 in years two, three, and four respectively.

8.9. Course coordinators are concerned that there has recently been a fall in the number of applicants for these courses,
that funding arrangements may be impeding progress of students through to graduation, and that some courses may not be sustainable in the future. For example, in 2006 North East Surrey College of Technology (NESCOT) had insufficient applications to run the first year of the course, although students continue in years two to four.25

8.10. Funding of clinical physiology degree courses varies across the United Kingdom. In England university courses are commissioned by Strategic Health Authorities, but in some areas NHS Trusts are required to employ trainee physiologists throughout training or during clinical placements. In Wales clinical physiology students are supported by four-year bursaries from the Welsh Assembly. In Northern Ireland trainees do not receive any financial support during clinical placements (total 105 weeks), which may explain the high attrition rate reported from this course.26

8.11. In 2001 the University of Wolverhampton was commissioned to provide training for 35 clinical physiologists (cardiac, respiratory, neurology) per annum. For the first two years of training these students are funded centrally but for the final two years students are employed by a local NHS Trust. In 2006 20 students completed year two, and due to financial pressures currently facing NHS Trusts only 17 found employment in West Midlands, while three students had to seek employment elsewhere. Intake onto this course in 2006 was only 14 students.27

8.12. The number of student physiologists on some courses is limited by capacity for clinical placements. For example, at Swansea University and the University of Leeds students are supported by means tested bursaries, but the annual student intake is restricted by training capacity in local hospitals.28,29

8.13. Recently a fast-track clinical physiology training programme for science graduates was trialled at Manchester Metropolitan University but it proved impossible to satisfy the RCCP requirements for accreditation in a two year course.30 In addition a small number of individuals are employed in trainee physiologist posts but are not enrolled
in university courses and may therefore not obtain a registerable or transferable qualification at the completion of training.\textsuperscript{31}

8.14. Cardiac physiologists also provide echocardiography services. The demand for echocardiography is projected to rise reflecting a growing number of patients with heart failure, the impact of guidelines that cite the need for echocardiography, and demand for echocardiography in the community.\textsuperscript{14,32-34}

8.15. Since 2000 the British Heart Foundation (BHF) has supported a total of 51 echocardiography trainees on a two year programme aimed at attaining British Society of Echocardiography (BSE) accreditation. Approximately two thirds of these trainees were clinical physiologists and one third was other science graduates. Such support from the BHF is welcome but specialisation of trained physiologists does not expand the workforce and may put pressure on other areas of cardiology. Moreover science graduates may not obtain a registerable qualification limiting their opportunities for future career development.

8.16. Options to expand the echocardiography workforce to meet the 18 week diagnostic waiting time target set out in the NHS Improvement Plan 2004 \textsuperscript{35} are currently being considered by the Chief Scientific Officer (CSO). In a paper submitted to the CSO representatives of the profession proposed an accelerated two year graduate diploma in cardiac physiology with specialisation in the second year in echocardiography (or other areas of cardiology). In addition a stand-alone graduate qualification in echocardiography has been suggested, although it is not clear whether any of these proposals will meet the demand for echocardiography workforce.

8.17. Physiologists are also required for rhythm management services including pacemaker and defibrillator implantation, and device follow-up clinics. In response to NICE guidance demand for these services has increased in recent years. Demand for physiologist time in the catheter laboratory to support electrophysiology and ablation services is also increasing.\textsuperscript{9,36,37}
8.18. In summary, available information indicates that demand for physiologists is continuing to rise and exceeds the limited training capacity currently available in the United Kingdom.

9. Radiography Workforce

9.1. In the United Kingdom radiographers participate in individual catheter laboratory procedures but also contribute to installation and programming of new radiographic equipment, quality assurance, training, and radiation protection.

9.2. In November 2006 a total of 23,845 radiographers were registered with the Health Professions Council.\textsuperscript{38}

9.3. In September 2006 the Society of Radiographers (SOR) membership included 15,377 radiographers based in the United Kingdom and of working age, of whom 370 reported a specialist interest in cardiology.\textsuperscript{39} This number is likely to be an underestimate as SOR membership is not compulsory and members are not obliged to declare specialist interests.

9.4. In 2005 the NHS in England employed 12,700 individuals (10,526 wte) in diagnostic radiography.\textsuperscript{16}

9.5. The role of diagnostic radiographers in the NHS is evolving with major changes in skill mix across different professional groups. In many institutions assistant practitioners carry out some plain film radiography examinations under the supervision of a registered radiographer or consultant radiologist, thereby helping to release radiographer capacity for other activities. Other work previously carried out by doctors is now routinely done by radiographers. Moreover radiographers are presented with a range of career opportunities in other imaging modalities, including ultrasound, computed tomography, magnetic resonance imaging, and nuclear medicine.

9.6. In the United Kingdom 25 Higher Education Institutions offer degree courses in radiography. The courses are for three
years in England but four years in Scotland and Northern Ireland, moving to 3 years from 2007 in Northern Ireland. The number of students enrolled on these courses and registered with the SOR increased from 2,895 in 2002 to 4,612 in 2006. The number of graduates in diagnostic radiography increased from 529 in 2002 to 829 in 2006, and when the most recent set of students graduated in June 2006 SOR reported a small surplus of radiographers relative to immediate workforce requirements.20,39

9.7. In England the National Workforce Review Team Recommendations 2007/08 highlight uncertainties about the balance between demand and supply of radiographers, generated by the effects of new policy initiatives, financial pressures, and changes in skill mix. Further changes in skill mix are anticipated with radiographers taking on more work formerly done by doctors and passing on work to assistant practitioners.20

9.8. Precise information about the number of radiographers working in cardiology or in catheter laboratories in the United Kingdom is not available.

10. Catheter laboratory assistants and administrative support

10.1. There is increasing recognition of the importance of unregistered staff in the delivery of healthcare in the United Kingdom.40 The Career Framework for Health defines healthcare workers at levels 2-4 as support workers, senior healthcare assistants or technicians, and assistant or associate practitioners. With appropriate training and supervision these workers can develop a range of competences and carry out tasks currently carried out by registered members of staff.41

10.2. Several catheter laboratories in the United Kingdom employ unregistered staff to undertake a range of duties which were previously the responsibility of registered nursing, physiology, or radiography staff. These duties vary widely between different institutions but include, for example, preparation of patients for procedures, phlebotomy and
venous cannulation, arranging sterile trolleys, setting up pressure transducers, assisting at procedures, and arterial sheath removal.

10.3. In some cardiac catheter laboratories skilled and experienced professional staff are responsible for material and personnel management, including ordering of equipment and construction of work rotas. Many of these tasks could be appropriately devolved to clerical and administrative assistants. Greater use of information technology for stock control and automated ordering might also free professional non-medical staff from administrative duties.

10.4. There is currently no national information about the number of level 2-4 staff working in cardiac catheter laboratories or in cardiology, or about the work these staff carry out.

11. **Role of medical staff**

11.1. Catheter laboratory staffing models and working practices in many European and American centres differ from practice in the United Kingdom. For example in some European centres cardiologists operate the radiographic imaging system, reducing the need for other staff to undertake radiography duties during catheter laboratory procedures.

11.2. In the United Kingdom only a minority of cardiologists operate the radiographic equipment. In some cardiac catheter laboratories there may be opportunities for medical staff to contribute more to this aspect of catheter laboratory work, but this will depend critically on local arrangements, including medical staffing levels and requirements to train junior medical staff. Moreover, in many circumstances it may be inappropriate for medical staff carrying out complex interventions to assume additional responsibility for the radiographic aspects of the procedure.
12. **Conditions of employment**

12.1. Agenda for Change, introduced in December 2004, aims to create a new NHS career structure in the United Kingdom, with progression through pay scales linked to roles and responsibilities (via job descriptions and person specifications). Supporting this is a Knowledge and Skills Framework that seeks to define knowledge and skills required for a particular role and enable training to be planned systematically. In practice the implementation of Agenda for Change has often been challenging with disparities in banding between cardiac centres and within individual departments, and in some instances this has created resentment between different groups of workers and difficulty with retention of qualified staff.

12.2. Cardiac catheter laboratories are complex environments, but most qualified staff learn their roles by supervised experience and receive little or no formal training in catheter laboratory work. Educational opportunities for the existing non-medical catheter laboratory workforce are very limited, and consist mainly of ad hoc local programmes and regional or national conferences. Moreover in many departments there is a lack of protected time for professional development of both established and new non-medical catheter laboratory staff.

12.3. Catheter laboratory staff in many hospitals are expected to contribute to on-call rotas to cover emergency (out-of-hours) activity. In some institutions the introduction of primary angioplasty services has substantially increased the emergency workload and this may influence retention of staff. In other institutions the introduction of a primary angioplasty service has required additional staff to ensure compliance with the European Working Time Regulations (EWTR). For example at the London Chest Hospital 10 additional physiologists had to be recruited from overseas to support the North East London primary angioplasty service and to facilitate EWTR compliance.

12.4. The NHS in England is currently undergoing a major process of restructuring with the objective of creating a mixed economy of healthcare providers. Many NHS Trusts
are facing severe financial pressures caused by recurrent operational deficits, the impact of increased staffing costs, and new commissioning arrangements. In an attempt to reduce deficits some Trusts are imposing restrictions on recruitment of new and replacement staff, including the appointment of non-medical cardiology staff. These factors limit opportunities for service development and modernisation, create uncertainties about job security, and may impact negatively on staff morale.

12.5. Anecdotal experience suggests that substantial numbers of experienced catheter laboratory staff each year find alternative employment in industry, reflecting the disparity in remuneration between the public and private sectors. Employment opportunities in alternative service providers including Independent Sector Treatment Centres may also attract non-medical professional staff in the future.

13. **Skills for Health and National Occupational Standards**

13.1. The Department of Education established the Sector Skills Development Agency (SSDA) in 2002. The SSDA is a non-departmental public body which funds, supports and monitors a network of 25 Sector Skills Councils. The Sector Skills Council for the health sector is Skills for Health.44,45

13.2. One of the main functions of Skills for Health is to develop National Occupational Standards (NOS) and National Workforce Competences (NWC) for use within the health sector. These statements of competence are applicable across the United Kingdom, are transferable between employing institutions, and can be used to design roles and services. They can help to determine education, training and curriculum requirements, and form the basis of National and Scottish Vocational Qualifications. Within the NHS they can be used by employers and individuals to support the use of the Knowledge and Skills Framework.

13.3. HEIs can deliver the knowledge and understanding that underpin National Occupational Standards, and provide quality assurance around the assessment of competence. However assessment of competence against NOS can also
be carried out by an occupationally competent individual and does not necessarily require HEI input.

13.4. Skills for Health have been commissioned by the Chief Scientific Officer to review the training requirements and programmes for all Healthcare Scientists, including training for clinical physiologists.

14. Alternative workforce models

14.1. The Fifth Report concluded that there are opportunities to use staff more efficiently, particularly by reviewing and revising their roles. In the United Kingdom several cardiology services are exploring alternative workforce models to support cardiac catheter laboratory activity. These ad hoc developments are often driven by local shortages in a particular staff group, vary widely in scope, and are not guided by regional or national practice standards.

14.2. Multi-skilling of the catheter laboratory workforce has been proposed as one method of dealing with non-medical catheter laboratory staff shortages. The suggested advantage of multi-skilling is that it increases workforce flexibility and reduces reliance on a single professional group. On the other hand multi-skilling challenges professional boundaries and pre-existing differences in staffing levels, work rotas, and banding may all hinder efforts to integrate different professional groups into a unified workforce. Ongoing projects to implement multi-skilling range from pilot projects to structured courses leading to a formal qualification.

14.3. In some institutions such projects have been successful in maintaining services in spite of significant staff shortages. For example at Whipps Cross hospital nursing staff have been trained to carry out radiography and physiology duties within the catheter laboratory, and this in-house programme has facilitated the delivery of a cardiac catheter laboratory service for several years. In Nottingham a shortage of radiography staff has been managed by training nursing and physiology staff to operate radiographic equipment.
This programme involves two days tuition and a period of practical training, following which staff are approved locally to carry out radiographic duties during catheter laboratory procedures. Similar projects have been initiated at several other cardiac centres across the United Kingdom but none of these programmes provide a transferable qualification. Moreover provision of protected time for in-house teaching and training is difficult when staff are also required to deliver the clinical service.

14.4. The Cardiac Catheter Laboratory Practitioner Project was initiated in 2004 and adopted a different approach to multi-skilling of the non-medical catheter laboratory workforce. The project identified competences required for non-medical catheter laboratory workers, which form the basis for a postgraduate course at London Southbank University (LSBU). The course involves five weeks of academic tuition, a four month period of supernumerary clinical experience with at least 25 hours per week in the catheter laboratory, and a formal exit examination. The aim of the course is to develop competences across traditional professional boundaries, leading to a postgraduate certificate in cardiac angiography that will be transferable between different healthcare institutions. Staff from all three professional groups (nursing, radiography and physiology) were enrolled in the first course and 11 staff have recently graduated, some of whom are now working in extended catheter laboratory worker roles.

14.5. These programmes extend the roles of existing staff but do not address the underlying shortage of trained staff. The overall size of the workforce could be increased by developing generic catheter laboratory worker roles, which would require new science graduates to be trained to carry out all of the various nursing, physiology and radiography duties required in the catheter laboratory. There is currently no training programme or registered qualification for a generic catheter laboratory worker role in the United Kingdom, and the development of such a role would require sustained investment. Furthermore, there is no career structure for such generic workers and opportunities for career progression would be limited, especially if science
graduates without a registered health professions qualification were attracted into such roles.

14.6. The costs of multi-skilling or re-training the existing workforce through centralised training programmes are likely to be considerable. The start-up costs of the LSBU Cardiac Catheter Laboratory Practitioner project including set-up costs (development of syllabus and teaching modules), running costs (lecture fees, facilities, examinations), and indirect costs (incurred when staff are seconded from their usual professional roles) have been estimated at £0.5 million.\textsuperscript{47} Moreover current service and financial pressures may prevent enrolment of large numbers of supernumerary staff on extended postgraduate training programmes, and the planned intake for the second Cardiac Catheter Laboratory Practitioner course in 2007 is currently 10 students.

14.7. E-learning offers an alternative method of delivering education and is increasingly being used for some elements of healthcare training programmes. A major advantage of e-learning is that the location, time and pace of the educational activity are determined by the student. In addition e-learning packages can be configured to involve the trainee in the learning process, provide feedback and support, and assess a student’s progress. On the other hand the flexibility in time and location of e-learning means that the learner is often studying alone without face-to-face contact with other students and teachers.

14.8. E-learning is also associated with significant costs including set-up and administration costs. Commercial e-learning is estimated to cost around £20,000-£30,000 per hour of learning material (generally considered equivalent to around six hours of conventional learning materials).\textsuperscript{48}

14.9. The Radiology – Integrated Training Initiative (R-ITI) is a collaborative on-line training programme for radiologists involving the Royal College of Radiologists, Department of Health and NHS. This e-learning project developed 600 hours of e-learning materials over 18 months, at an estimated cost of £2 million. The costs of R-ITI include hardware, software and licence costs, and using this
infrastructure the same development team have recently provided three hours of radiation protection material for South West Strategic Health Authority at a total cost of £5,500.\textsuperscript{48,49} This infrastructure is now available for e-learning projects developed by other organisations within the NHS and can deliver on-line educational material at an estimated cost of £3,000 per hour.\textsuperscript{48}

15. **Cardiac catheter laboratory workforce survey**

15.1. A questionnaire was circulated to the catheter laboratory managers of 170 hospitals with cardiac catheterisation laboratories. Completed questionnaires were returned from 86 hospitals (51%). The response rate was higher from hospitals that carry out percutaneous coronary intervention procedures (64%) than from centres that do not (36%). 44% of hospitals in the survey carry out electrophysiology procedures.

15.2. The minimum number of non-medical staff considered necessary for cardiac catheterisation procedures averaged four (2 nursing, 1 physiology, 1 radiography) but in 27% of hospitals cardiac catheterisation is carried out with a minimum of three staff and in 28% with a minimum of five staff. Similarly in 21% of hospitals percutaneous coronary intervention is carried out with a minimum of three staff but in 21% five or more staff are considered necessary. Fewer nursing staff (average 1.6) are required for pacemaker or electrophysiology procedures.

15.3. 54% of hospitals in the survey had vacant non-medical catheter laboratory staff posts (67% of 12 hospitals in London, 52% of 73 hospitals outside London). Vacancies for physiology staff were reported in 41%, for nursing staff in 34%, and for radiography staff in 25% of hospitals.

15.4. A primary angioplasty service for ST-elevation myocardial infarction is provided by 46% of the responding hospitals, but is the default reperfusion strategy in only 14% of hospitals. Of note, 79% of centres that carry out primary angioplasty (either for selected cases or as the default reperfusion strategy) had at least one staff vacancy.
compared with 38% of centres which never undertake primary angioplasty.

15.5. In total the survey identified 185 vacant posts including 67 nursing posts, 80 physiology posts, 33 radiography posts and 5 other staff posts. Simple extrapolation of these data may be confounded by sampling and other biases. Nevertheless, after adjustment for the number of catheter laboratories at participating hospitals, it is estimated that there are 303 vacant non-medical catheter laboratory staff posts across the United Kingdom.

15.6. Hospitals in the survey employed a total of 603 wte nursing staff (data from 72 centres), 217 wte physiologists (58 centres), and 259 wte radiographers (71 centres) dedicated to catheter laboratory work. Extrapolation of these data (with adjustment for the number of catheter laboratories) estimates that there are 1,106 nursing, 511 physiology, and 478 radiography wte staff employed in 266 cardiac catheter laboratories in the United Kingdom.

15.7. It can therefore be estimated that there are around 2,095 wte non-medical professional staff in United Kingdom catheter laboratories. The survey did not record whether vacant posts are included in this number, but the overall vacancy rate for cardiac catheter laboratory posts is estimated to be at least 12%. These data may overestimate the true vacancy rate because centres with vacancies may be more likely to participate in workforce surveys, but nevertheless indicate a high vacancy rate amongst non-medical cardiac catheter laboratory staff. By comparison the NHS vacancy survey 2005 recorded a 3-month vacancy rate of 1.9% for nursing staff in all areas, 3.4% for allied health professionals, and 2.2% for scientific, therapeutic and technical staff.50

15.8. Non-medical staffing numbers were considered to limit catheter laboratory activity in 63% of centres. This was due to numbers of physiology staff in 45%, nursing staff in 41%, radiography staff in 36%, and portering staff in 14% of hospitals. In 42% of hospitals medical staffing levels were also considered to limit catheter laboratory activity.
15.9. Difficulty recruiting catheter laboratory staff was reported in 64% of hospitals, including nursing staff in 41%, cardiac physiologists in 62%, and radiographers in 48% of hospitals. A lack of experienced applicants was the most frequent reason given for recruitment difficulties.

15.10. Difficulty retaining catheter laboratory staff was reported in 31% of hospitals, including nursing staff in 24%, physiology staff in 23%, and radiography staff in 15% of units. Working conditions, pay and banding, and on-call demands were all cited as reasons for difficulty in retaining staff. Some respondents commented that staff have been ‘poached’ by hospitals setting up new catheter laboratories, and in some cases staff have left to work in industry.

15.11. Multi-tasking between professional groups was considered routine in 13% of hospitals. In 25% of hospitals nursing staff were ‘fully supportive’ of multi-tasking or generic worker programmes. By comparison physiology staff in 12%, and radiography staff in 19% of hospitals expressed similar support. On the other hand 49% of respondents felt catheter laboratory multi-tasking would help staff recruitment and 59% felt multi-tasking should be introduced.

16. Conclusions and possible solutions

Workforce numbers

16.1. Cardiac catheter laboratories are central to the provision of a modern clinical cardiology service and in recent years catheter laboratory capacity has expanded rapidly to meet a rising demand for invasive cardiac procedures. This capacity can only be fully utilised if it is supported by appropriate levels of non-medical catheter laboratory staffing.

16.2. The number of catheter laboratory staff required for a specific cardiac procedure will depend on many factors including case complexity, experience of individual staff, presence of trainees, and layout of facilities. It is therefore not appropriate to define a minimum staffing requirement
but catheter laboratories must ensure that sufficient numbers of staff are available to carry out procedures safely.

16.3. Information about the non-medical cardiology workforce including staffing levels, trainee numbers, workforce demographics, and retirement intentions is very limited.

16.4. Existing information suggests that there is a significant shortage of professional non-medical staff in cardiac catheter laboratories in the United Kingdom. The survey estimated that invasive cardiac services are currently provided by 2,095 wte non-medical clinicians, but the 2005 BCS workforce committee report estimated the requirement for such staff to be 3,024-3,660 wte.\textsuperscript{14} This shortfall must be considered in the context of the growing demand for trained non-medical staff in other areas of cardiology and across the NHS.

16.5. In particular the number of trained cardiac physiologists working in the NHS is insufficient to meet the demand for cardiac catheter laboratory activity and other cardiac services, including echocardiography and rhythm management. It is estimated that there are around 3000 cardiac physiologists in the United Kingdom, but the projected need is for 3,874-4,857 wte,\textsuperscript{14} which suggests an immediate shortfall of 800-1,800 wte. Moreover the capacity of clinical physiology training programmes is currently very limited and cannot address this deficit or meet future service needs.

16.6. The survey also suggests that there is a shortage of experienced nursing staff available to work in cardiac catheter laboratories. At the same time reports indicate unemployment amongst newly qualified nurses, but uncertainty about capacity within the profession to meet longer term demand.

16.7. The survey identified a small number of vacant radiographer posts in cardiac catheter laboratories, which may reflect the high demand for radiographers in other areas of radiographic work. As there is now a small surplus of qualified radiographers relative to demand the number of vacancies may reduce, although it is unlikely that new
radiography graduates will be recruited directly to current catheter laboratory vacancies due to their lack of experience.

16.8. Plans for primary angioplasty services across the United Kingdom are unlikely to be realised with current non-medical catheter laboratory staffing levels.

Possible solutions – expanding the workforce

16.9. Catheter laboratory staffing shortages should be addressed by increasing the supply of appropriately trained personnel, equipped with the competences required to deliver a safe, effective and sustainable service. This will require sustained investment to expand undergraduate and postgraduate training capacity, and coordinated efforts to attract students and graduates into catheter laboratory work and other areas of cardiology.

16.10. Work experience schemes to expose school sixth-formers to cardiology and catheter laboratory work could be developed at local and regional levels, or through cardiac networks, to encourage recruitment into the relevant professions and into cardiology in the longer term.

16.11. Undergraduate nurses and radiographers do not always experience cardiac catheter laboratory work during training and may not consider applying for a job in this environment. Student nurses and radiographers should be encouraged to undertake short attachments in cardiac catheter laboratories or other areas of cardiology, with the objective of attracting greater numbers into catheter laboratory employment.

16.12. The imbalance between training capacity and the demand for cardiac physiologists requires urgent attention. The four year clinical physiology degree course is currently under review and alternative, potentially shorter training programmes for larger numbers of students may be feasible. In the interim there is a need to fully utilise existing training capacity. Funding arrangements for these courses vary widely and in some instances may be impeding recruitment into the profession and progress of student physiologists.
through to graduation. Several universities report capacity to enrol a larger number of trainees but are unable to find clinical placements at local hospitals. HEIs, SHAs, cardiac networks, NHS Trusts, and the wider cardiology community must address these issues and provide greater support to clinical physiology training programmes. Unless action is taken it is possible that the number of clinical physiology graduates will decrease in the next few years and cardiology services in parts of the United Kingdom may become unsustainable.

16.13. The pool of qualified nurses available to work in the NHS is large, and there may be opportunities to increase the size of the non-medical cardiac catheter laboratory workforce by employing additional nursing staff, particularly as some newly qualified nurses are currently unemployed. This will require competition for staff with other healthcare sectors and expansion of the workforce at a time when most NHS Acute Trusts are facing significant financial pressures. Moreover new nursing recruits to the catheter laboratory environment will require training to become effective members of the catheter laboratory team.

16.14. The development of generic catheter laboratory worker roles and the recruitment of new science graduates without a registerable qualification into catheter laboratory work is an alternative option, and could increase the size and flexibility of the workforce. To equip new graduates with the required competences a training programme with approved content would have to be developed. In the longer term appropriate career pathways would have to be established for such workers, which might need to define a route into one of the registered professions.

Possible solutions – new ways of working

16.15. For some centres the traditional model of cardiac catheter laboratory working may not be sustainable because of limited numbers of trained staff and alternative models of working should be considered.

16.16. In some institutions it may be possible to create additional capacity by enabling existing catheter laboratory staff to
concentrate on essential clinical roles and by minimising non-clinical activities. In particular some duties, including material and personnel management could be devolved to administrative personnel. In addition assistant practitioners and other unregistered staff could take on some clinical duties currently carried out by professional catheter laboratory staff. There is a need to review the use of unregistered staff in cardiac catheter laboratories across the United Kingdom and to develop standards and training programmes to ensure their full potential is realised.

16.17. Greater workforce flexibility allows for more efficient working patterns and relieves some of the vulnerability associated with small teams. The flexibility of the catheter laboratory workforce could be increased by including staff in rotations through other work areas, thus increasing the number of individuals with the competences required for catheter laboratory work. For example, many physiologists contribute to catheter laboratory work but also rotate through cardiac rhythm management and echocardiography services. In some institutions nursing staff work flexibly between the cardiac catheter laboratory, coronary care unit and cardiology wards. Radiographers can be employed to contribute to cardiac catheter laboratory work, while also rotating through other areas of radiology and working with other imaging modalities.

16.18. Individual cardiac catheter laboratory procedures can be carried out safely without input from specific professional groups, provided that the requisite range of competences is available within the catheter laboratory environment. With appropriate training these competences can be provided by members of any of the professional groups traditionally associated with catheter laboratory work. Multi-skilling of catheter laboratory staff (or in the longer term creation of a generic catheter laboratory worker role) has therefore been proposed as another method of increasing workforce flexibility and reducing reliance on a single professional group, and has already been implemented in several United Kingdom hospitals.

16.19. Training programmes should be developed to facilitate multi-skilling of the existing catheter laboratory workforce.
Such training could be coordinated across the United Kingdom with agreed national standards for the underpinning knowledge and supervised practical experience. Where possible these training initiatives should be accessible to established members of all three professional non-medical disciplines, and to new recruits into the catheter laboratory environment. If successful these training programmes could be developed into generic catheter laboratory worker programmes in the longer-term.

16.20. An indicative list of the knowledge and tasks considered necessary for multi-skilling in the catheter laboratory has been developed and is shown in the appendix. This list has been agreed by members of the working group including representatives from all involved professional bodies. Skills for Health are currently mapping the list to National Occupational Standards to identify transferable competences.

16.21. Training programmes for catheter laboratory multi-skilling could be delivered by HEIs, which would lead to a transferable qualification (e.g. postgraduate certificate). Such courses are likely to be expensive and will take time to develop. Moreover, demand for such courses is likely to be relatively small and distributed widely across the country, and incentives for HEIs to establish such courses are therefore limited. Realistically HEIs are unlikely to meet the training requirements for catheter laboratories in the short to medium term.

16.22. Alternatively existing local and regional training schemes could be expanded and developed to deliver training to agreed standards, possibly coordinated at a national level by the BCS in collaboration with other professional groups. Such training could lead to transferable competences based on National Occupational Standards.

16.23. E-learning packages to support some elements of training of non-medical catheter laboratory staff could be developed in collaboration with a HEI or the DOH e-learning project team, together with appropriate professional representation.
16.24. Retention of existing non-medical professional catheter laboratory staff is an important component of any workforce strategy and will be essential for maintenance of clinical cardiology services. Staff retention may be influenced by several factors including local working conditions and facilities, terms of employment and pay, on-call commitments, and opportunities for professional development and career progression. It is clear that Agenda for Change has not yet been fully implemented and discrepancies in banding between different professional groups need to be resolved. In some institutions it may be appropriate to review local working conditions and on-call rotas to maximise efficient use of staff and to identify opportunities for changes in skill mix and training.

16.25. No single workforce solution will be suitable for all environments and in most institutions a multi-faceted approach is likely. Senior medical and non-medical clinicians should engage with these issues, should champion multi-skilling of the catheter laboratory workforce, and state the case for investment in training of non-medical catheter laboratory staff at local, regional, and national levels.

17. Recommendations

The Working Group recommends that BCS Council

17.1. recognises the national shortage of appropriately trained professional non-medical catheter laboratory staff and highlights this shortage in future discussions with the Department of Health.

17.2. asks the BCS Workforce Committee to establish a national database of the non-medical cardiology workforce to provide reliable information about trainee numbers, staffing levels, and workforce demographics.

17.3. recognises the urgent need to address the imbalance between current training capacity and likely future demand for cardiac physiologists. BCS and the wider cardiology community should engage with other organisations (HEIs,
SHAs, cardiac networks) to develop and fully utilise existing physiology training capacity, and contribute to the ongoing review of the clinical physiology degree course.

17.4. actively explores options to increase the size and flexibility of the non-medical catheter laboratory workforce, including the more widespread and coordinated use of unregistered workers and assistant practitioners, and schemes to attract school leavers, nursing and radiography graduates, and new science graduates into the catheter laboratory workforce.

17.5. recognises the limited educational opportunities for the non-medical catheter laboratory workforce, and the need for investment in training programmes for multi-skilling and generic catheter laboratory worker roles.

17.6. supports the development of such training programmes. These programmes should be coordinated nationally and lead to transferable competences or qualifications. Training could be commissioned from HEIs or provided through expansion of existing local or regional training programmes, supported by e-learning packages developed collaboratively with the relevant professional representation.
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Appendix. Indicative knowledge and tasks contributed by each professional group to cardiac catheter laboratory activity. This list is being transferred to competences (National Occupational Standards) by Skills for Health. To become fully multi-skilled a trained member of one profession would have to acquire the competences of the other two professional groups.

**Generic**
- Patient positioning
- Infection control
- Wound care
- Respecting and promoting individuality
- Communication – patient, family, professional
- Psychosocial assessment
- Patient education
- Managing resources (staff, equipment, etc)
- Contributing to writing protocols and guidelines
- Resuscitation (intermediate life support)
- Co-ordination of daily procedure list
- Participation in audit

**Nursing**
- Venepuncture and venous cannulation
- Delivery of oxygen, saturation monitoring with pulse oximeter
- Haemodynamic monitoring and interpretation (heart rate, blood pressure, tissue perfusion)
- Assessment of chest pain
- ECG monitoring and interpretation
- Arterial access site management (femoral and radial sheath removal and brachial access site care)
- Care of temporary and external pacing
- Care of intra-aortic counterpulsation
- Intravenous drug administration
- Assisting at sterile procedures
- Care of dead and dying

**Radiography**
- Follow relevant local and national radiation protection policies
- Implement local IRMER procedures
- Switch radiographic equipment on and off
- Create new patient study and enter correct patient details into equipment
- Select appropriate program on the equipment
Understand principles of isocentring and perform this task
Position and move table/patient to provide optimum image quality
Operate the equipment to keep the patient and staff doses ALARP
(appropriate use of collimation, filtration, ‘store fluoro’ options)
Operate the imaging equipment safely to avoid collision with patient, staff or equipment
Understand standard radiographic views
View recorded acquisitions during procedure per frame or loop
Carry out quantitative coronary and left ventricular analysis
Send and retrieve images from store
Copy images to removable media
Recognise machine malfunction and take appropriate action
Understand issues concerning contrast agent selection
Set up and use contrast injector

**Physiology**
Set up and calibrate pressure transducer
Connect ECG
Switch on/system check of haemodynamic monitoring equipment
Monitor, record and interpret surface electrocardiogram
Monitor, record and interpret single or simultaneous arterial and venous pressure traces
Maintain procedure and equipment log
Carry out whole blood oximetry
Measure ACT
Maintain equipment (saturation machine, resuscitation trolley)
Operate ancillary equipment as required (including IVUS, rotablation, thrombectomy, pressurewire)
Carry out thermodilution cardiac output measurements
Operate pacing box for temporary pacing

**Advanced level (not for multi-skilling)**
Intra-aortic balloon pump operation
Pacemaker, ICD and CRT device implantation and programming
Electrophysiology and radiofrequency ablation