

## Recommendations for the Medical Physics support of a Magnetic Resonance Service

### 1. Introduction

There are a number of initiatives that are increasing the demand for MR physics support within the NHS – the Richards Report<sup>1</sup>, the NHS Long Term Plan<sup>2</sup>, the Diagnostic Imaging Network Workforce Guidance<sup>3</sup> and the establishment of Community Diagnostic Centres (CDCs) and Imaging Networks, increased investment more generally by Trusts in MRI scanners, development and implementation of more advanced techniques requiring physics support within the clinical environment (e.g. intra-operative MRI, radiotherapy treatment planning using MRI, advanced neuro MRI etc), increased numbers of MRI safety issues and enquiries, particularly concerning patients with implants and finally, an increased demand for clinical MRI research support within NHS departments, including NIHR funded research. There is a definite push to provide some of these services more locally to the patient, for example at their nearby DGH or CDC rather than having to travel to a tertiary/specialist centre, and MR physics groups would be key to establishing and supporting that increase in breadth and depth of service across the country.

There has previously been an IPEM working group to examine MRI Physics training and workforce issues, and this group produced a report for Scope at the start of 2020. As MR Physicists working in healthcare are normally HCPC registered Clinical Scientists, training routes for this staff group are typically via the Scientists Training Programme (STP) and the Association of Clinical Scientists (ACS) Route 2 pathway. This Scope report indicated that inadequate numbers of trainees were being trained to meet even the current demand, based on jobs advertised, and that there were considerable barriers to training more MR physicists.

A newly developed recommended minimum staffing calculator has been produced by the MR Physics workforce and planning group, which enables each service to formally assess current staffing levels versus required staffing and develop initiatives to support the large increase in MR physics demand we are seeing and anticipating. The calculator could form the basis to build concrete evidence to approach stakeholders, such as other professional bodies, HEE, NSHCS and the NIHR to obtain support and funding for these proposals, to ultimately put MR physics on a more visible, robust, and sustainable footing within the UK. This in turn will also lead to improved patient safety, efficiency and throughput.

This document seeks to address the current issues and gives updated guidance on the provision of a MR physics service to magnetic resonance imaging. Although the document provides guidance on the number of Clinical Scientists, physics required to provide a safe magnetic resonance service, it should be understood that increased levels of skill-mix can be applied to individual departments depending on local work practices and circumstances.

## 2. Recommended Minimum Staffing Calculator

The calculator can be used to determine the minimum number of clinical scientists required for magnetic resonance service as whole-time equivalence (WTE). The number of clinical scientists required for a service is based on the volume and frequency of activity a department engages with. Further, if a service is seeking to expand, the calculator may also be used to determine additional staff requirements. The activities of a MR physics service are divided into nine core areas:

- MRI Safety
- Quality Assurance and troubleshooting
- Site design
- Service delivery/development, protocol optimisation and sustainability
- Quality management and governance
- Research & Development & Innovation
- Education and training
- Clinical Scientific computing and informatics
- Scientific leadership and management

The calculator is used by multiplying the frequency of an activity performed by an MR physics service in each core area by the typical WTE dedicated to this activity to obtain the required number of Clinical Scientist posts required to support this core area. The total WTE Clinical Scientists required across all nine areas of activity can then be tallied up using the table at the end.

1. MRI Safety			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
10	Implant investigations - complex e.g. non-conditional, multiple systems, new implants (0.5 days/implant). Input also dependent on radiographer and radiologist expertise available locally	per year	0.02
10	Implant investigations - simple e.g. standard MR conditional pacemakers, routine implant queries (~1 hour/implant)	per year	0.005
10	Supervision of scans (could be phased as development becomes more routine) Pacemaker or spinal stimulator scanning support plus other ad-hoc cases, specialist scans, 'off label' scanning	per year	0.01
1	Audit of facilities for MR safety guidance compliance (annual) Annual safety review audit - could be for an individual scanner or per unit - include numbers as appropriate	per scanner OR per unit	0.003
1	Practical MR safety support Local rules, risk assessments, MR safety committee work, generic assessment documentation and audits, implant documentation	per department (inc. external clients)	0.08
1	Radiation protection equivalent role for delivery of 'regulatory' or other compliance (e.g. CEMFAW, safety frameworks, QSI/ISAS etc) Radiation Protection Committee involvement. May also include H&S involvement in Med Physics/Radiology/other depts and might include accreditation (i.e. QSI) involvement	0.02 per department (inc. external clients)	0.02
<b>Total</b>			

2. Quality Assurance and troubleshooting			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	MRI scanner QA and basic optimisation (e.g. routine QA, basic troubleshooting - although this varies) - internal (more involvement and time)  Trouble shooting, general help with sequences, responsive QA, annual QA, project-specific QA	Per scanner	0.1
1	MRI scanner annual QA only  Annual QA only or if your QA is every six months, double your 'count'. If you only provide safety advice, include this site in line 8 above	Per scanner OR per year	0.02
1	Artefact investigations	Per artefact OR per year	0.002
<b>Total</b>			

3. Site design (including procurement and acceptance testing)			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Equipment specification (including ancillary equipment)  e.g. approx. 0.5 scanner replaced per year	Per procurement OR per year (on average)	0.01
1	Equipment evaluation and commissioning (including travel)  Commissioning and acceptance	Per procurement OR per year (on average)	0.02
1	Advice for new installations (including travel)  Attending project meetings, site/safety advice	Per installation OR per year (on average)	0.005
<b>Total</b>			

4. Service delivery/development, protocol optimisation and sustainability			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
100	Image processing and image evaluation (including image quality review)  Number of patient events processed each year in total, e.g. fMRI, DTI, MRS, cardiac, breast etc	Per year	0.2
100	Clinical service support e.g. MDT attendance (time constrained)  Other clinical service support, e.g. MDT attendance (per patient), discussion of results with clinicians/radiologists	Per year	0.03
1	Testing protocol development on scanners (see areas below) – inc. out of hours working Developing/implementing new techniques and applications on scanners e.g. cardiovascular MR and fMRI	Per advanced application	0.02
1	Ongoing service development/delivery  Other aspects of ongoing service improvement, e.g. planning, business cases, software, analysis, discussion	Per advanced application	0.04
<b>Total</b>			

Examples of advanced applications are given below.

- Functional MRI
- DTI for neurosurgical planning
- Intra-operative MRI (neuro)
- Interventional MRI (MR guided biopsy, eg breast/prostate and intervention)
- Spectroscopy
- MRI for RT treatment planning

- MRI for brachy
- Quantitative perfusion MRI (DSC, DCE, ASL)
- Advanced cardiac MRI
- Whole body DWI
- Quantitative T2\* mapping etc (eg liver/heart)
- Advance MR angiography/neurography
- Quantitative ADC mapping

5. Quality management and governance			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Clinical Governance including ongoing clinical audits/QI/clin effectiveness.  Developing frameworks for this within Med Phys and/or Radiology, assisting with processes and evaluations, audit projects	Per department	0.1
1	Quality management e.g. ISO9001 and/or ISO13485 (software)  Any QMS activity for processes and software	Per department	0.05
<b>Total</b>			

6. Research, Development, and Innovation			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Research and Development including clinical research (clinical) - overarching strategic and operational support for clinical trials.  Covering a wide range of ongoing work, including strategic, operational and academic involvement - planning, staffing, costings, grants, protocols etc, supporting either NHS or university work (count as separate depts)	Per department	0.2
1	Clinical trials with trial specific QA requirements Practical work to support clinical trial or research project QA	Per department	0.1
1	Carrying out research led by your service (academic).  Own dept research	Per project	0.05
1	University research support. Supporting university research work, particularly if there are no local academics to do this	Per project	0.05
1	MRI research leadership. Sitting on research management committees within Trust/University/region and providing MRI specific advice e.g. interdisciplinary groups, academic committees, NIHR groups	Per department	0.2
1	MSc/PhD supervision.	Per student	0.1
<b>Total</b>			

7. Education and training			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Delivering STP specialism training and Route 2 trainees	Per trainee	0.2
1	Delivering STP rotational training	Per trainee	0.02
1	Delivering academic teaching (inc FRCR teaching ) e.g. FRCR, UG Physics med phys option, Biomed Eng MSc	Per hour	0.0006
1	Education and training within service (radiographer teaching and training)	Per department	0.05
<b>Total</b>			

8. Clinical scientific computing and informatics			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Computing network support and scientific computing input e.g. Syngo Via 'Clinical Administrator', DICOM connectivity, research networks (e.g. XNAT), PACS interactions, software development	Per department	0.1
<b>Total</b>			

9. Scientific leadership and management (including own)			
Unit	Activity	WTE per Activity	WTE Clinical Scientist
1	Management of scientific service (e.g. direct management of scientific support for clin service developments) - including other meetings/responsibilities Management and supervision of MRI Physics team and related responsibilities	Per department	0.1
1	Maintain knowledge - reading, courses, conferences, lectures, peer reviews Gathering of new information and learning	Per person per week	0.1
1	Attend section meetings, supervisor meetings and maintain CPD (IPEM work) Own supervision and development	Per person per week	0.05
1	Involvement in wider NHS activities and professional bodies Wider professional activities e.g. IPEM, NIHR, BIR committees	Per commitment	0.05
1	General admin Invoicing, contracts, arranging travel, annual leave, stat and mandatory training, meeting organising etc	Per person per week	0.1
<b>Total</b>			

Number.	Area of Activity	WTE Clinical Scientist
1	MRI Safety	
2	Quality Assurance and troubleshooting	
3	Site design	
4	Service delivery/development, protocol optimisation and sustainability	
5	Quality management and governance	
6	Research & Development & Innovation	
7	Education and training	
8	Clinical Scientific computing and informatics	
9	Scientific leadership and management	
	<b>Total</b>	

### 3. Reference

[1] NHSE (2020). Diagnostic Recovery and Renewal. Report of the Independent review of Diagnostic Services for NHS England, London

[2] NHS (2019). The NHS Long Term Plan. Accessed via:  
<https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/>

[3] NHSI (2022). Diagnostic imaging network workforce guidance. Accessed via:  
[https://www.england.nhs.uk/wp-content/uploads/2022/04/B0418\\_Diagnostic-imaging-network-workforce-guidance\\_April-2022.pdf](https://www.england.nhs.uk/wp-content/uploads/2022/04/B0418_Diagnostic-imaging-network-workforce-guidance_April-2022.pdf)