Executive Summary

The provision of Medical Physics and Clinical Engineering Services has been mapped across the UK. IPEM now has a centrally-held, updateable, database describing the majority of large-centre MPCE provision across the UK, as well as many of the smaller centres.

A guidance document to aid NHS Trust and Health Board Lead Scientists in England and Wales with assigning posts to the new (2014) ESR codes has been produced, and is available to download from the IPEM website.

A comprehensive survey of Radiotherapy Physics has been carried out, including staff in post, post profile and vacancy information. The vacancy data has been modelled, combined with training output in the past, and the output used to influence training commissioning at Health Education England, and to maintain the occupation of radiotherapy physicist on the National Shortage Occupation List.

A Magnetic Resonance Physics survey was carried out, in conjunction with the IPEM MR Special Interest Group (MRSIG), inviting responses on staffing and equipment factors. The output has been used to evidence optimum staffing levels for a Policy Statement Document on MR Physics

Preliminary surveys in Diagnostic Radiology, Radiation Protection and Electronic and Biomedical Engineering (EBME) have been carried out, covering staff in post, post profile and vacancy information. These have provided an insight into the relevant workforce issues in these areas, and will provide a foundation for further work.

This project has provided data and information as a foundation for the Workforce Intelligence Unit, and established IPEM's position as a credible source of accurate Workforce data.

Contents

Project Background

This project was initiated to meet a widely recognised lack of comprehensive data in this area. High-quality data is vital to ensuring the right decisions are made on issues such as training, recruitment, staffing and services. Decision makers such as Health Education England and the Migratory Advisory Committee need workforce data, often at short notice, which makes it impossible to provide an accurate response unless data is already held on record. The information could prove particularly important for any future review of NHS healthcare science. Workforce Intelligence improves IPEM's knowledge and understanding of the sector and helps form IPEM's policies and priorities, including Position Statements and Policy Statements on Staffing Levels

Main objectives:

1. To **map services** across the UK first and use this to build links that enable better data gathering over time. Bring together information and map all physics and engineering areas and related services, within and outside of the NHS.
2. To provide IPEM with an accurate description of the workforce in terms of composition (discipline & qualification level) and geographical location. It is also desirable to obtain age and gender information, but this is more difficult, and this project aims to make steps towards gathering this data. A key output will be links and a structure to continually monitor this in the future. Currently available data will be amassed first, then a survey carried out to fill in the gaps.
3. Promote the importance of the consistent use of the ESR to members (where applicable), and issue guidance for doing so. Also to stress the importance of updating IPEM membership records to reflect current workareas, and the impact of this on workforce intelligence.
4. Make the data available to **support members by providing comparative data and best practice** to counteract pressures to reduce staffing where this would affect quality or safety of services. Access to data will be a member benefit

Secondary aims:

- Monitor development of bands 2-4, including new job roles

- Gather information on radiotherapy skills mix, 6-7 day working and the Medical Physics Expert
- Input into work on nomenclature and terminology re scientist and practitioner careers
- Provide example descriptions for job roles, from bands 2-4 upwards, to promote parity across regions
- Capture issues and contacts regarding recruitment and retention
- Identify **further opportunities** for IPEM to further its strategic objectives and support members that might arise out of this work. Including but not limited to:
    - the use of the data to **influence the Department of Health and others** on workforce, service quality and safety issues
    - influencing development of education, training and CPD resources.
    - workforce planning and development
    - influencing Governmental Policy
    - linking to membership and issues that arise from greater understanding of membership and profile

This project was named the Workforce intelligence Baseline Project. It was intended to **incorporate as much information as possible from that available** within other organisations, and collaborate where appropriate with other organisations to avoid duplication while ensuring that the information is specific to our areas of interest.

Main outputs

Mapping Services

The structure and provision of MPCE services has been examined across the UK. There are significant variations in the structure and provision of services, and as to what is covered by each service. These variations, and a background describing healthcare structures in the UK are covered in Appendix B. However, each workforce can be broadly grouped into themes, aligned with the IPEM Special Interest Groups.

Service information has been assembled for approximately 60% of Trusts and Health Boards and in many cases key contacts have been identified. This puts the Institute in a good position to progress future workforce intelligence work from surveys to census. A SQL-searchable database has been designed and built in order to hold this information, and information collected in the future. The database structure is detailed in Appendix A. Services information has been made available to members via an interactive, updatable map on the Institute's web pages. More detailed service information can be accessed from the database on request, for example, all the departments providing a nuclear medicine service or all departments providing rehabilitation engineering services.

Promoting the importance of the Electronic Staff Record

The Electronic Staff Record and its role in Workforce Intelligence is discussed in detail in Appendix D.

In January 2014 the Workforce Standards at the Health & Social Care Information Centre issued a User Notice (UN1828) requiring the re-coding of all posts in the Healthcare Science (HCS) Staff Group within the Electronic Staff Record (ESR). The recoding was intended to improve the description of the workforce and increase workforce intelligence. The responsibility for ensuring this re-coding took place rested with HR staff, but without HCS staff input the re-coding would not have been accurate. The HSCiC asked HR departments to liaise with HCS leads: "I**t is vital that any changes are**

made in collaboration with Healthcare Science leads within your organisation"[i]. However, not all organisations have a Lead Scientist in place, and where this is an organisation-wide lead, this may not be a Medical Physicist or Clinical Engineer. Consequently, IPEM urged members in senior roles to make themselves known and available to HR to ensure that this sector of the workforce is coded as accurately as possible.

In December 2013 the Workforce Intelligence Project issued guidance aimed at assisting Lead or other senior Healthcare Scientists to assist Human Resources. This was disseminated via Twitter, LinkedIN, IPEM's newsletter and as a news item on IPEM's website. It is still available to download from the member's area of IPEM's website:

It is not known how many Trusts and Health Boards have finished this process, nor how many complied with the requirement to seek out the Healthcare Science Lead for assistance.

Workforce Surveys

Detailed workforce data has been collected from four workforce themes, and analysed to provide a workforce profile, and other information. Full details of survey data and analysis are contained in Appendix F, but the main outputs are summarised below.

Magnetic Resonance Physics Workforce Survey

Survey data relating to staffing numbers, workload, and adequacy of staffing provision have been used to provide a basis for the Magnetic Resonance Special Interest Group's upcoming Policy Statement on Staffing Levels, and is summarised in the table below.

Table 1: Summary of MR physics staffing data

Internal Scanners Only	Number of WTE MRI Clinical Scientists per scanner
Summary of all responses	0.44 [0.24-0.51]
Summary of responses (stating either just about or adequately covered)	0.56 [0.44-0.88]
Summary of responses (stating adequately covered)	0.77 [0.67-1.25]

The above data provides an evidence base for the proposed statement that a minimum of 0.67-1.25 WTE Clinical Scientists per scanner is required for an adequately supported service.

Radiotherapy Physics

An acute and problematic shortage of both Clinical Scientists and Technologists in radiotherapy physics has been uncovered. Essentially, there are difficulties recruiting to established posts. This data has been used to draw awareness at Policy-making level; Health Education England, the Centre for Workforce Intelligence and as a letter to the Chief Scientific Officer, Prof Sue Hill. Possession and usage of this reliable vacancy data has identified IPEM as a credible source of workforce intelligence data in the area of MPCE. There is still further work to be carried out to establish whether establishment (if at complement) is generally sufficient, and to consider whether the current workload algorithm is still fit for purpose given changes in working practice. Many departments expressed concern at understaffing, but low establishment needs to be untangled from an inability to fill establishment.

Radiotherapy Physics Clinical Scientists

In 2014 the vacancy rate was found to be 9.3% of the establishment, nearly 60 WTE. This shortfall has mostly been redressed by the larger-than-usual out-turn of newly qualified Clinical Scientists in

2014. However this increased out turn will not happen again in the future and the workforce supply and demand from previous years should be modelled to inform training requirements against a background of likely increasing service requirements. A more detailed subsequent analysis of this data can be found in an additional document "Radiotherapy Physics Clinical Scientist Workforce Review and Projections".

Radiotherapy Physics Clinical Technologists/Practitioners

A very concerning shortage of practitioners was noted, with a vacancy rate of 15% at Band 5 and 11% at Band 6. This is particularly concerning as the current training programme (Practitioner Training Programme, PTP) is producing very few qualified practitioners. IPEM has raised concerns regarding the efficacy of the PTP with representatives from the Academy of Healthcare Science. The PTP was recently reviewed by Health Education England and the outcome is awaited.

The solution to the vacancy problems is more complex than simply commissioning more training places. The PTP course shows a low level of attractiveness, with courses closing owing to lack of students. The STP course, by contrast shows a high level of attractiveness, but the training capacity is limited. A training capacity survey showed that 60% of training centres would be unable to offer additional capacity, another 25% are limited by the demands of training in other specialties and that only 15% may be able to offer more training places.

Diagnostic Radiology & Radiation Protection Physics

A survey of approximately a third of DR/RP departments showed that the workforce concerns in this area of work are different to those in radiotherapy. Although the concern at insufficient staffing is as great, in this area of work there are many fewer vacancies (4.7% cf to 9.3%). In addition, the vacancies were all at Band 7. This suggests a workforce which is inadequately maintained and under pressure; insufficient establishment to perform the role, and recruitment only permitted at entry level. The accompanying comments were extremely concerning, with one Trust reporting that the low establishment in radiation protection had been placed on the Trust's Health and Safety Risk Register. In 2015 the WIU will work towards producing a Policy Document on Staffing Levels to assist addressing these workforce issues.

Medical Equipment Management (Clinical Engineering/EBME)

The workforce concerns in this workforce were again different and specific. The vacancy rate is comparatively low; 5.5% for Bands 1-5 and 2.7% for Bands 6-8d. However, concerns were still expressed over recruitment, both in terms of recruiting newly trained engineers, and recruitment difficulties relating to location. The geographical difficulties range from difficulty of recruiting lower-paid staff in high cost-of-living areas, a difficulty in attracting staff to more remote areas of the UK, to a difficulty in recruiting staff at a level which is not traditionally geographically mobile. A key concern expressed by respondents is that of succession planning, which is not reflected in the vacancy rates. There is concern that suitable replacements for senior engineers are not visible. This could be because insufficient are being trained, or the training scheme is no longer suitable, or it could be because there is little opportunity for career advancement, so suitable individuals are leaving. This may also be linked to geographic considerations.

It is noted that the EBME survey achieved a much lower depth of coverage than the other workforce surveys, so in 2015, efforts will be directed towards increasing visibility of the workforce intelligence unit's work, increasing our contacts, and defining the most useful information to acquire in order to best address these specific workforce concerns.

Future Work

The Baseline Project has laid important groundwork and IPEM's knowledge of surveying the MPCE workforce has increased significantly. This is discussed more fully in Appendix F. Future work will take into account the learning points regarding:

- Increasing engagement and response rates
- Respecting commercial confidentiality
- Balancing ease of response with useful information sought

The Workforce Intelligence Unit must build on the work of the Baseline Project. A key factor in the success of surveys has been relationships, and communication of aims, objectives and intentions. The overall aims for 2015 are to

- build relationships and establish credibility within and without IPEM
- improve communications with high priority
- Push out workforce survey to cover more themes
- Continue to build services database
- Improve use of radiotherapy data

A focus of 2015 should be communication and relationship building, both within IPEM and with other groups. Communication of WIU successes is of great importance, for example planning a regular slot in the IPEM newsletter, and also tweeting updates and activity whenever possible. Further advancement of the workforce staffing and services survey is also planned, learning from 2014 mistakes and streamlining data extraction.

Each workforce theme will be treated according to needs. For 2015 it is planned to carry out the following work in the following key areas:

EBME/Clinical Engineering

Relationship building and links are of key importance. The key aim for 2015 is to increase knowledge of departments and network to increase survey coverage. The WIU must work effectively with the Clinical Engineering Special Interest Group (CESIG), and consider which information channels to use. A secondary aim is to build a workload descriptor in order to allow comparisons and benchmarking.

Nuclear Medicine Physics

The British Nuclear Medicine Society (BNMS) has carried out a workforce survey in the past, and was reportedly carrying out one in 2014. Rather than duplicate efforts, it would be beneficial to work together. IPEM & BNMS have been working together in the past on a workload /staffing calculation, and IPEM has made a commitment to finalise this in 2015. The Workforce Intelligence Unit will work to assist completion.

Non-ionising Radiation Physics

The WIU is working with the Ultrasound and Non-Ionising radiation Special Interest Group (UNIRSIG) with the aim of undertaking a detailed survey on this workforce and equipment in 2015.

Clinical Computing

The WIU is already in the process of creating a clinical computing survey, in conjunction with the Informatics and Computing Special Interest Group (ICSIG), looking at variation in service provision, workforce numbers and training concerns.

Magnetic Resonance Physics

The 2014 survey provided useful information for assessing workload, but we still have little information as to how extensive the coverage of this survey was. The WIU should continue to amass information regarding MR Physics service structure across the UK, and consider the potential impact of the changed training under Modernising Scientific Careers.

Radiotherapy Physics

A follow-up survey to the 2014 survey is anticipated in order to ascertain whether the scientist shortfall has been redressed as anticipated, or not. It is hoped that the high profile and outcomes of previous survey will enable this survey to be completed with reduced input from the WIU. Explore possible integration with the Workforce Integrated Planning Tool (WIPT).

Physiological Measurement

The aim for this workforce is to continue to locate scientists and practitioners, and to build links with other professional organisations such as British Society for Clinical Electrophysiology of Vision (BriSCEV), to aim to put IPEM in a position to carry out a meaningful workforce survey in 2016.

Diagnostic Radiology and Radiation Protection

Having carried out a workforce survey in 2014, it is hoped that the WIU build on this by developing an assessment/calculation of workload. We are in discussions with the Diagnostic Radiology Special Interest Group (DRSIG) as to how to best progress this.

Rehabilitation Engineering

Rehabilitation Engineering is one of the more challenging workforces, however, IPEM currently has good engagement and a Memorandum of Understanding with RESMaG, a voluntary group of rehabilitation engineering professionals formed to assist healthcare professionals working in rehabilitation engineering in the UK. Many individuals working in rehabilitation engineering have commented on the value of workforce intelligence, and demonstrated willingness to provide it. RESMaG have an out-of-date map of wheelchair provision, which would provide a good starting point and list of contacts. The WIU cannot avoid a workforce simply because it is difficult.

With many thanks to the steering committee:

Andy Rodgers (Radiation Physics, Nottingham)

Dr Canice McGivern (Head of Regional Medical Physics Service, Belfast)

Prof Colin Gibson (Head of Rehabilitation Engineering, Artificial Limb and Appliance Service, Cardiff)

Dr Diane Crawford (Director of Medical Physics and Bioengineering, Bristol)

Dr Peter Jarritt (retired Director of Medical Physics and Clinical Engineering, Cambridge, also project lead for iCEPPS, Academy of Healthcare Science)

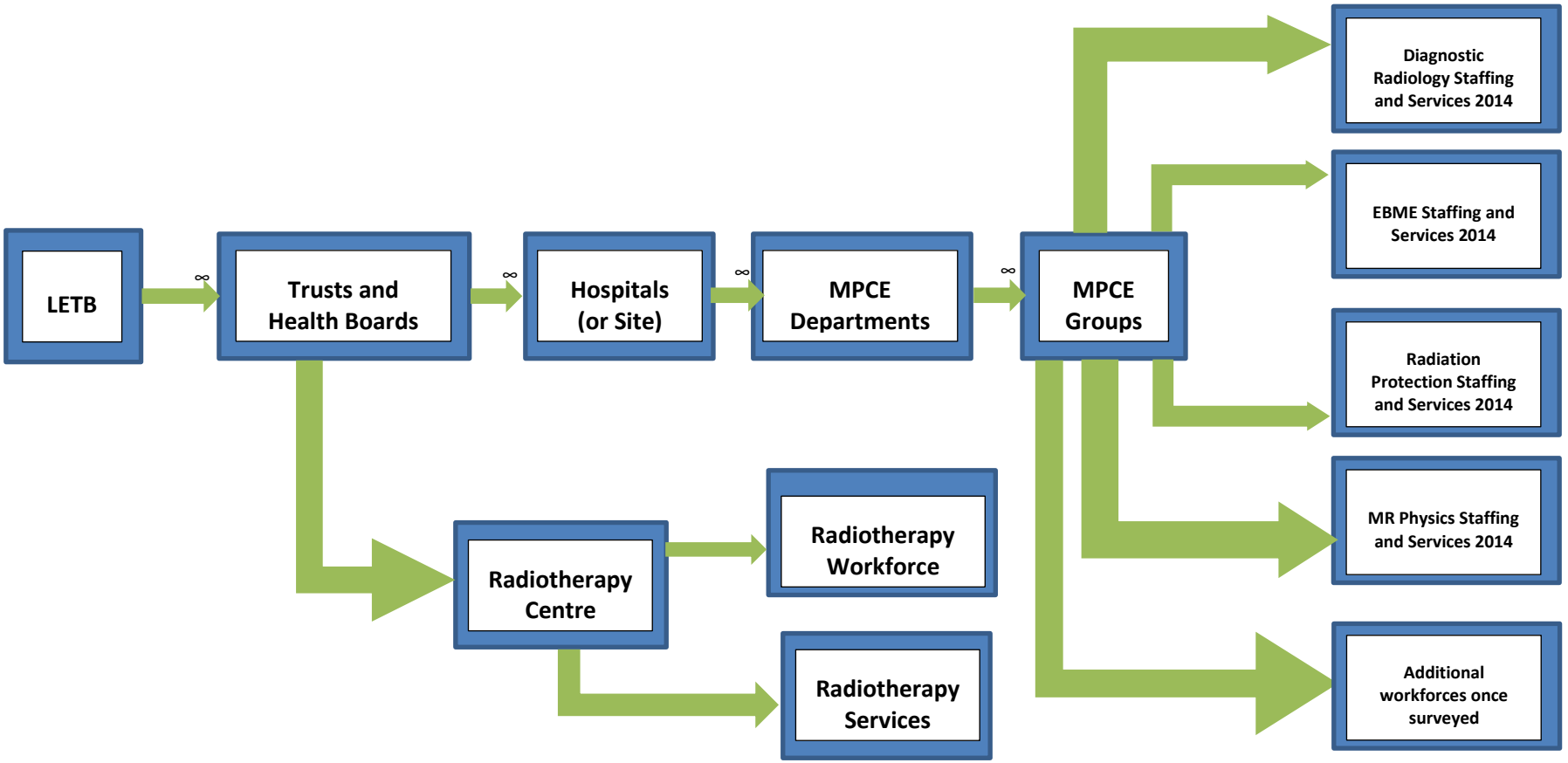
Dr Richard Scott (Consultant Clinical Scientist, Engineering, Sherwood Forest)

Dr Ruth Hamilton (Consultant Clinical Scientist, Physiological Measurement, Glasgow)

Julian Amey, CEO of Institute of Health Estates and Estate Management (IHEEM)

Rosemary Cook CBE, CEO of IPEM

Appendix A: Database Design & Structure



Appendix B: Glossary of Workforce Terms and Acronyms

Responses to survey questions and discussions reveal that knowledge of commonly used workforce terminology is not universal, even among Group or Section Heads. A brief glossary of commonly used workforce terminology follows:

Headcount: the number of individuals in a workforce, irrespective of their working hours.

Whole Time Equivalent (WTE) or Full-time Equivalent (FTE): a unit that indicates the working time of a staff member.

Establishment: This is the number of posts in a particular work group that are established to be available, NOT those that are actually filled.

Electronic Staff Record (ESR): This is the record held by Human Resources for all NHS staff in England and Wales. Each post is coded according an occupation matrix. Healthcare Scientists are coded on the U-matrix; with Medical Physics and Engineering having a UJ* or UH* code. The full coding matrix can be found at http://www.hscic.gov.uk/media/13060/NHS-Occupation-Code-Manual/pdf/NHS_Occupation_Code_Manual_Version_13.1.pdf .

For example if there are four members of staff in Diagnostic Radiology, and a further part-time position of four days/week (0.8 WTE) is advertised. Two of the current staff each work part time, at two and a half days a week (0.5 WTE each).

The establishment is 3.8 WTE

The number of vacancies is 0.8 WTE

The headcount is four (at present, this will change once the advertised post is filled

Acronyms

AfC	Agenda for Change, staffing levels
CCG	Central Commissioning Group
CfWI	Centre for Workforce Intelligence
DH	Department of Health
EBME	Electro-Biomedical Equipment Management
ESR	Electronic Staff Record
HB	Health Board
HCS	Healthcare Science
HEE	Health Education England
HSCiC	Health and Social Care Information Centre
IPEM	Institute of Physics and Engineering in Medicine
MEMO	Medical Equipment Management Organisation
MPCE	Medical Physics and Clinical Engineering
MSC	Modernising Scientific Careers
MRI	Magnetic Resonance Imaging
PBT	Proton Beam Therapy

PTP	Practitioner Training Program
STP	Scientist Training Program
WIU	Workforce Intelligence Unit
WTE or FTE	Whole or Full Time Equivalent

Appendix C: Healthcare Structure in the UK

Healthcare is a devolved issue, and the NHS is organised differently in all four countries served by the Institute.

In Northern Ireland, NHS provision is provided by five Health and Social Care Trusts, only one of which has a Medical Physics Service, which is contracted to provide services to all Trusts in Northern Ireland.

In Scotland NHS provision is via fourteen Health Boards and five Special Health Boards. Five of the Health Boards have a full Medical Physics & Clinical Engineering Service, and some of the other Boards may have limited MPCE services; for example The NHS Scotland National Services Division employs Radiological Physicists to support their Breast Screening Program, and many nuclear medicine services are provided locally. The large, regional Medical Physics services are then contracted to provide services to the Health Boards without MPCE service in-house. There is no pressure, financial or contractual, for Health Boards to consider private sector provision.

Wales operates under a similar model in which healthcare is provided via seven Health Boards, and three Trusts. Three Health Boards and one Trust have a large MPCE service, and these provide services to the other Health Boards, although again, services such as medical equipment management and nuclear medicine are frequently provided locally. Some specialist rehabilitation engineering services are provided as an all-Wales service. As in Scotland, there is no legal requirement or financial pressure for Boards to buy in services from a private provider although they may do if they wish.

In England the healthcare organisational structure is more complex. Healthcare is provided through Trusts (Acute, Mental Health, Health & Care and Ambulance) and Special Health Authorities, commissioned by Central Commissioning Groups (CCG). The majority of Acute Trusts running a large Teaching Hospital and/or a radiotherapy centre run a full MPCE department, and trusts with smaller hospitals bringing in services via a service level agreement. Frequently EBME and nuclear medicine services are provided locally, and many acute Trusts running smaller hospitals provide a part MPCE service while externally sourcing others. With a different political background for healthcare in England, medical physics and clinical engineering services may frequently be sourced from outside the Trust, either from another Trust, or from a private provider. Financial considerations mean that competition for provision of medical physics and clinical engineering services between NHS and private sector is significant. Large MPCE departments generate substantial income through the provision of service to other Trusts, to independent businesses such as vets, dentists, private healthcare organisations, Universities. The level of competition is area dependent, with some areas of England currently not experiencing any competition and in others there is robust competition. In some clinical areas services are purchased from the private sector without competition, although this too varies by geography.

Medical Physics and Clinical Engineering Organisation Structure

There is a very large variation in the structure of the provision of MPCE services across all four countries, and it is essential to have the full picture of variation in order to effectively gather information across all structures. A survey design which is a poor fit to the organisation which receives it is much less likely to be completed than a survey which is designed to allow for the organisational structure. The services survey aimed to provide this overview.

- All Health Boards and Trusts (including Health & Care, Mental Health and Ambulance, as well as acute) have a need for medical equipment management services.
- Almost all Health Boards, Acute Trusts and many Health & Care Trusts; those operating hospitals or walk-in clinics with imaging facilities have a need for Medical Physics Services in the form of Diagnostic Radiology and Radiation Protection,

- Almost all Acute Trusts, and Health and Care trusts running a hospital larger than a community hospital have a need for nuclear medicine services.
- All Acute Trusts operating a radiotherapy centre have in-house radiotherapy physics services, and radiotherapy engineering services are provided either fully in house, or through a mix of in-house and through SLA with equipment manufacturers.
- Provision of physiological measurement services, clinical computing services and clinical scientist involvement varies regionally.
- Provision of rehabilitation engineering services varies regionally.
- In addition private hospitals require MPCE services
- Many vets, GP surgeries and dentists

Accordingly, provision of MPCE within an organisation ranges from a large departments, overseen by a director covering all themes within a large Teaching Hospital Trust or Health Board to a single discipline group within a small Trust or Health Board.

Traditionally a large department was overseen by an overarching head, having managerial and professional responsibility for all services, and this structure is still recommended in IPEM's Policy Statement "Managing Medical Physics and Clinical Engineering Services"[ii] . However, despite this recommendation, this structure is changing with several large departments having no formally identified Head. This has typically come about where a Head or Director of a department retires, and is not replaced. There are notable exceptions where a case has been made to retain an overall head, and succession planning has ensured that this takes place. Scottish and Welsh Health Boards, and the NI Medical Physics Service follow this model, as do Nottingham, Leicester and Bristol (among many others) in England. In Cambridge, Southampton and Norwich, and others, there is no overall head, although there is a Medical Physics & Clinical Engineering entity, with services identifying as part of Medical Physics but with no overall head. In such cases much of the workload of a Head of department falls upon one or all of the Heads of Group, and many complain of becoming over-stretched. Less common is a large Trust, providing all services, but in splintered groups, rather than individual groups identifying as medical physics. Examples, though include Poole and Southend.

Even in a Trust with a cohesive MPCE department, an Electro-Biomedical Engineering (EBME) department providing medical equipment management is equally often managed through the Estates directorate, as it is part of a MPCE departments. Nuclear Medicine and medical equipment management are frequently the only services provided by smaller trusts, but we have no examples of these two services alone forming a MPCE department.

In some Radiotherapy Centres Radiotherapy Physics exists as a stand alone MP service within Oncology or Cancer Services for example, rather than under the main Medical Physics Department. Examples of this structure are Newcastle and Taunton. Some Trusts and Health Boards provide just one theme of services in-house, most frequently nuclear medicine or physiological measurement. The department may still be termed "Medical Physics", simply named after the category of service provided. Examples include NHS Ayrshire and Arran, Poole, York and Aneurin Bevan Health Board. Unusually for a large Trust the Royal Liverpool and Broadgreen MPCE department specialises in Clinical Measurement and Computing, sourcing other services externally.

In these Trusts and Health Boards, remaining services are provided from an often, but not always local medical physics and clinical engineering service, via a Service Level Agreement.

Assistive technology services, such as wheelchair services are rarely part of rehabilitation engineering within a large MPCE department, and in England are frequently provided by a different Trust than other MPCE services. The Hospital-based MPCE services (radiotherapy, nuclear medicine, physiological measurement etc) are provided by Acute Trusts, but wheelchair provision often falls under community and so is provided by a Health and Care Trust.

For example in York, the local Acute Trust is The York Teaching Hospitals Trust, which has no wheelchair services. These are provided by Harrogate and District NHS Trust. In a further example as to how fragmented the rehabilitation engineering workforce can be, in York paediatric specialist communication aids and assistive technology are provided through the City Council Special Educational Needs Physical Disability and Medical Needs Team. This team does not employ engineers directly but engages with private suppliers to provide equipment or make the required adaptations. Such suppliers and manufacturers of rehabilitation equipment frequently employ Clinical Scientists or Technologists.

In some Trusts and Health Boards, for example Oxford, Newcastle and Highland the wheelchair services along with other rehabilitation engineering services are provided by the main Acute Trust, through a specialised mobility service. However there are no formal links with the Medical Physics and Clinical Engineering Department.

Another model is similar to above, but the wheelchair services are provided through private provision, such as in Belfast, where Opcare works in partnership with the Regional Disablement Service.

Personal dosimetry is a service which is frequently provided from the private sector without competition but in all other services NHS providers are, dependent on geography, competing with the private sector.

Nuclear Medicine

The description nuclear medicine covers nuclear medicine therapy, in-vitro nuclear medicine, radiopharmacy/radiochemistry production, cyclotron production, and in some departments the nuclear medicine group may also provide radionuclide therapy and PET-CT. Often PET-CT is provided through a private provider, such as Alliance or InHealth, and often through a mobile unit, very few NHS operated PET-CT services exist. These independent organisations employ physics and technologist staff, as well as the obvious staff employed by the NHS.

Rehabilitation Engineering

This term describes the range of services Clinical and Rehabilitation Engineers provide to meet the clinical, functional and social needs of disabled people. It covers wheelchair sand specialist seating, commissioning and maintenance, electronic assistive technology and communications, prosthetics, orthotics and gait analysis, as well as computing services to support these.

Wheelchair and Assistive Technology Services are probably the most disparately delivered service. Rehabilitation engineering services in general cover much larger geographical areas than other services, often covering an entire region rather than just one Trust or Health Board.

In Wales EAT is delivered as an all-Wales service by the Artificial Limb and Appliance Service (ALAS) out of Rookwood Hospital (part of Cardiff and Vale University Health Board), with Wheelchairs, Prosthetics, Orthotics and Specialist Seating being divided approximately North/ South with northern services provided by the ALAS based at Wrexham (part of Betsi Cadwaladr University Health Board).

In NI the Regional Disablement services covers orthotics, prosthetics, Wheelchair fitting and maintenance, posture and mobility services and Limb fitting. These are provided in partnership with Opcare.

In Scotland the large Health Boards with Medical Physics and Bioengineering Departments also operate Regional Disablement Services, for example the SMART Southeast Mobility and Rehabilitation Technology Centre provides rehabilitation technology services for the South East of Scotland, covering Lothian, Fife and the Borders. These include mobility and postural services (wheelchairs and special seating), prosthetics, orthotics and artificial limbs and special equipment, a Disabled Living Centre and Gait Analysis Service.

In addition, wheelchair services are often contracted out to the private sector, and in other areas, private sector wheelchair services operate in competition with NHS services.

Orthotics and Prosthetics

Orthotics describes the making and fitting of external mechanical devices to aid movement, correct deformity or relieve pressure and prosthetics describes the making and fitting of artificial replacements for missing or ineffectual body parts. Orthotists and Prosthetists frequently carry out gait analysis.

While manifestly prosthetics and orthotics are a branch of engineering in medicine, prosthetists and orthotists practice under the HCPC registered and protected titles of Prosthetist and Orthotist, rather than Clinical Scientist. Prosthetists and Orthostist are not coded on the Healthcare Science U-matrix, but as Allied Health Professionals, although maxillofacial prosthetist is available as a tertiary area of work under the UH* coding. As far as is possible to determine, there are no prosthetists or orthotists who are members of IPEM. They do not, therefore, form part of the Healthcare Science Workforce and there are no plans for IPEM to collect data on this workforce. It is noted that The British Association of Prosthetics and Orthotics has a membership of around 900, and that approximately 80% of Orthotists and Prosthetists work in private practice, although may be contracted to provide services to NHS organisations.

Radiotherapy Physics

Radiotherapy is delivered at sixty-seven NHS centres and 3 private centres throughout the UK although not all offer all services. The number of linear accelerators ranges from 1 to 15, and the availability of advanced techniques varies. A limited proton beam therapy service is provided at The Clatterbridge Cancer Centre, and two proton beam therapy centres are being developed; one at The Christie, and one at University College, London. Many smaller radiotherapy centres have been opened in England to enable the DH's ideal target of no more than 45 minutes travelling time to access radiotherapy to be met. Incidentally the 45 minute target does not apply in NI, Wales or Scotland. There are geographical barriers to reaching such a target in Wales and Scotland, and travel times in Scotland can exceed 3 hours. In NI a new centre will open in 2016 which will significantly reduce travelling times.

Radiotherapy Physics is the most well-defined MPCE workforce, as all NHS and most private centres are known and well-connected to IPEM. Radiotherapy services include external beam therapy, brachytherapy, intra-operative radiotherapy, radiosurgery, and are supported by treatment planning, mould room services, equipment maintenance and computing. Some radiotherapy physics services also support radionuclide therapy, some may provide all RPA and ICT to medical physics, while some have their RPA and computing provided by other sections of medical physics, or in some instances have IT support only from the Trust IT function. Thirty-two of the centres support training under STP, and all report that this occupies significant amounts of clinical scientist's time.

Scientists, Technologists and engineers are all required to support a radiotherapy service, although the service model varies considerably from centre to centre. There is an IPEM Policy Statement[iii] regarding the number of staff needed, based on algorithms drawing on patient and equipment factors, but the current version does not take different services models or working hours into consideration. Some centres employ more clinical scientists and fewer technologists, and many employ fewer engineers. In many centres treatment planning is carried out in whole or in part by the radiography department, and the same is true of mould room services. In many centres some or all of the linear accelerators are supported via a full or part service contract, and in some instances these engineers are based at the centre. In most centres the radiotherapy equipment engineers are part of the radiotherapy physics department, but in a significant minority these engineers form part of the medical equipment management department under an estates or facilities function. It is important that all these variables are recorded if comparison between centres is to be undertaken.

Both private and NHS services are expanding and new conventional centres, both satellite and stand alone are planned for 2015. In addition the two Proton Beam Therapy centres are to be staffed in 2015; and this is a high-public profile project, for which failure is not an option. Furthermore radiotherapy is one of the areas in which NHS England is aiming to implement 7-day working, and a key finding of IPEM's Working Party on 7-day working is that extended working hours will require an increase in staffing numbers[iv].

Radiation Protection and Diagnostic Radiology

The radiation protection and diagnostic radiology workforce was surveyed individually in 2014, however for future surveys it will be combined. A large majority of departments are combined, and staff work across both disciplines. This workforce covers scientific & technical support, including advisory and QA for all modalities of x-ray, including CT, mammography, sealed source and unsealed source Radiation Protection Advisors, Radioactive Waste Advisors, personal dosimetry, uv & pulsed light source Clinical & QA services, laser safety and laser protection adviser and dangerous goods safety adviser.

This support is provided by the Regional Medical Physics service in Northern Ireland, through the five MPCE departments in Scotland (each covering the surrounding health boards as geography dictates- for example Greater Glasgow & Clyde Health Physics provides services to NHA Ayrshire & Arran, Dumfries and Galloway, Lanarkshire, Forth Valley, Borders, Argyll and the Golden Jubilee National Hospital. Wales operates on a similar model with MPCE departments at Abertawe Bro Morgannwg and Cardiff and Vale covering South Wales, and the MPCE department at Betsi Cadwalldr covering North Wales.

In England Medical Physics departments at large acute Trusts are commissioned to provide these services, both internally and to smaller acute Trusts, Health and Care Trusts running community hospitals in the NHS and privately to veterinarian practices, GP surgeries, dentists, opticians, private healthcare institutions and academic institutions. Medical Physics services are also be provided by independent companies or RPAs and these are in competition with NHS Trusts for such commissioned services.

Non-ionising radiation

Depending on the departmental structure, non-ionising radiation services may form part of a Diagnostic Radiology group; in larger centres it is often a separate group, and may be merged with MR Physics. Non-ionising radiation includes ultrasound, ultrasound QA, laser applications including LPA, uv clinical services and QA. There is a concern over the decreasing role of the physicist in ultrasound, and the lack of legal requirement for ultrasound QA.

Magnetic Resonance Physics

Magnetic Resonance Imaging is available at a large number of hospitals in the UK, however, specialist physics support is less widely available. Around 30 large MPCE departments have specialist MR Physics staff, and in the remainder of organisations a minimum of MR support and QA is provided by non-magnetic resonance specialist medical physicists. In some organisations Physics staff are not involved at all in MR support.

Many MR Physics groups provide support to other NHS organisations, private hospitals and others. There is considerable private provision of MR, with Alliance and InHealth providing mobile MR services to NHS organisations as well as private service. The physics support used by these organisations is unknown, but independent medical physics services also cover MR Physics.

Physiological Measurement

Physiological measurement covers the branch of medical physics devoted to the quantifiable measurement of the body's functions, and covers cardiology, respiratory physiology, sleep science, vascular sciences, clinical perfusion, audiology, neurophysiology, ophthalmic and vision science,

urodynamics and GI physiology. Members of this workforce are not always located in Medical Physics departments, although they are in some instances, such as at Leeds Teaching Hospitals Trust, but are often in a separate department, such as at the Royal Cornwall Trust or Royal Devon and Exeter both of which has Vascular Science groups outwith Medical Physics. Alternatively they may be working in Trusts where there are no other MPCE services, other than medical equipment, such as at The Royal National Hospital for Rheumatic Disease. This challenging workforce is scheduled for more work in 2015, with a concerted effort to fully map activities across the UK.

Computing and Bioinformatics

Computers are an important and integral part of many areas of modern clinical activity. Computer-based medical devices are used in fields such as digital radiology, radiotherapy planning and delivery, nuclear medicine and physiological measurement. The growing benefits of tomography, first with X-ray CT, then PET and Optical (OCT) techniques, together with MRI scanning systems all depend upon computers. Picture Archiving and Communications Systems (PACS) can then make the collected images readily accessible to clinicians.

Medical physicists and engineers are involved at all stages of the working life of computer-based medical devices, from their purchasing through to developing protocols for their use, upgrade and maintenance. They work closely with the clinicians that will use these devices for the diagnosis and treatment of patients, to ensure safe and optimum use. They also negotiate with hospital IT departments to ensure good management of data, for example in setting up image database systems, and connectivity between devices. In addition, ongoing close co-operation with companies providing medical devices is necessary, to provide feedback about problems and to suggest improvements. Government guidelines issued in August 2014 clearly states that under some circumstances software and apps can be considered medical devices in their own right, and are thus regulated by the Medicines and Healthcare Products Regulations Agency (MHRA). Clinical computing expertise is also utilised to manage interaction between medical devices, taking account of the provisions of IEC80001 and other appropriate standards.

Clinical or Scientific Computing varies significantly between Trusts and Health Boards, with some MPCE departments having a significant Scientific Computing Group, such as Sheffield or Leeds, and others relying on IT support from Trust IT department. Satisfaction varies considerably.

This is a challenging, disparate workforce, and is scheduled for more work in 2015.

Clinical Engineering

Clinical Engineering is the term given to the development, use, on-going support, and maintenance of technology for diagnosing, aiding or treating patients. It covers a very wide range of devices used in healthcare. Medical devices benefit from advances in electronic, electrical, information and computer technology (ICT), hydraulics and mechanical technologies as well as biochemical and gene developments. Dramatic advances in technology have transformed many medical devices. It also covers equipment and contract management. If contract management is purely contract management, with no technical input, such as specification or assessment of provision, then this is classified as an admin role, however, if technical input is necessary, then this is a healthcare science role.

Electro-Biomedical Engineering (EBME) sometimes called Medical Equipment Management Organisation (MEMO) is a subset of Clinical Engineering. All NHS organisations have need of Medical Equipment Management, from the obvious Acute Trusts and Health Boards running large hospitals, but also including Health and Care Trusts, Mental Health Trusts and Ambulance Trusts. Some of these organisations might source support from large Acute Trusts; for example West Suffolk NHS Foundation Trust's EBME department provides services to East Anglian Ambulance Service and also to Community providers of Healthcare throughout West Suffolk, but many are provided in-house,

and if so, these departments are usually within facilities or estates, and, in England and Wales, the staff may well not be correctly coded in the ESR system.

As well as providing services to other NHS organisations through contract service agreements these departments often provide services commercially to any healthcare organisation in need, such as GP, vets, dentists, and others.

This is a large workforce, and challenging because many do not identify as healthcare scientists, and are not well-engaged with IPEM.

Appendix D: Electronic Staff Record & the current state of Workforce Intelligence in Healthcare

Workforce Intelligence available prior to 2013

The Centre for Workforce Intelligence (CfWI) was formed in 2010. It is commissioned by the Department of Health, as well as Health Education England and Public Health England, to look at specific workforce groups and pathways, and to provide materials, tools and resources to inform workforce planning policy decisions at a national and local level. The CfWI intends to be a key contributor to the planning of future workforce requirements for health, public health and social care in England. There is no equivalent organisation in Wales, Scotland or Northern Ireland. The NHSS (National Health Service Scotland) run a Programme on Pan-Scotland workforce planning, but the most recent report: Pan Scotland Workforce Planning Assessment and Recommendations, published March 2014 make no mention of the scientific workforce.

In 2012 the CfWI published a report on the education commissioning risks summary project (WRO ECRS 2012) on the healthcare science workforce. This report contained very little data, and what little there was had been taken directly from the pre-2014 ESR coding. It is known that a substantial number of posts in healthcare science are miscoded; estimates suggested that up to 1/3 of posts were miscoded, making use of this data very unreliable.

Consequently there is very little reliable data on the MPCE workforce. Data, sourced from CfWI and ESR, has been quoted by NHS England, which is known to be inaccurate. For example the Chief Scientific Advisor, Sue Hill, in a presentation to the International Conference of Medical Physics 2013 stated that there had been a 9% reduction in the Rehabilitation Engineering Workforce between 2010 and 2012. This is widely believed to be inaccurate; there may well have been a 9% reduction in the rehabilitation engineering workforce ***employed by the NHS*** as it has been observed across all four countries that these services are increasingly being commissioned from the private sector.

The healthcare science workforce underwent a re-coding exercise in the Electronic Staff record system in 2014, which was intended to address the problem of accurately describing the workforce.

Workforce Standards at the Health & Social Care Information Centre issued a User Notice (UN1828) requiring the re-coding of all posts in the Healthcare Science (HCS) Staff Group within the Electronic Staff Record (ESR). HR departments were asked to audit all posts to ensure that the coding was correct, not just migrate posts across to the new matrix descriptors. The extent to which this request has been carried out is unknown, and in addition there is no requirement for Trusts to use ESR, although almost all do. It is commonly stated that two Trusts do not use ESR, but this statement cannot be verified.

The ESR system is used in Wales, but in Scotland and Northern Ireland there is no universal HR coding system which describes the workforce, although this is under review in Scotland as part of the Workforce Planning Programme.

Electronic Staff Record (ESR): This is the record held by Human Resources for all NHS staff in England and Wales. Each post is coded according an occupation matrix. Healthcare Scientists are coded on the U-matrix; with Medical Physics and Engineering having a UJ* or UH* code. A full description of the U-matrix, coding and usage is available at: http://www.hscic.gov.uk/media/13060/NHS-Occupation-Code-Manual/pdf/NHS_Occupation_Code_Manual_Version_13.1.pdf .

The 2014 surveys revealed that many heads of department, especially smaller departments were unaware of the ESR system “this has never been discussed at [our Trust]”. In another Trust, as a result of the survey, the Head of Department discovered that a high proportion of his staff were coded incorrectly, and was able to correct this.

Electronic Staff Record Guidance

In January 2014 the Workforce Standards at the Health & Social Care Information Centre issued a User Notice (UN1828) requiring the re-coding of all posts in the Healthcare Science (HCS) Staff Group within the Electronic Staff Record (ESR). The intention of this was two-fold; to align the description of the workforce with the Modernising Scientific Careers (MSC) Training Programme themes, and to improve the accuracy of coding within the HCS workforce. At that time it was estimated that at least 26% of the HCS workforce is inaccurately coded, and even if coding was accurate, it still did not provide a detailed description of the workforce. The main aim of the re-coding exercise is to better profile the workforce, and the work is driven jointly by the Health & Social Care Information Centre (HSCiC), Health Education England (HEE) and NHS Employers.

The ESR Occupation Code for each post comprises three parts, the Staff Group, Job Role and Area of Work. Occupation Codes are a long established set of codes used to classify NHS staff. Occupation Codes are three character codes, presented as a matrix by broad Staff Group, showing the level on the vertical axis and the area of work on horizontal. In January 2014 a new matrix, the U-matrix was issued for the Healthcare Science Staff Group, to replace the T-matrix. The U-matrix is considerably more detailed. Consequently old values could not simply be mapped to new values. The responsibility for ensuring this re-coding took place rested with Human Resources staff but without HCS staff input the re-coding would not have been accurate. The HSCiC asked HR departments to liaise with HCS leads: "**It is vital that any changes are made in collaboration with Healthcare Science leads within your organisation**"[i]. However, not all organisations have a Lead Scientist in place, and where this is an organisation-wide Lead, this may not be a Medical Physicist or Clinical Engineer. Consequently, IPEM urged members in senior roles to make themselves known and available to HR to ensure that this sector of the workforce is coded as accurately as possible.

In December 2013 the Workforce Intelligence Project issued guidance aimed at assisting Lead or other senior Healthcare Scientists to assist HR. This was disseminated via Twitter, LinkedIN, IPEM's newsletter and as a news item on IPEM's website. It is still available to download from the member's area of IPEM's website:
http://www.ipem.ac.uk/Portals/0/Documents/Professional%20Matters/IPEM%20Guidance%20on%20ESR%20Coding.pdf

It is not known how many Trusts and Health Boards have finished this process, nor how many complied with the requirement to seek out the Healthcare Science Lead for assistance. The new codes do improve the workforce description considerably, but IPEM recognise that the current codes could still be improved upon. The area of work descriptors are either over-detailed or lacking in detail. The list of available options for Medical Physics and Clinical Engineering is shown below:

Medical Physics	Clinical Engineering
Angiography Breast Screening Clinical Radiology CT Dental and Maxillofacial Radiology Diagnostic and Interventional Radiology Imaging Mammography	Clinical Measurement Medical Equipment Management Maxillofacial Prosthetics Medical Engineering Design Radiation Engineering Rehabilitation Engineering Renal Technology Clinical Engineering

Medical Illustration MRI Non-ionising Radiation Nuclear Medicine Radiation Safety Radiotherapy Physics Radiopharmacy Ultrasound Medical Physics	

Table 2: List of "Area of Work" options available in the ESR for the Medical Physics and Clinical Engineering codes

It is unlikely that there are any (or if so very few) staff in England and Wales who are solely occupied with mammography, angiography or CT. Computing and Bioinformatics is not accounted for at all; the IPEM guidance issued recommended that computing staff be recorded in the area of work that they mostly supported, as per a suggestion by an attendee at the Heads of Department meeting at ICMP 2013. Subsequently the Informatics and Computing Special Interest Group (ICSIG) has indicated that the computing and informatics community would prefer identification as a separate area of work. This would fit with the HSCiC professed wish to align ESR with MSC themes, as of 2015 Bioinformatics is a separate theme within MSC. Correspondence with HSCiC has indicated that this is under consideration, and discussions between them and HEE are taking place to decide how to incorporate this theme into data standards.

Additionally ESR does not cover Scotland or Northern Ireland, so can provide no information from there, nor does it provide any information on the workforce in the private sector.

Appendix E: Surveying and survey methods

The definition of a survey is the collection of data from a systematically determined subset of a population, designed to accurately reflect the whole of that population. Without a full appreciation of the population a sample designed to accurately reflect the population is impossible to achieve.

Consequently the essential first step to surveying the workforce was to survey the service provision.

Although records are held on each IPEM member in order to administer their membership, in 2013 IPEM held no accurate exhaustive list of either MPCE departments or their Heads. Historically, a list of departments was held by IPEM, but this had not been updated for several years and proved to be very out of date; with over 50% of heads having since retired, and other departments having been re-structured. A search of the IPEM membership database records under the"Job Title" field was no more revealing, owing to the variety of Head of Service descriptors and use of the generic "Consultant Clinical Scientist".

Identifying what services are provided where was then an essential first step. The most accurate workforce information is achieved from a census, where each and every department is offered the opportunity to participate. This would not have been possible for specialties other than radiotherapy physics. For Radiotherapy physics there was, and continues to be an actively maintained list of Head of Radiotherapy Physics departments, and an associated workspace and forum, making a census of this workforce achievable.

For other specialties an initial list of departments and contacts was compiled through personal knowledge of the Steering Group, and the intention was that from gathering contacts information would spread out, and eventually be received from all departments. The services survey was intentionally NOT sent to all known departments in order to assess the success of this approach.

The Services survey took the form of an excel spreadsheet listing 67 services which are provided by the MPCE workforce, grouped into themes approximating to the MSC themes. The survey asked whether each service was provided at the respondent's institution, and if so, which department, group or external supplier was responsible, along with a contact name and e-mail address. The aim was to gather data on the structure of the department; which services are provided by which group, whether a department is cohesive, under an over-arching Head of Department, or whether there are managerially separate groups. Another example would be to determine whether EBME is part of clinical engineering or part of estates. In essence, to determine how sectors of the workforce would be best grouped, for staff surveys, and which individuals would be able to provide the information for each organisation.

Questions were also asked regarding the provision of services to other organisations; specifically which services to which organisation, and more generally regarding the provision of services to the private sector. It was recognised that private sector provision may be commercially sensitive, and so the survey only asked for the type of business and the number served (eg. Vets(5)). The aim of these questions was to build a picture of the level of work undertaken for benchmarking and context purposes. This was an add-on to the main function, which was to build a picture of service structure and gather contacts lists for workforce questions. Unfortunately respondents were very concerned about commercial sensitivity and data protection, which often resulted in non-response to the entire survey. It became clear that this method of data collection was not going to achieve the roll-out effect that was intended, although useful information was elicited regarding service structure, it was not possible to identify even half of all MPCE departments in this way. A discussion with Debbie Peet and Diane Crawford elicited further contact details for the South West, East Midlands and South East, again through personal knowledge. Peter Jarritt, through his former role as Lead Scientist East of England was able to encourage survey responses from all major departments in the

East of England region, through face to face meetings. Even so, EBME department at smaller Trusts were not located, as contact details were not provided.

Further information became available through workforce staffing survey responses, and from postings to mailbases and other public fora; these were all added to the workforce service and staff database.

Finally, information has been extracted from the the IPEM database by searching under the "Job Title" field, it was possible to identify the existence of departments, and in some cases a likely key contact, especially single theme departments such as EBME, wheelchair services or nuclear medicine.

A SQL searchable database was created to store the department structure and workforce information. All information collected has been entered into the database. The structure allows for searching and grouping by LETB, Organisation (Trust, Health Board or Private company), Hospital or site and services provided. The database structure is shown in appendix A. For example a list of Trusts, Departments and contact details for all Trusts providing nuclear medicine services can be extracted, or a list and staffing information for all radiotherapy centres carrying out brachytherapy.

Given the aims of the project, it was important to collect workforce staffing data, even in the absence of a complete, or even near-complete department dataset. The advantages of this were two-fold; a pilot survey would gain some information, possibly further structural information, but most importantly, understand the difficulties and problems with undertaking such a survey. With a full dataset of radiotherapy centres, a census of radiotherapy physics staff could be undertaken.

The definition of a census is "the procedure of systematically acquiring and recording information about the members of a given population. It is a regularly occurring and official count of a particular population." The Radiotherapy Physics workforce is subject to a census. IPEM has collected workforce staffing information on this group annually since 2008 (except for 2013), and requests for data have been sent to all radiotherapy centres. Some have declined to take part but the invitation has been open to all.

In the absence of a comprehensive dataset of MPCE departments an appreciation of potential survey bias is important. All the workforce staffing surveys except the Radiotherapy Physics Workforce survey were made available as weblinks to a survey hosted by SurveyMonkey, and advertised through mailbases, LinkedIN, on the IPEM website, and in the IPEM monthly newsletter. They are therefore subject to selection bias, because only those who chose to do so will take part. An invitation to complete a survey may get lost among the sheer volume of emails; this is partially mitigated by sending several invitations, and also via different channels.

As the survey link was made publically available to the entire medical physics community, several surveys were started by individuals who did not have access to the necessary information, eg trainees, or junior staff. Though not individually time consuming to delete, this did create additional work. With greater population of the departments and groups database, the need to make links publically available with decrease.

After the surveys had been created and publicised, a member responded stating that their Trust Policy specifically forbade the use of Surveymonkey for transmission of data:

> *"From April 1st 2013, all electronic surveys must be conducted using either Contact or Lime Survey tools. Other tools, such as Survey Monkey and Key Survey, should not be used as the information is stored on servers outside the European Economic Area (EEA) and therefore the Trust's contracts with these companies will not be renewed.*
>
> *As you know, keeping information confidential and secure is one of the key requirements that we have as a Trust. Technology now allows us to gain opinions from staff and*

> *service users via online questionnaires. However, care must be taken that the information contained is safe and secure. A number of the online survey tools are based within the United States and therefore outside of the regulations and governance of the EEA. This means that the information contained could be at risk of being disclosed and as an NHS organisation we are mandated to only send electronic information within the EEA"*
>
> *Extract from South Devon Healthcare Trust's Policy on Data Security*

Presumably the mandate to only send electronic information within the EEA applies to all NHS organisations; it is not known whether other NHS organisations take this view, certainly only South Devon Medical Physics declined to complete a survey citing this concern. Surveymonkey servers are sited in Luxembourg and United States, so should the data be stored on the Luxembourg server this requirement would be met. The information regarding which server IPEM's account's data is stored is not available and it is likely that it is backed up on both in any case. Note this data protection requirement does not preclude submission of personal opinions to SurveyMonkey, for example regarding an IPEM conference, but does, mean that for employees of any Trust taking the above view on information confidentiality would be prohibited from completing any survey involving Trust information hosted on Survey Monkey.

While only one member stated this concern, and over 100 NHS employees completed IPEM surveys hosted on Survey Monkey in which staffing details were sought, it is inappropriate for a professional body to ask its members to submit data in a format which is formally prohibited by their employer. There are alternatives available; in addition to the tools identified by South Devon (Contact and Lime Survey) in 2014 a competitor to Survey Monkey appeared, SmartSurvey, who specifically guarantees that

> *"All data collected through SmartSurvey is stored and backed up on UK servers which adheres to the Data Protection Act laws. We simplify the process of gathering data, as well as guarantee security for any client with sensitive data requirements."*

SmartSurvey list a large number of NHS Trusts and Health Boards amongst their customer list, suggesting that it is an acceptable supplier. In 2015 surveys will be conducted either using SmartSurvey or in-house software.

Appendix F: Data and Results of Surveys

Services Survey

Fifty-five surveys were sent out, accompanied by a letter from IPEM's President, Prof. Steve Keevil, and twenty-four responses were received. As responses were received, the services list was refined, with clarifications, additions, and at the suggestion of the ICSIG, an additional bioinformatics theme, instead of an ICT option within each theme. The output was used to shape the workforce surveys in terms of grouping services within a theme, and also to create a map of service provision UK-wide which is available to members on the workforce pages of the IPEM website. This list and map continue to be added to as personal enquiries and web searches elicit further information. The list forms the basis for distributing workforce surveys.

Responses were more likely to be received from individuals or departments with whom there had been personal interaction. Members of the steering group contacted departments personally and nearly all departments contacted this way responded. Simply sending a cold email from IPEM is of limited use, and around a 50% response rate was received using this approach, for large departments. This dropped to 0% for small departments. Another commonly occurring problem was emails becoming lost among the sheer volume of mail received by managers.

Workforce Surveys

The workstream on providing a description of the workforce was narrowed down as a result of the non-response to the service survey and the massive amount of work it would represent. It was proposed that a sector of the workforce be surveyed; and that other groups be surveyed in 2015, following more services work.

Magnetic Resonance Physics

In 2014 IPEM's Magnetic Resonance Special Interest Group (MRSIG) wished to update IPEM's Policy Statement on Minimum Staffing Levels to provide an MR Physics Service. In order to provide evidence to support their Statement, the workforce intelligence unit carried out a staffing survey. This was viewed as a pilot survey, and aimed to gather services information and well as MR staffing information.

At the time this survey was sent out, very few services survey responses had been received, so the decision was made to post a short web-based survey to the mailing lists commonly subscribed to by the MR Physics community (MRIPHYSICS@JISCMAIL.AC.UK & MEDICAL-PHYSICS-ENGINEERING@JISCMAIL.AC.UK). The message appealed to UK-based MR Physicists in both NHS and private hospital settings, and the survey, hosted by SurveyMonkey comprised 15 questions:

1) How would you describe your organisation, eg, Foundation Trust, Biomedical Research Institute
2) How does your MR group fit into your organisation
3) How many MR scanners does your group support
4) Please list the sites within your organisation on which your group provides MR Physics support
5) How many systems outside of your organisation does your group support, eg through a service level agreement
6) Please list the sites outside of your organisation, but within the NHS (if none, please state none)
7) How many WTE staff are there in each of bands 4-9

8) How many WTE Clinical Scientists are there in your group
9) How many of these posts are vacant
10) How many WTE are effectively engaged in routine work
11) Does your group support advanced applications (eg fMRI, qMRI)
12) If yes, how much time does this engage
13) Does your group support other services, eg informatics
14) Do you feel MR Physics is adequately supported
15) Other comments

The survey was open for completion for 52 days, and within this time, 48 respondents started the survey, although only 33 finished it. Of these, 4 declined to answer critical questions, 1 appeared to be outside the UK, and 4 contained anomalous staffing information, so in total **24 responses** were analysed. There were responses from a range of NHS organisations, including large and medium Teaching Hospital Trusts and Scottish and Welsh Health Boards, which cover a wide geographic region. The survey respondents were a self-selecting population, as there was no compulsion to reply. This is known to introduce survey bias towards those with strong opinions; and might be considered to overrepresent those who have a staffing shortage they are interested in redressing. However, the magnetic resonance physics community is small, and therefore likely to elicit altruistic responses from individuals interested in helping the community achieve the end result. It could also be argued that staff in an adequately-staffed service are more likely to have time to complete a survey.

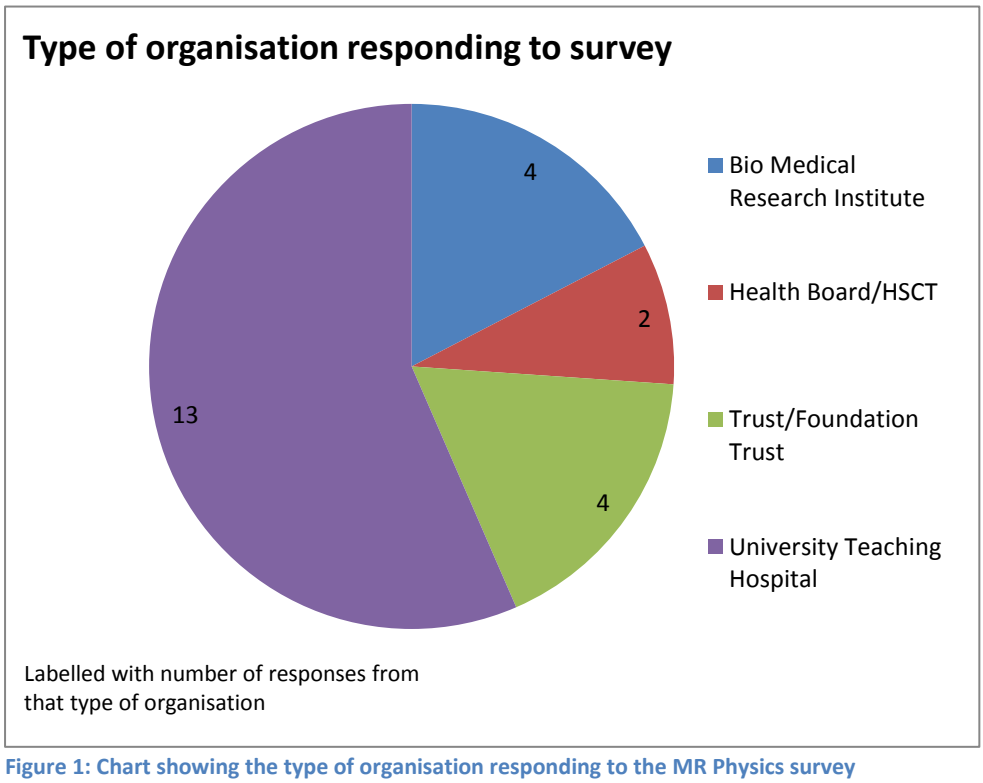


Figure 1: Chart showing the type of organisation responding to the MR Physics survey

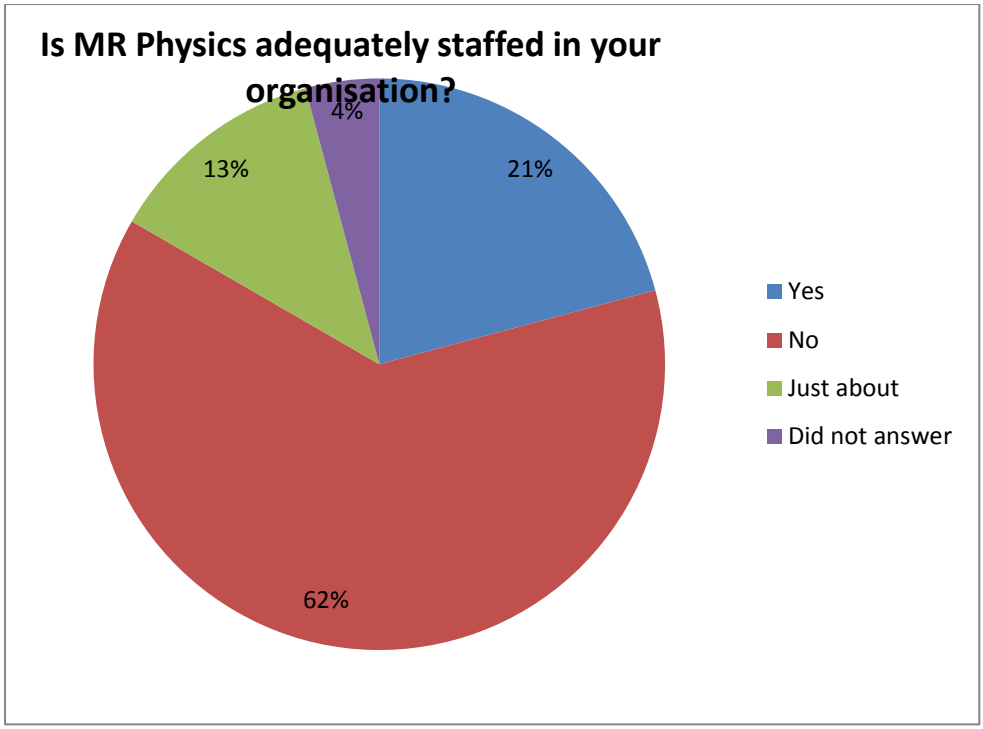


Figure 2: Responses to the question "Is MR Physics adequately staffed in your organisation"

The majority of respondents (62%, 15/24) felt that their activities were not adequately supported, a further 13%, 3/24) feeling that their activities were just about adequately supported at present, but that workload was increasing. 21% (5 respondents) believed their activities were adequately supported, 3 of these were Biomedical Research Centres, confirming the supposition that these centres are better supported than average. Informally a number of respondents stated that they routinely include final year trainees in the WTE count, as they are involved and required for adequately supporting the MR service they provide. All four of the responses which were not included in the analysis also believed their service was not adequately supported.

The majority of groups also support scanners external to their organisation, either in other NHS organisations or privately run scanners by way of service level agreements. Each individual response was allocated a number, and summary anonymised responses are shown in the table in appendix 1. The numbers of scanners supported is summarised in Figure 3.

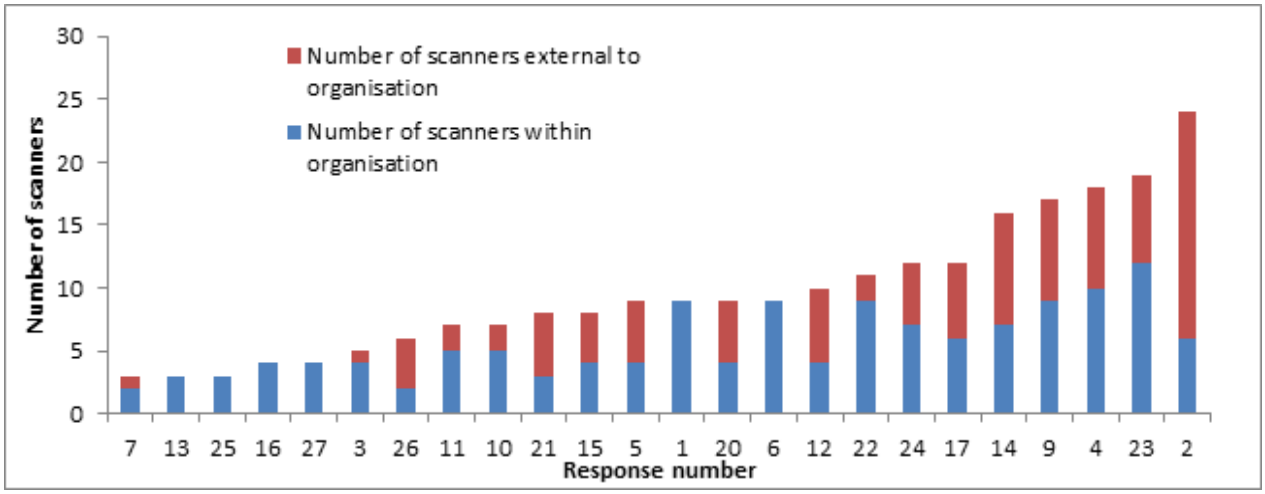


Figure 3: The number of scanners (within and external to the organisation) supported by the departments responding to the survey

A scatter plot of total staff (WTE) against number of scanners supported is shown below. It is perhaps self-evident that staffing requirements for an MR Physics service are more complicated than simply a total of WTE staff (of all bands) to scanner ratio, but as these groups are mostly small in terms of WTE staff it provides a useful starting point.

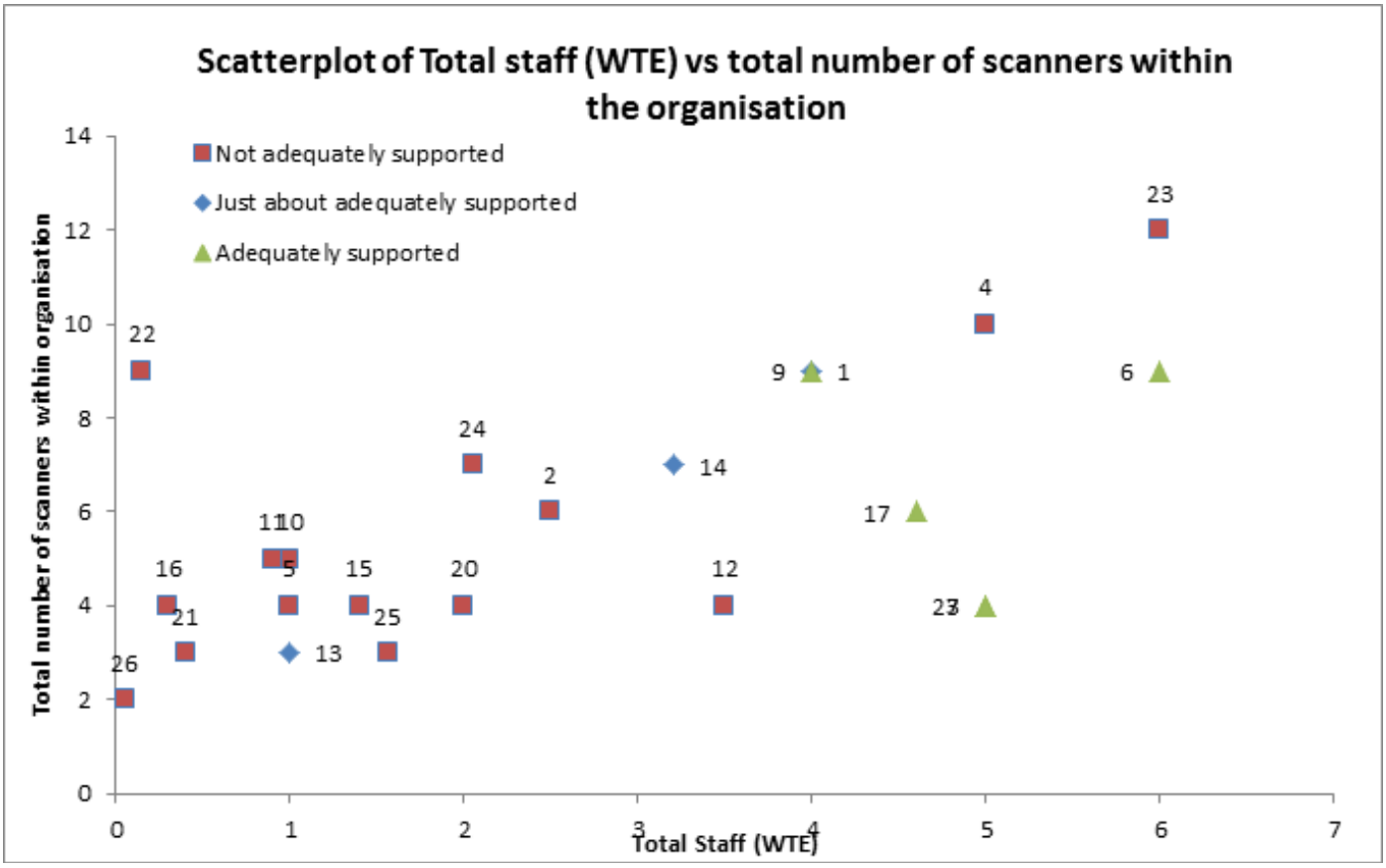


Figure 4: Scatterplot of total staff (WTE) and number of MRI scanners for adequately and inadequately supported organisations

workload, which is a subjective observation, but the groups fall into clear categories. The chart below shows the ratio of staff:scanner considering only scanners within the organisation.

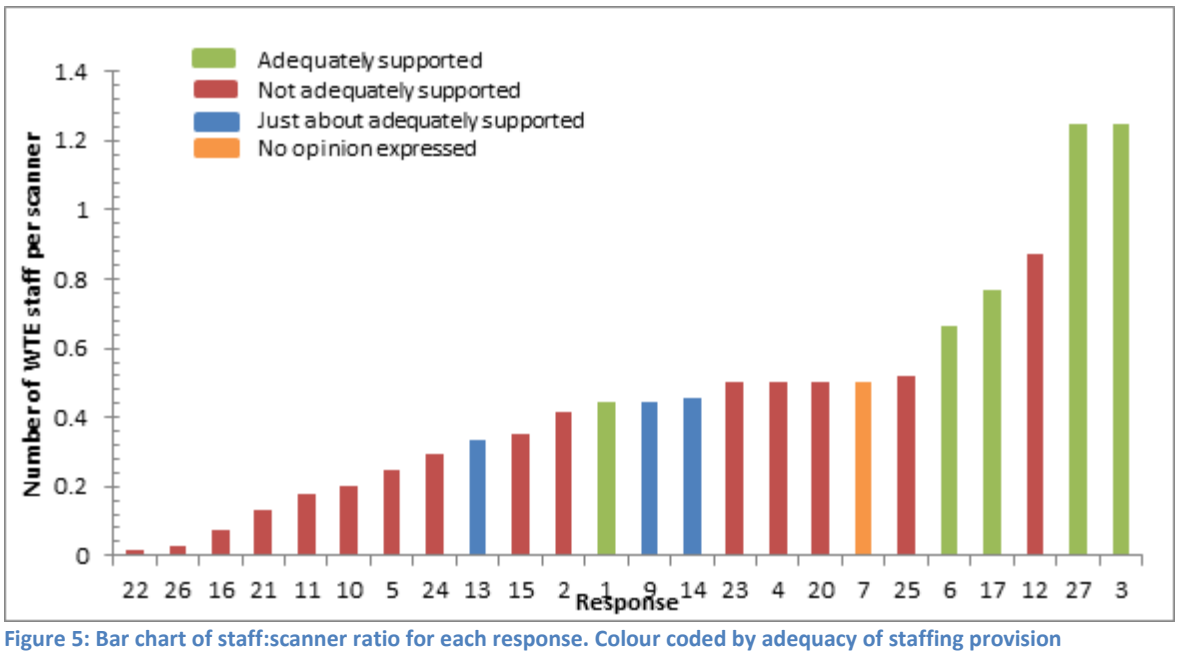


Figure 5: Bar chart of staff:scanner ratio for each response. Colour coded by adequacy of staffing provision

Table 3 reports summary statistics to investigate the relationship between the number of WTE MRI clinical scientists the number of internal scanners. These ratios were formally assessed to determine if the data meet normality assumptions using a Shapiro-Wilks-W test. Consequently, medians and inter-quartiles are reported.

Table 3: Average ratio of WTE staff:scanner for all responses

Internal Scanners Only	Number of WTE MRI Clinical Scientists per scanner
Summary of all responses	0.44 [0.24-0.51]
Summary of responses (stating either just about or adequately covered)	0.56 [0.44-0.88]
Summary of responses (stating adequately covered)	0.77 [0.67-1.25]

The three groups with the lowest number of staff:scanner ratios do not support advanced techniques, which provides an explanation as to how these groups can support a service with such low staffing provision. Additionally routine support may come from other departments. When defining minimum staffing levels, the provision of advanced techniques should be taken into consideration. The above table suggests that approximately 0.67 to 1.25 WTE staff:scanner is required for an adequately supported service.

Other points for consideration are

- This survey represents a sample of MR groups within the UK.
- Service level agreements supporting scanners external to the organisation vary in the complexity in the level of service provided.
- Organisations that cover a large number of sites over a large geographical area will have higher staffing requirements.
- Sites on which there is significant research activity, may have staff employed solely in a research capacity, but who also contribute to the provision of MR safety, thereby creating resilience within the service
- The role of Part 2 trainees has not been captured. Informal information suggests that some sites are utilising 3rd year trainees to support service delivery. This may well change as the Modernising Scientific Careers STP scheme matures, as initial reports suggest that trainees on this scheme are not imputing as much into service delivery as trainees on the IPEM Part 2 scheme.

Radiotherapy Physics

A census of the whole radiotherapy workforce has been carried out since 1998 by the Radiotherapy Board, consisting of the Society and College of Radiographers (SCoR), and inputted into the National Cancer Services Analysis Team (NATCANSAT) data set. IPEM has been involved through its Radiotherapy Special Interest Group (RTSIG) in all years except 2013 (when no census took place) since 2008.

The Radiotherapy Physics workforce census 2014 was carried out via SurveyMonkey and asked questions on:

1. services provided, including training
2. total headcount of Clinical Scientists, Technologists and engineers
3. establishment, vacancies and frozen vacancies WTE by agenda for change band for each of the three staff groups
4. establishment, vacancies and frozen vacancies WTE by electronic staff record
5. IPEM recommended staffing levels calculated using the algorithms in IPEM's Policy Statement on the Provision of a Physics Services for Radiotherapy (2008)
6. Whether they feel the services is adequately supported in staffing terms
7. The number of members of staff aged over 55
8. Other workforce comments

Following compilation the questionnaire was tested by around five Heads of Radiotherapy Physics, before being sent directly via email to all the members of the Heads of Radiotherapy Physics list, held on the IPEM database. The data capture point was set at 1st August 2014. A post advising that this was imminent was also placed on the Heads of Radiotherapy Physics Workspace forum. This included several observers who are retired, and a number of Heads of Medical Physics (as well as the relevant Head of Radiotherapy Physics). Those in this category who responded were not sent any further reminder regarding completing the questionnaire. During this process it became apparent that three Heads of Radiotherapy Physics were not on the list, therefore neither had access to the Workspace, nor had received an email. All were added to the list, and sent two sent emails. IPEM held no contact details for the remaining individual, so this Head was contacted personally by member of the RTSIG. A total of sixty-three centres were contacted, including three private centres. A number of follow-up emails and reminders were made, and fifty-two responses in total were received (82.5%), 51/60 for NHS centres and 1/3 for private.

Of the 52 responding centres, all support external beam physics (perhaps evidentially), treatment planning and radiotherapy QA. Provision of other services varies as shown in figure 6 below:

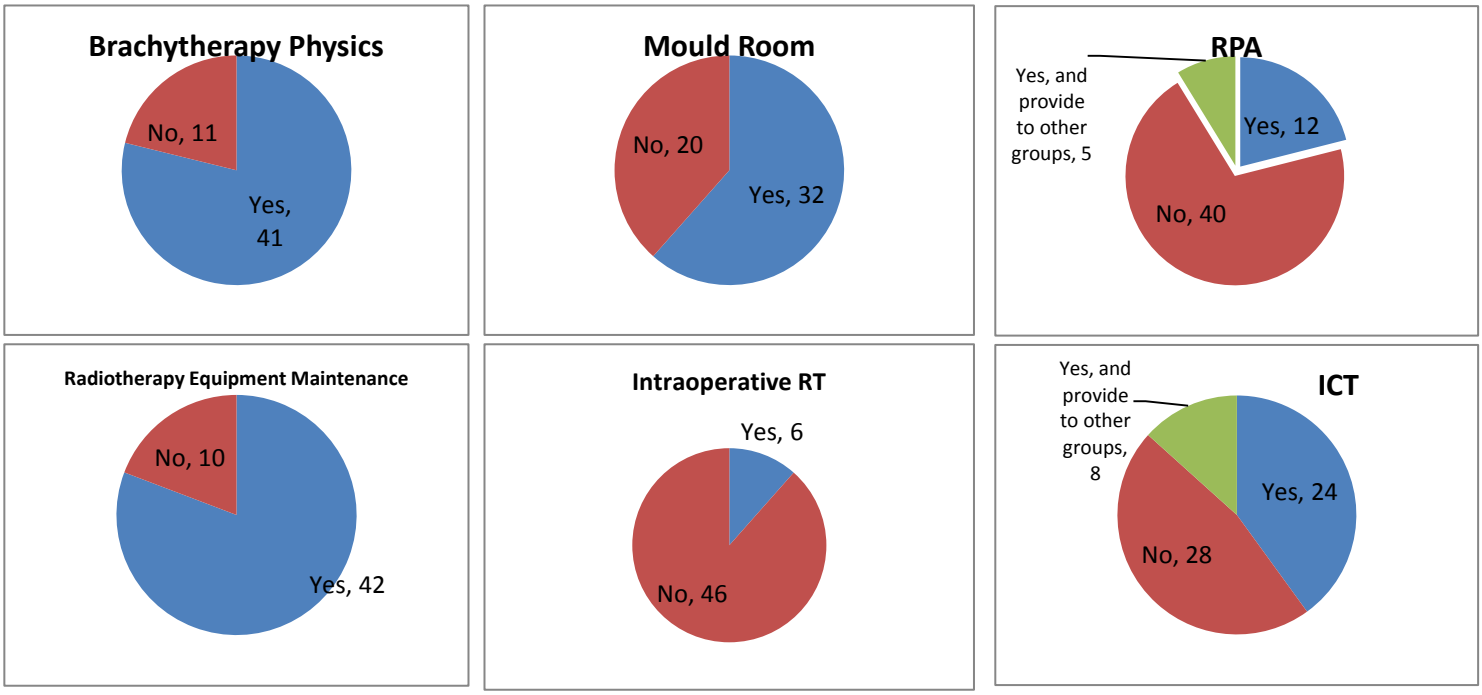


Figure 6: Provision of services at responding centres

The variability of services is accounted for in the algorithm used to calculate the number of WTE staff required for adequate staffing IPEM's Policy statement; however IT provision does not appear to be included.

The radiotherapy service has expanded considerably over the last 5-10 years, and continues to do so, with several new centres, both satellite and stand-alone in various stages of development, and two proton beam therapy centres due to open in 2018.

The 1st August data capture point included staff already in post at the satellite centres at Hereford (opened August 2014), and Redhill (opened September 2014) but not Altnagelvin (due to open mid 2016). The two centres awarded contracts for Proton Beam Therapy (The Christie and UCL) while not due to open until 2018, are also absorbing effort to develop Proton Beam Therapy (PBT) without having additional staff officially appointed.

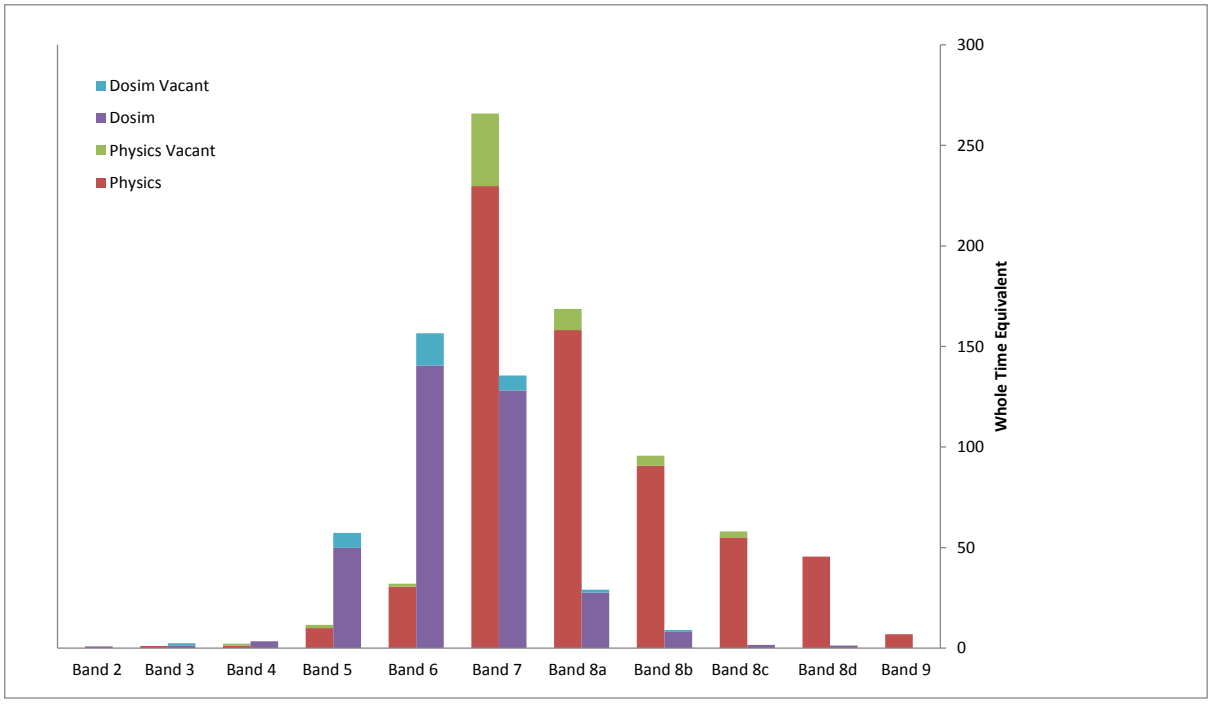


Figure 7: Profile of UK radiotherapy physics and dosimetrist/technologist establishment, both staff in post and vacancies

Of the responding centres 23/52 did not feel adequately supported in staffing terms, with a further 6 stating that although the establishment levels would be about right, but with turnover, inadequate replacement for staff on maternity leave and the difficulty with filling vacancies the centre was rarely at complement.

Fig.7 shows the workforce profile in terms of agenda for change band, with vacancies. The physics vacancies at Band 7, and the Dosimetrist vacancies at Band 5 represent a 15% vacancy rate. This is a concerning vacancy rate at entry-level, and is convincing evidence to confirm that there is a recruitment difficulty. This is especially concerning in view of the upcoming service expansion. Service expansion is anticipated not only in the provision of new NHS conventional centres and PBT centres but in the implementation of 7-day working and development of new private centres, such as The London Radiotherapy Centre which opened in October 2014.

The radiotherapy physics workforce census has shown a consistent shortage (combined for scientist and practitioner over all Bands) over the period 2010-2012:

2010: 7%
2011: 9%
2012: 8.8%

In 2014 that vacancy rate had increased to 9.4% overall, and 15% in the entry-level Bands. The reduction in supply of newly-qualified scientists and practitioners is most probably a direct effect of changing the training program, which took place in 2011.

Note that this census did not absolutely distinguish between scientists and practitioners, but between the services provided, and there is some overlap. However, since the shortfall is similar for each workforce, the overall picture is accurate. The vacancy data is snapshot in time data, however, in 2012 vacancy data was collected over five months, at 3 data collection points, and this showed little variation in the overall vacancy picture; we have no reason to believe 2014 data any different. In addition, three month vacancy data can mask on-going staffing shortages when the workforce is mobile; no one position remains un-filled for 3 months but there are still insufficient staff to fill all established posts.

Clinical Scientists (Radiotherapy Physics Scientists)

Prior to 2012, Clinical Scientists were trained via the IPEM training scheme, which operated in two parts, Part 1 and Part 2, each lasting two years. In Part 1, trainees selected three work areas to specialise, and be examined in, before moving to Part 2 and a single area of specialism. There was an out-turn from Part 1 averaging 80 per annum over all MPCE specialties, of which around 80% selected radiotherapy physics as one of their three specialist areas. Around 80% of these continued to Part 2 specialising in radiotherapy, producing an average of around 52 newly qualified Clinical Scientists in radiotherapy annually. This number maintained the level of staffing, but vacancy rate was not reduced.

During the period 2012-2014 there was a dip in numbers out turned from the training program; 176 compared to 270 in the period 2010-2012, caused by a changeover from IPEM training scheme to the Modernising Scientific Careers STP programme. There is an anticipated double turn-out in 2014, but the majority of these cohorts submitted for ACS assessment in June 2014, prior to the August census, and a significant (but unknown) majority had secured substantive posts prior to the census, and have therefore been counted. This disruption to the training program has almost certainly resulted in a **15% shortage** at Band 7 in 2014 census.

Looking to the future, this picture shows no signs of improvement. For the 2014 cohort only 67 places over all MPCE specialisms were commissioned in England. Given previous years' experience, this will equate to 40-45 newly qualified radiotherapy Clinical Scientists in England. There will be an additional but unknown number from training schemes in Wales, Scotland and Northern Ireland, and a small contribution from the ACS Route 2. These figures need examining in more detail in order to project whether the future supply will be adequate, or whether there will continue to be concerns.

There are currently 58.5 WTE vacancies, and possibly more from non-responsive centre. NHS England has committed to two proton centres, and two conventional centres as well as the implementation of seven-day working, NHS Scotland has unveiled plans for a new satellite centre in the West of Scotland, and a new centres is due to open in Altnegelvin, Northern Ireland in 2016. A staffing report produced by IPEM, and available on the website. Approximately 38 WTE is anticipated for new centres, but the implementation of 7-day working is not yet at a stage where numbers of additional staff can be estimated. IPEM's report on the implications of providing a 7-day service is available on IPEM's website. **It is very likely that not enough places have been commissioned to maintain current staffing, and certainly not enough to provide staffing for the planned expansions**.

The solution to this vacancy problem is more complex than simply commissioning more training places. All training centres report that the training load on qualified staff is higher under MSC than previously and that consequently their capacity to train has reduced. Of the training centres polled

(28/34), 60% would be unable to offer increased training capacity, another 25% are limited by the demands of training in other specialties and the remaining 15% may be able to offer limited additional capacity. At present training places are commissioned based on capacity to train, not workforce demands now or in the future. Several centres reported that additional training capacity would be available if it were funded, but in many cases the use of these funds would be to employ additional staff to cover the shortage in service delivery created by the demands of training. Given there is a staffing shortage it cannot be assumed that there would be staff available to employ in this capacity. It is also of note that 26 applications are received for each STP place, so these occupations are both visible and seen as highly desirable. Should training capacity be increased it is very likely that good-quality trainees would be easily recruited.

Clinical Technologists (Radiotherapy Physics Practitioner)

This workforce was traditionally an apprentice-style trained workforce, and with Modernising Scientific Careers switched to training through the Practitioner Training Programme (PTP). Unfortunately this programme is not supplying a sufficient recruitment pool of Physics Practitioners at present. Only a few courses at Swansea University, University of Cumbria, De Montford University and University of Coventry were accredited, and only Swansea is still running a course.

With a limited supply of physics-trained radiotherapy practitioners, some centres have recruited solely from radiographer pool in recent years, and while this remains a valuable source of practitioner staff, for many it is highly desirable to maintain a mix of skill sets which would require continued training of physics practitioners. There is professional debate regarding radiographer-trained practitioners, and no consensus at present.

There are currently 34.5 WTE vacancies, and possibly more from non-responding centres, with the vacancy rate at **15% in Band 5 and 11% in Band 6.** Approximately 25 staff members are anticipated for planned service expansions, and more for implementation of 7-day working.

The fast track GradDip route has been successful in converting good Physics graduates to qualified Practitioners but training capacity within the workplace will limit numbers. HEE has confirmed that, as a result of the data collecting the GradDip program will continue in the short term. In Swansea the PTP is successfully recruiting; this is believed to be because the Welsh Assembly has funded places thus increasing credibility and viability of this course which leads directly to employment in an area which is not visible to school-leavers. These measures alone, however will in no way meet the shortfall, and other measures to increase the take up of PTP must be considered.

Radiotherapy Engineering Scientist and Practitioner

This workforce has also been affected by the changes that have affected the Physics workforce. There is an 8.7% vacancy over all grades, with 11% at Band 6. There are currently 26 vacancies, and service expansion anticipates a requirement for another 14. The Scientist engineering training places are possibly even further reduced that the physics places; only 7 STP places were commissioned in 2011, but data from later years is not yet available.

Attrition

There is insufficient information on attrition, but the loss of trained staff is unlikely to be accounted for solely by retirement. At 1st August 2015 70 members of staff were aged over 55, and therefore likely to retire in the next five years. This gives an average of 14 per annum. An input of 52 per annum was insufficient to redress the shortfall in 2010-2012, and a reduction in numbers has caused a further shortage. These figures suggest that either the service has been expanding at a rate of 38 staff per annum year on year, or that around 38 staff per annum are leaving for reasons other than retirement.

Anecdotally, Northern Ireland report a consistent loss of staff to the Republic of Ireland, and other areas of the UK report loss of staff to Australia and New Zealand. Both Scotland and high cost of living areas (eg London and the South Coast) report a difficulty in retaining staff at lower-paid Bands.

The private radiotherapy sector is growing, and is recruiting staff from the same recruitment pool, but offering no training input. A further cause of attrition is reduction in working hours to care for dependents. Although in recent years there has been an increase in childcare responsibilities taken on by fathers, the Equality Human Rights Commission[v] reports that considerably more women are employed part-time than men (43% compared to 13%). Anecdotal reports from the radiotherapy physics workforce suggest that this workforce is no exception, with many women returning part time, (0.8 or 0.6 WTE) after maternity leave. The effect of part time working, and the need to train more than one individual to obtain 1WTE of workforce may become more significant in the future as currently 50% of STP entrants are female. Additionally, maternity leave presents another workforce challenge as the cover for which is often only partially covered by the employing organisation. For example the University Hospitals of Bristol will only finance 60% of a maternity cover.

There will also be other leavers, about whom we have no data. A causes of attrition survey would be beneficial to identify other losses to this workforce.

Many centres have been recruiting good quality staff from abroad, both from within and outside the EU. The data from the 2014 census has been presented to the Centre for Workforce Intelligence, who have subsequently recommended to the Migratory Advisory Committee that the occupations Radiotherapy Physics Scientist and Practitioner remain on the National Shortage Occupation List. Inclusion in this list removes the need for the labour market test in the application for a tier 2 Visa, and thus facilitates recruitment from outside the EU. However the Migratory Advisory Committee wish this to be a short term measure and urge measure to be taken to address the national shortage.

Adequate establishment

More work will be required to allow an accurate comparison of staffing levels to IPEM recommended levels. The wide variation in responses; whereby some respondents adjust their numbers to account for extended working hours, engineering service contracts and treatment planning taking place in radiography, and some did not make those adjustments, means that further, analysis is needed.

Diagnostic Radiology Physics

With no complete list of departments and contact details it was not possible to conduct a census, nor to select an appropriate sample, however all information gathered is of use in building a full picture. An invitation to complete a web survey was sent to all centres that had reported provision of DR Physics services in the services survey. In additional a weblink and an invitation to complete was submitted to the mailbases via Twitter (#Radiology), LinkedIn, IPEM newsletter and as a news item on IPEM's website. Twenty-six centres responded, although not all completed all sections. The Workforce Intelligence Unit now has a list of around fifty departments and independent companies providing diagnostic radiology services, there are certainly some missing, but it is likely that 26 departments represent around a third of Diagnostic Radiology Departments in the UK. The type of department responding is depicted in the pie-chart below. The responding large MPCE services included responses from Scotland, Wales and Northern Ireland.

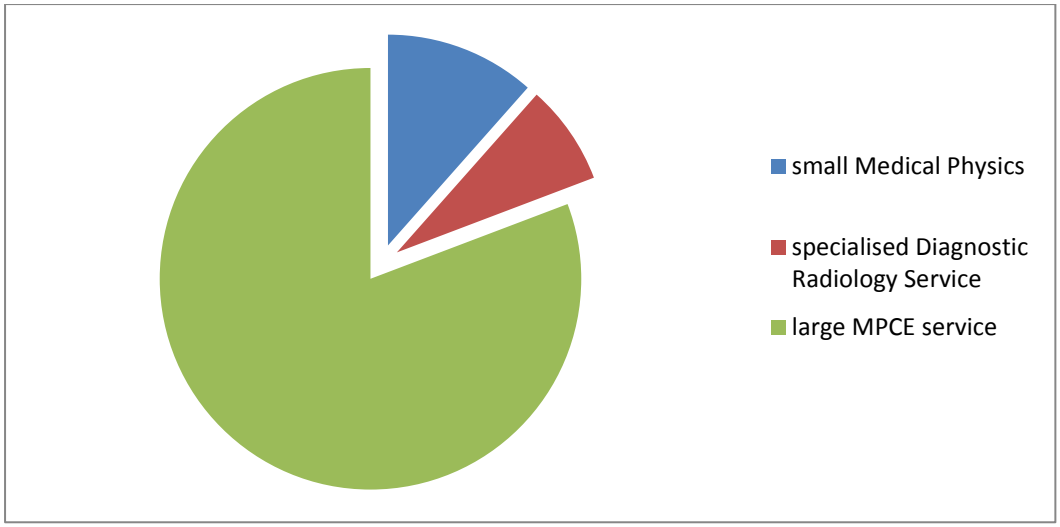


Figure 8: Piechart showing type of organisations responding to the DR/RP survey

The Diagnostic Radiology Physics Survey asked questions on

1. services provided, including training
2. total headcount of staff
3. establishment, vacancies and frozen vacancies WTE by agenda for change band
4. establishment, vacancies and frozen vacancies WTE by electronic staff record
5. Whether they feel the services is adequately supported in staffing terms
6. The number of members of staff aged over 55
7. Other workforce comments

In an attempt to collect data that was comparable between centres, the survey asked for WTE involved in supporting angiography, fluoroscopy, CT including CT QA, DEXA, Mammography including Mammo QA, plain X-ray including QA, ICT for Radiology/PACS, Dental Radiology only and not for WTE spent supporting other services. A separate question asked about other services supported (including training) and an estimate of time spent. This proved to be a challenge for the overwhelming majority of departments who are unused to allocating time in this way and so was overly time consuming for the respondent, and undoubtedly reduced response rate. Additionally it is believed that many departments simply reported the WTE of their entire diagnostic radiology section, irrespective of whether they support additional activities, and in some joint DR/RP departments simply split the WTE half and half between DR and RP.

Eleven centres (42%) reported that they felt under-resourced in staffing terms.

Of these centres the vacancy rate over all Bands was 5.3%. The vacancy rate over all departments was 4.7%. This contrasted with a much greater vacancy rate (9.3%) in radiotherapy physics, although a similar feeling of lack of staffing resource. The associated comments suggest that the staffing problems lie in insufficient establishment rather than inability to fill vacancies, although there is also a concern that recruitment would be difficult even should establishment be increased. The workforce profile and vacancies are shown in the fig. 9 overleaf.

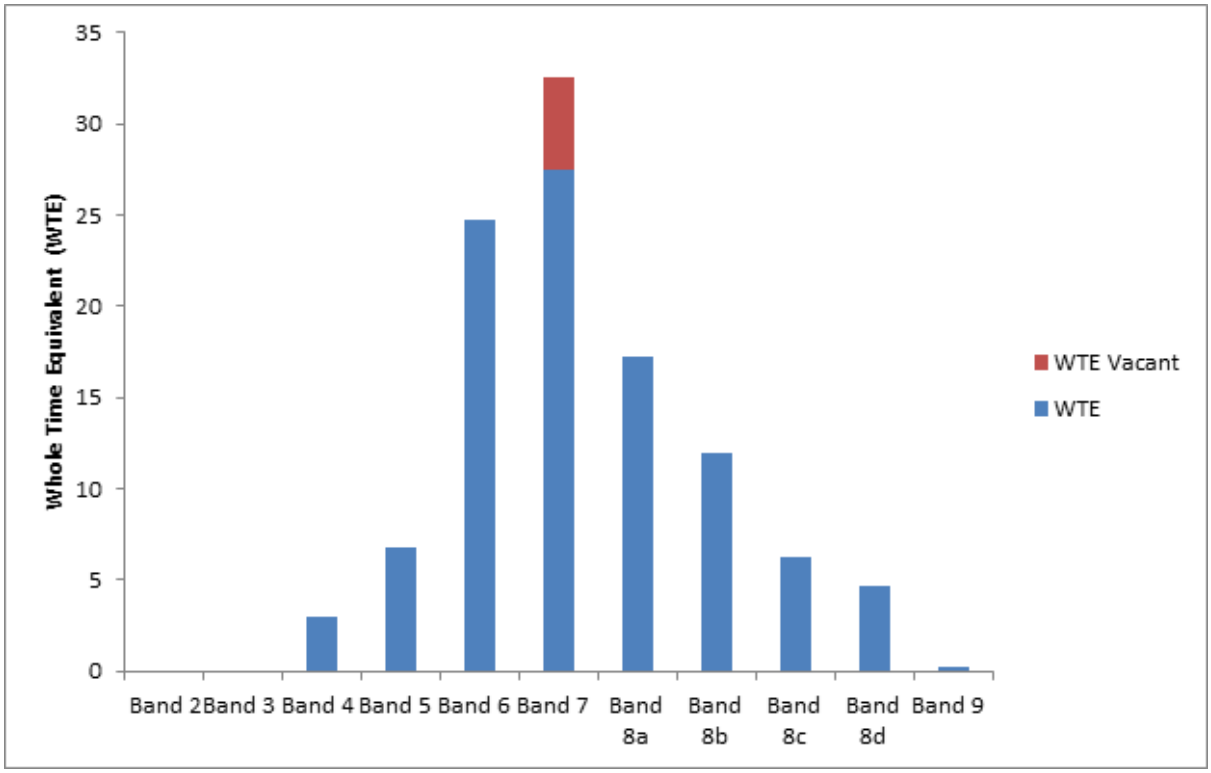


Figure 9: Profile of UK Diagnostic Radiology workforce, established posts and vacancies by AfC band

It is immediately apparent that the vacancies are all at Band 7. It is likely that when additional resource is approved, only recruitment at Band 7 is permitted, rather than vacancies only every arising at Band 7.

Informal discussion with the Diagnostic Radiology Special Interest group (DRSIG) suggested that the figure of 42% of departments under-resourced is a low estimate, and that the true figure is considerably higher. Certainly some individual comments portray an extremely concerning situation:

> *"Service is at breaking point, no capacity to train and insufficient physicist staff in particular. Flagged with Trust Health & Safety and on risk-register. There are insufficent trained staff to recruit, albeit that funding has been impossible to obtain. This is a multidiscipline problem. We are unable to train under MSC due to increase in burden and lack of staff. Unable to retain existing trainees due in part to work stresses."*

> *"not adequately resourced. Fall below 50% of EU MPE staffing guidance, main limiting factor is cost."*

The view of the DRSIG is that the best way to address establishment staffing concerns would be to produce a Policy on Staffing levels. In order to do this the WIU would need to gather information on workload, in order to devise a measurement for comparison. A previous survey in which the DRSIG had attempted to gather this data only achieved a 15% response rate. This is thought to be because the complexity of the survey made it very time consuming to complete.

There is concern within the DR community that recruitment of experienced staff is difficult, although we have not collected evidence to support this. Certainly the absence of any vacancies above Band 7 makes this difficult to assess. The training difficulties relating to clinical scientists in radiotherapy also affect radiation physics specialties and so the numbers qualifying in these specialities will also

be reduced compared to those under the IPEM training scheme. The training survey found that training capacity in other specialities (including DR/RP) to be restricting radiotherapy training capacity, suggesting that training capacity is limited in this area of work as well. In addition to workload information, the WIU should also examine training places and capacity in more detail, collecting data on training places, capacity and reasons for leaving in conjunction with a Policy Statement on Staffing levels.

Of the groups responding to the survey who provided this information the headcount of staff was 137 of whom 20 are over 55 (14.5%). This is comparable with staff in Radiation Protection and EBME. (Data not available for radiotherapy)

Radiation Protection Physics

The Radiation Protection workforce was approached in an identical way to the diagnostic radiology workforce, and the same questions asked.

Many departments who responded to the diagnostic radiology survey also responded to the radiation protection survey, as many groups are joint DR/RP groups, and workforce information was received from 19 departments. As for diagnostic radiology, this is likely to represent around a third of RP departments. The profile of this workforce is shown, both establishment and vacancies, broken down by Agenda for Change Bands below.

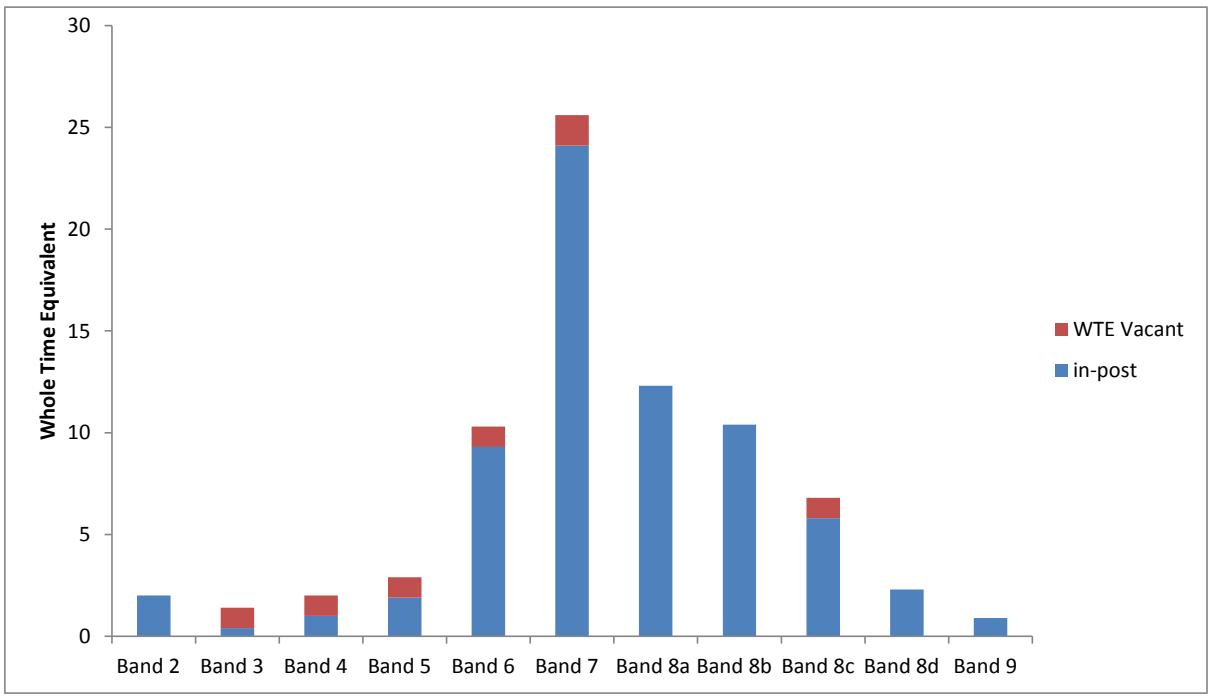


Figure 10: Profile of UK Radiation Protection workforce, established posts both filled and vacant

The vacancy rate in radiation protection over all bands was 8.5%, close to that in radiotherapy physics. 40% (8/20) departments felt that they were inadequately supported, however the comments suggests staffing issues are more widespread. The below comments are all from departments who reported adequate staffing support:

> *"It is of significant concern that we feel when we lose staff (at any level of seniority) all we can do is replace them with someone who has just finished part I (or equivalent). Even then, we are struggling to identify current trainees within Scotland who might want to apply for a Band 7 post and fear having posts we cannot fill. Our experiences indicate that we are not training enough physicists to cover all modalities"*

and "However, one of the members of staff (current AFC 8a) is iminently going to hand in their notice. We are not confident of being able to replace them like for like (other Scottish Centres who have tried to recruit recently have not been successful)."

"Because there is no Head of Medical Physics I have to do a lot of the work a Head would do. This means that I struggle to cope with the workload."

"recent restructuring and recent appointees a lots of training & resulting strain on service.

In Scotland pool of RP Scientists is limited which often leads to staff moving from HB to HB to achieve desired grade. Feels like spend a lot of time training, only to lose them. Limited scope internally to upgrade staff."

The training issues are similar to those in diagnostic radiology; and work in the immediate future should investigate this further in terms of training capacity, commissioned places, time required for training. This should also be linked to work on the implementation of Medical Physics Expert accreditation.

Electro-Biomedical Engineering (EBME)

As discussed earlier, this is one of the most challenging workforces for IPEM to survey. Surveys were sent to all centres responding to the services survey and reporting EBME services, as well as to the MPCE mailbase, via Twitter, LinkedIn, IPEM newsletter and as a news item on IPEM's website. Responses were sought from all departments providing EBME services, whether located in Estates or a larger Clinical Engineering department.

Questions were asked regarding:

1. services provided, including training
2. total headcount of staff
3. establishment, vacancies and frozen vacancies WTE by agenda for change band for the following services only:
    - Anaesthetic Equipment Maintenance
    - Mechanical Workshop
    - Electro-medical Equipment Maintenance
    - Equipment Library
    - Medical Device/IT Integration
    - Theatre Tech and Equipment Maintenance
    - Design and Manufacture to ISO 13485
    - Equipment Management and Contract Maintenance
    - X-Ray Equipment Maintenance

And separately for

- Radiotherapy Equipment Maintenance

4. establishment, vacancies and frozen vacancies WTE by electronic staff record
5. If there were any staff coded on another matrix
6. Whether they feel the services is adequately supported in staffing terms
7. The number of members of staff aged over 55
8. Other workforce comments

Twenty responses were received, and with the number of EBME services being so much greater than Diagnostic Radiology or Radiotherapy this represents a much smaller proportion of services. It is not unfeasible that there are 200 EBME departments in the UK and IPEM have confirmed contact details for only 39. It is probable, therefore, that the responses represent only 10% of departments.

The information of service provision was combined with the services survey information to show that: of 32 departments 75% (24/32) run a mechanical workshop, 28/32 operate an equipment library, just over half perform medical device/IT integration (10/32), but only a third design and manufacture to ISO 13485. X-ray maintenance is carried out by only a third of departments, with the most of the other departments using original equipment manufacturers through service level agreements; in one Trust this was carried out by medical physics.

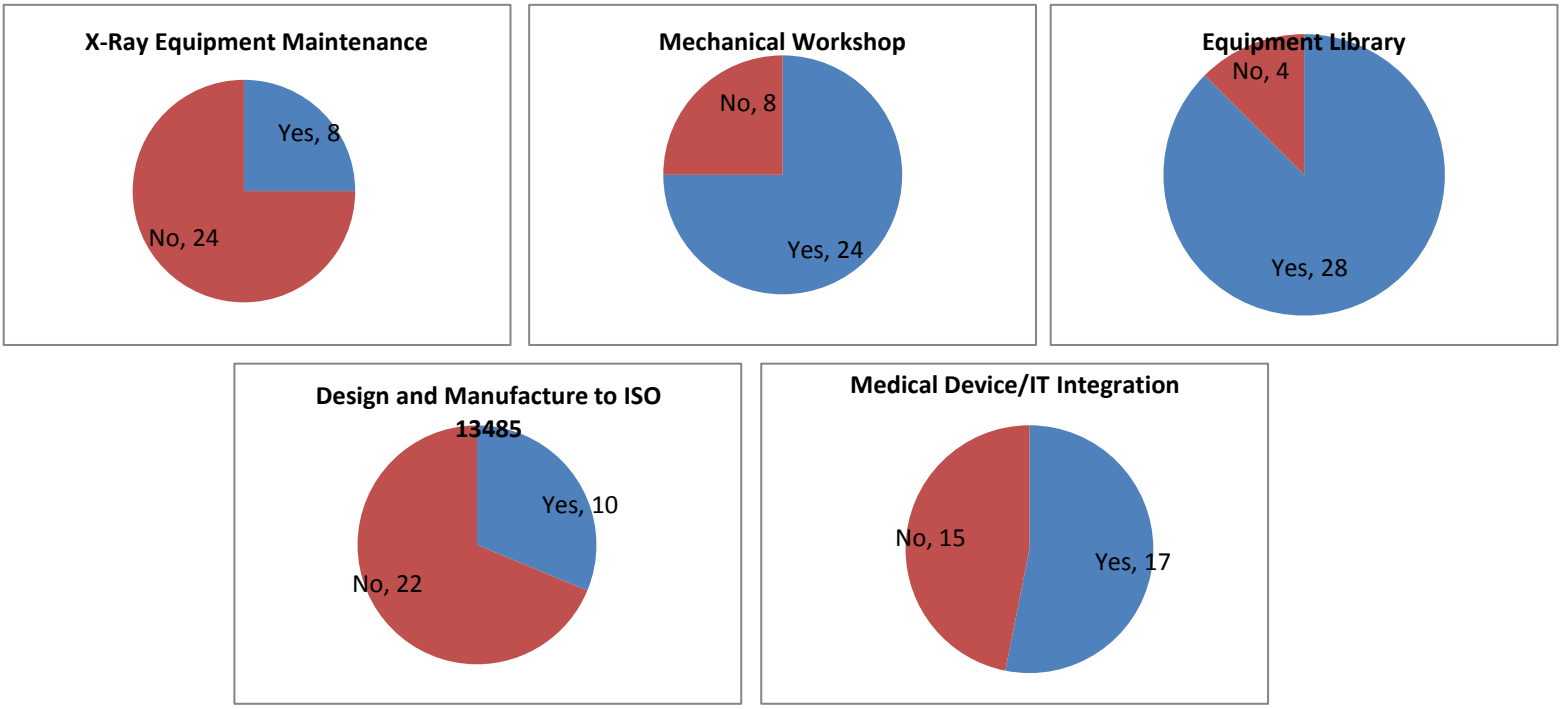


Figure 11:Provision of services in responding EBME departments

Five departments responding carried out radiotherapy equipment maintenance. Respondents were asked to report WTE required to support RT Equipment Maintenance separately to other services, and this was provided. This data will be added to the radiotherapy workforce to allow comparisons and for completeness, while making it clear which staff groups are employed by estates.

Fewer departments 36% (7/20) felt understaffed, and that the comments supported this, but this is unlikely to be the sole reason for lower opt-in. This workforce has not, historically, been well-engaged with IPEM, and greater engagement with IHEEM may well assist in increasing responses.

Only 18 departments provided workforce information, but this represents the largest staff group; with a headcount of 403, of whom 66 are over 55 (16.3%). This is larger than in other staff populations, but there is insufficient data with which to compare. However, it is noteworthy that in one department ALL staff were aged over 55.

Respondents were asked how much WTE was available to support Anaesthetic Equipment Management, Mechanical Workshop, Electro-medical equipment Maintenance, Equipment & Contract Maintenance, X-Ray Equipment Maintenance, Equipment Library, Medical Devices, IT Integration, Theatre Tech & Equipment Maintenance, and Design & Manufacture to ISO 13485. It is not known how many respondents, if any, adhered to this, and how many reported the WTE in their entire department. The profile of the workforce, in terms of agenda for change bands, both establishment and vacancies is shown in fig. 12 overleaf.

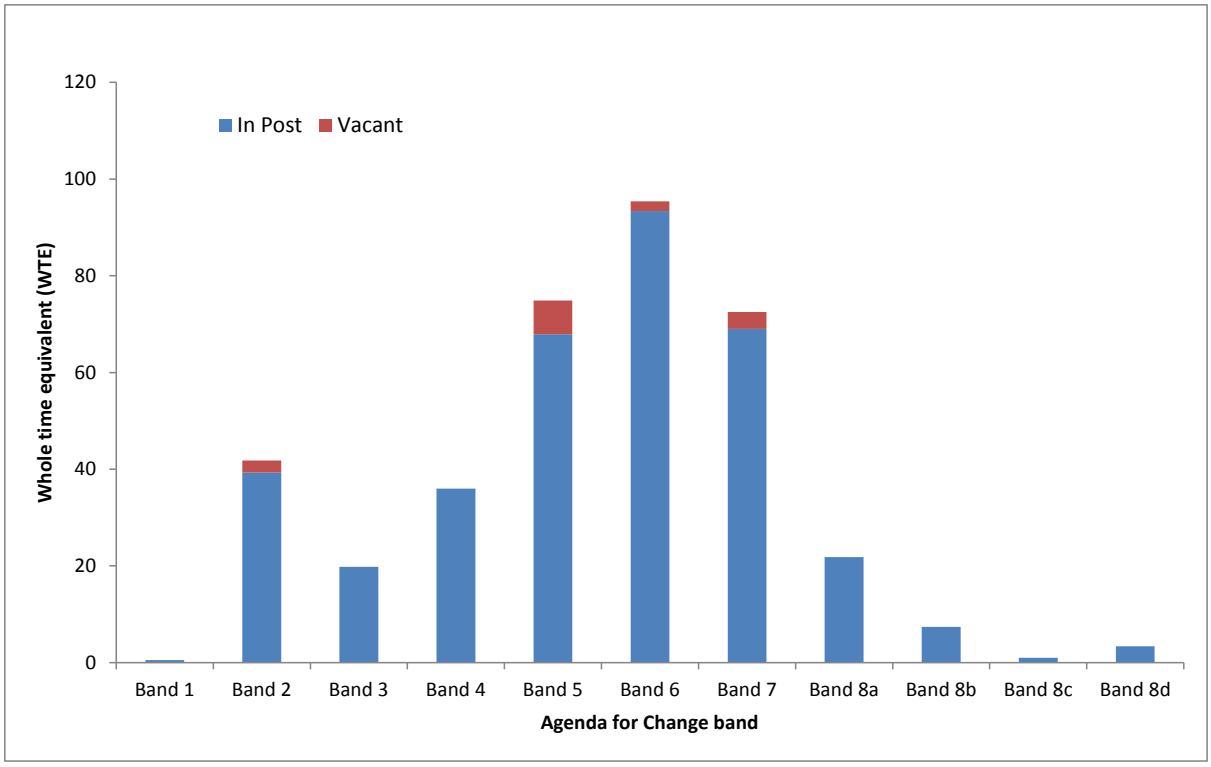


Figure 12: Profile of UK EBME workforce (in centres responding to survey) established posts, both filled and vacant

The vacancy rate is lower than in other workforces surveyed; 5.5% for Bands 1-5 and 2.7% for Bands 6-8d. There was concern expressed over recruitment, both in terms of recruiting newly trained engineers, and recruitment difficulties relating to location. The geographical difficulties range from difficulty of recruiting lower-paid staff in high cost-of-living areas, a difficulty in attracting staff to more remote areas of the UK, to a difficulty in recruiting staff at a level which is not traditionally geographically mobile. One respondent commented that a locally-trained practitioner route would be beneficial.

Other concerns raised were regarding the increasing complexity of equipment to be maintained, along with a growing requirement for networking was increasing workload. A key concern expressed by respondents is that of succession planning, which is not reflected in the vacancy rates. There is concern that suitable replacements for senior engineers are not visible. This could be because insufficient are being trained, or the training scheme is no longer suitable, or it could be because there is little opportunity for career advancement, so suitable individuals are leaving. This may also be linked to geographic considerations.

The majority of responding departments are under Estates and Facilities, and two centres reported that there were also contract management staff recorded on the ESR G-matrix (Administration and Estates) rather than the U-matrix (Healthcare Science). If contract management is purely an administrative function, then it is not a healthcare science role, but if it involves the generation of specification and monitoring delivery of contract performance then it is a healthcare science role. In future surveys it would be valuable to additionally ask whether the respondent assesses this coding as accurate.

Learning Points

This project is a new venture for IPEM, with experience in workforce data collection and surveys in the past limited to the radiotherapy physics workforce. The surveys carried out in 2014 provided a great deal of learning points and opportunities.

Response rates and engagement

The services survey was envisaged to cascade outwards, with services known to IPEM identifying services not known to IPEM, and in time providing IPEM with an accurate picture of service provision over the entire UK. This did not happen, but analysing the reasons for this is informative.

For those engaged with, or approached by an individual engaged with the project, completing the services structure survey was not perceived to be a problem, and contact details were provided. However for heads of service not engaged with the project, and even more so for those not engaged with IPEM this request for information was met with a degree of suspicion. Many individuals were reluctant to provide contact details, citing data protection concerns, or even a name for those outside their organisation or department, so for example, the services survey would learn that the medical physics services at a Trust were not integrated with EBME services, but not who we should contact to ask about EBME workforce and services.

Passing on a work-related contact name in a work-related capacity does not breach data protection rules, although it may be considered impolite. An article in Scope, published in March 2014 re-iterated this, but did not improve responses.

Many Heads of Service did not return the services survey at all; and some required considerable prompting. Several responded that this work is extremely important, but were subsequently unable to find the time to complete a survey, perhaps demonstrating the extent of the problem! Reducing the complexity and difficulty of surveys, and ensuring questions are well-focussed should increase response rates.

Response rates were particularly low from departments with which there had been no prior engagement. A key feature of the workplan for 2015 will be communication and relationship building. Opportunities for engagement directly with the workforce and public visibility such as Regional Meeting will be sought. Additionally, as the results of the WIU efforts are published, suspicion level should decrease. The majority of intended respondents are members, and with increased visibility and communication will see that IPEM is using the data gathered in the best interests of the profession.

Commercial Confidentiality and Data Sensitivity

An unexpected barrier to responses proved to be commercial confidentiality and data protection concerns. Originally it was envisaged that the services survey would reveal departments through reporting of service level agreements, and initially it was intended to publish these to demonstrate the wide geographical area over which services are provided and the range of scope of departments. However, many departments were reluctant to publicise details of their service level contracts as these are commercially sensitive. The degree of concern over this varied widely from departments who were quite prepared to be totally open, to those with a mild level of concern, to those who were unwilling to inform IPEM other than under a non-disclosure agreement. The variation in level of concern is almost certainly directly related to the experience of competition for the award of these contracts. Some areas of England have no private competitor for services, and while services can be provided over a large distance, there are some limitations, so there the areas of England with no private competitors have a lower level of concern. This commercial concern is at present limited to England, as the Health and Social Care Act, with provision for Any Qualified Provider only applies in England, but this is likely to be increasingly part of the landscape, and does create a barrier to workforce intelligence.

IPEM must respond to this concern; it would be inappropriate for a professional body to provide this information for competition to competitors. Staff in competing service providers, both NHS and private are eligible for membership; so restricting information to members only is not a viable solution.

Unfamiliar terminology and coding

With the recoding of healthcare scientists within ESR, NHS Employer functions have moved to describing the workforce in terms of Scientists and Practitioners, however this is not yet commonly adopted by services heads. In the 2014 surveys several heads did not respond to the ESR questions; and indeed some implied that their Trust did not use ESR.

Although in the future ESR will become the standard descriptor of post, at present the information is not freely available to managers, and almost certainly presents a barrier to data collection; once a respondent reaches a difficult section of a survey, it may be discarded, and not returned to. As a positive, enquiries regarding ESR coding in one department led to inappropriate coding to be corrected. It is also known that some establishments have been trying to change inappropriate ESR codes for some years, but meeting with no success. Collecting data under ESR coding headings would consequently miss out mis-coded individuals. For 2015 it may improve response rates if ESR code is seen to be an optional extra, rather than a key requirement.

Ideally for workforce planning, information on age, gender, attrition, reasons for leaving, as well as AfC Band, and WTE hours worked would be collected. The ideal for planning, would be to collect information on each established post including data on the current incumbent, and ESR grade of the post if known, but this could prove immensely time consuming for large departments. The Radiotherapy Physics Department at The Christie has over 75 established posts, for example, and providing such a high level of detail for each post-holder, while relatively easy, would be extremely time consuming. However, providing information on head count and WTE for each agenda for change band within a department is relatively achievable; provided that no artificial constraints over services covered are applied, as described below.

Another difficulty presented by the 2014 survey format was the request to respondents to estimate WTE spent covering a particular group of services. The majority of respondents stated that they simply do not work under such divisions and were unable to estimate WTE split. In future it will be of much more benefit l to collect information regarding the services provided, and the associated WTE and staffing information, since this will almost certainly result in greater response. Variation of service provision can then be allowed for in data analysis.

In an example as to how a time consuming survey reduces responses, the EBME survey was emailed directly to four Heads of EBME at small community healthcare trusts. All started the survey, suggesting that this was an area of interest, but not one finished, suggesting that the level of detail required by the survey was off-putting. If open questions, which can be responded to quickly, were asked at the start of the survey, with quantitative questions requiring more effort placed later, then at least some information would be gained. It was also be of value to provide some estimate for how long the survey will take to complete, and indeed encouragement during the survey.

The collaboration with IHEEM was intended to improve links with this group, however, while IHEEM are keen in principle to progress this work, they lack the staffing resources to provide timely assistance. For example, they were asked to distribute the EBME Staffing survey through an email to their members. They were only able to action this 3 days before the survey closing date, over 6 weeks after they had been sent the link. In future a better course of action might be co-badging and presidential co-signing of surveys so that they are seen to be mandated by both organisations but administration rests solely with IPEM's Workforce Intelligence Unit.

None of the 2014 workforce surveys made a category of admin staff clear; and it is important to address this in future for several reasons. In a small department admin may be an additional workload on the scientific staff, and this should be captured. In EBME departments, staff solely carrying out contract management are very likely to be classified as admin; and this will depend on department structure, whereby some departments prefer to use scientific staff for all aspects of

contract management, not just the specification. A separate category for respondents to include information on admin staff would provide clarity.

Similarly none of the surveys specifically asked about trainees. STP training contracts run until 31 October each year, and ACS assessment centres are held in February, June and October. Some individuals may therefore be uncategorised in a survey with a collection point in August.

For individuals who pass at the February and June assessments they could either

- Have secured a substantive post, either at their training institution or elsewhere but not yet started
- Be still seeking employment
- Not planning on taking up Clinical Scientist employment in the UK

For a vacancy that has been filled, but the individual has not yet started in post a head of department could either

- Report a vacancy
- Report established post filled-no vacancy

There was no guidance on how to record trainees in the 2014 surveys, leading to uncertainty in the vacancy and newly qualified scientist figures in the 2014 radiotherapy workforce survey. Again, this must be rectified in future.

Assessing Departmental Workload

Only the radiotherapy workforce survey enquired regarding workload, through the IPEM recommended staffing numbers. However, in future this question needs to be asked more carefully, so that it is clear how many hours/week of service this is covering, whether adjustments have been made for the existence of a service contract or for treatment planning in the radiography group.

For other workforces, a decision must be taken in conjunction with each workforce as to a sensible measure of workload, again, taking in to account both the need for accuracy and for a number of survey replies. It is desirable that this takes place prior to any survey; so the staffing numbers can be viewed in context. All SIGs have been asked to review or create Policy Statements on Recommended Staffing Levels.

Changing working practices should be reflected in Policy Statements; it is known that employing organisations view professional body's recommendations on staffing levels to be an upper estimate, and will often automatically revise downwards by as much as 20%. It is important that IPEM maintain credibility by not allowing over estimation, and this can also be achieved by endeavouring to include all contributions.

For example, the STP scheme reportedly requires more supervisory input from mentoring staff. This impact on staffing in respect of service provision is unrecorded. The 2009 Radiotherapy Physics Policy Statement[iii] states that additional resource should be made available, but does not attempt to calculate absolute numbers.

Similarly, a number of centres reported radiotherapy staff in bands 2-4; and the staffing numbers at these centres were below IPEM recommendations. If this is possible, and safe, because of the Band 2-4 staff, then this option should be noted in a Policy Statement.

Additionally many centres reported the valuable contribution to service provision from final year Part 2 trainees; and this is not acknowledged anywhere. It is far from desirable that adequate staffing is achieved this way, but the withdrawal of this hidden workforce will have an impact on the adequacy of staffing level. The change in training scheme is likely to bring about this withdrawal, as reportedly, STP trainees are not able to contribute to service provision in the same way as Part 2 IPEM training scheme trainees, owing to a lower level of experience at that stage in their training.

The gap between safe and desirable should also be noted. It is desirable that sufficient centres have time allocated for research, development and training. Continuing Professional Development is essential both for maintaining professional registration and to maintain service excellence, and this should be acknowledged in a Policy. Staff should have time allocated for CPD, but where this is not possible a service may still be "safe" in the short term, although it will not remain so indefinitely. Some small centres reported in the MR Physics survey that they are unable to utilise new equipment properly because there is no time in which to learn or try out new techniques. While able to maintain a safe service, this is inefficient and not future proof. A further example is Shrewsbury Radiotherapy Centre, where at just 48% of staffing as recommended by IPEM, they are able to provide a routine service, prioritising patient needs, but will be unable to develop and very likely to have great difficulty in implementing DH initiatives such as the drive to deliver a higher percentage of RT using IGRT/IMRT by 2014.

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[i] NHS Occupation Code Manual V13.1 http://www.hscic.gov.uk/media/13060/NHS-Occupation-Code-Manual/pdf/NHS_Occupation_Code_Manual_Version_13.1.pdf

[ii] IPEM Policy Statement on Managing Medical Physics and Clinical Engineering Services (2008)

[iii] IPEM Policy Statement on the Provision of a Physics Services to Radiotherapy (2009) http://www.ipem.ac.uk/Portals/0/Documents/Publications/Policy%20Statements/Recommendations%20for%20Prov%20of%20Phys%20Serv%20to%20RT.pdf

[iv] Position Statement "The Impact of Extended Clinical Hours on a Radiotherapy Physics Service" (2014)

[v] http://www.equalityhumanrights.com/about-us/devolved-authorities/the-commission-in-scotland/legal-news-in-about-us/devolved-authorities/the-commission-in-scotland/articles/women-men-and-part-time-work