IPEM Institute of Physics and Engineering in Medicine

Report on the 2021 Survey of the Diagnostic Radiology and Radiation Protection Workforce

Foreword

Since the start of 2020, Diagnostic Radiology and Radiation Protection (DR&RP) services have helped support imaging departments impacted through COVID-19. Support has included commissioning and advising NHS Trusts on a large number of new mobile radiography systems and new novel CT modular buildings, advising on safe practice for x-ray imaging in nightingale centres and radiology departments working in different ways during the pandemic.

To support changes to the structure and governance of imaging services and to help plan for future growth, NHS England are exploring ways to support the imaging workforce including radiologists, radiographers and medical physicists. To understand the current position of DR&RP services nationally, IPEM has carried out a detailed and comprehensive survey of the workforce.

This survey shows the vast majority of DR&RP services are far behind recommended staffing models with some services at a worryingly low level, working at less than 1/3 of what models advise. Services were also asked for a desirable workforce level, which most services still fall far short of, even though the desirable level it is lower than what established models recommend.

In 2018, the two main sources of legislation on ionising radiation safety received the most significant update in almost two decades. The Ionising Radiations Regulations 2017 and the Ionising Radiation Medical Exposures Regulations 2017 both include medical physicists as duty holders. The IR(ME)R regulations placed additional emphasis on the role of the Medical Physics Expert especially for high dose imaging modalities.

Several publications since the last workforce survey in 2018 point to the future direction of imaging in England. The Transforming Imaging Services publication (NHSE&I, 2019) outlines the new governance structures between NHS Trusts with the formation of Integrated Care Systems (ICSs) as a collaborative between groups of Trusts. ICSs will collaborate across Imaging networks which will fall under the structure of seven regions in England. Examples of collaborative work include imaging equipment procurement, asset management, workforce standardisation and standardised imaging practices, all of which will require imaging physics input.

Over the next five years, the Richards' Report (NHSE, 2020) has recommended a significant expansion in imaging assets and healthcare professionals involved in imaging service delivery, including an additional 220 medical physicists. This survey shows that as well as the additional 220 physicists to support the planned growth in imaging services, the UK workforce needs significant growth now to deliver a comprehensive service and meet the current NHS need.

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Executive Summary

This data is compiled from IPEM's Diagnostic Radiology and Radiation Protection Survey 2021, carried out in March 2021 with a capture date of 26th March. An invitation to respond was sent to all heads of Diagnostic Radiology and Radiation Protection (DR&RP) services in the UK, including NHS (58 services) and Independent providers (6 services).

Data was gathered on two professional groups: Clinical Scientists and Clinical Technologists. Information was also gathered on other staff essential to the clinical service provision, along with numbers of Medical Physics Experts, Radiation Protection Advisers and Radioactive Waste Advisers. Respondents were asked to provide data to inform staffing models from two different publications; European Commission Radiation Protection report 174 – European Guidelines on Medical Physics Expert and Evans et al. – the EFOMP policy statement 7.1 on staffing levels in Medical Physics. We also invited respondents to comment on training and recruitment difficulties.
A response to the workforce component of the survey was received from all but one NHS centre and one independent centre, meaning a response rate of 97% across all centres offering DR&RP physics services was achieved. This includes a small number of independent services including consultants, and specialised NHS departments, as well as traditional larger services. A further two services were unable to respond to the second component regarding the staffing models, and so this data is presented with a response rate of 94%

The survey shows a workforce which is already depleted and required to expand rapidly to meet increased demand.

- 9% vacancy rate in clinical scientists
- 7% vacancy rate in technologists
- The 469 established clinical scientists and technologists posts need to expand to over 900 staff to meet workforce model recommendations to support existing imaging departments. This does not include the additional 220 posts to meet the recommended growth in imaging over the next five years.

Recommendations

1) UK DR&RP services should be aiming for staffing levels as per EFOMP and EU report 174 recommendations. While there may be economies of scale for larger departments, all aspects of a comprehensive service should be provided
2) Diagnostic Radiology and Radiation Protection Special Interest Groups (DR/RP SIGs) should produce a service specification covering the range of activities within a comprehensive DR&RP service
3) IPEM to produce a service structure recommendation covering roles of Clinical Scientists and Technologists within a DR&RP service
4) IPEM to adopt a position that Route 2 training should be supported through supernumerary funding or funding available for MScs

Data

Although vacancy rates have decreased since the last survey, there is anecdotal evidence that vacant posts that have been difficult to recruit have been removed from department budgets. A 9% vacancy rate is an unsustainably high figure. Information from training routes presented later in this document shows that forecast training outturn for the next few years will not meet the current workforce vacancies.

Establishment and Vacancy Rates

	WTE of responding centres	Vacancy Rate	Estimated WTE across UK*
Clinical Scientists	330	9%	335
Clinical Technologists	132	7%	134
Other Staff	31	3%	

*Estimate based on approximate known size of the two non-responding centres

Vacancy Rates Over Time

Vacancy Rates Over Time		
	Clinical Scientist	**Clinical Technologist**
2021	9%	8%
2018	11%	12%
2014	6%*	

*2014 Vacancy rate is not split between Clinical Scientists and Clinical Technologists

Comparing the vacancy rate to other Medical Physics specialisms, Diagnostic Radiology and Radiation Protection is similar to Radiotherapy Physics at around 9%. Nuclear Medicine appears to have a lower vacancy rate, though the existing workforce surveys are not as detailed as Radiotherapy or DR&RP. A more detailed Nuclear Medicine survey is in progress at the time of publishing this survey.

The data shows that the wider medical physics profession cannot afford to divert more trainees into DR&RP without other specialisms suffering further staff shortages. An increase in training across all specialisms of medical physics is required.

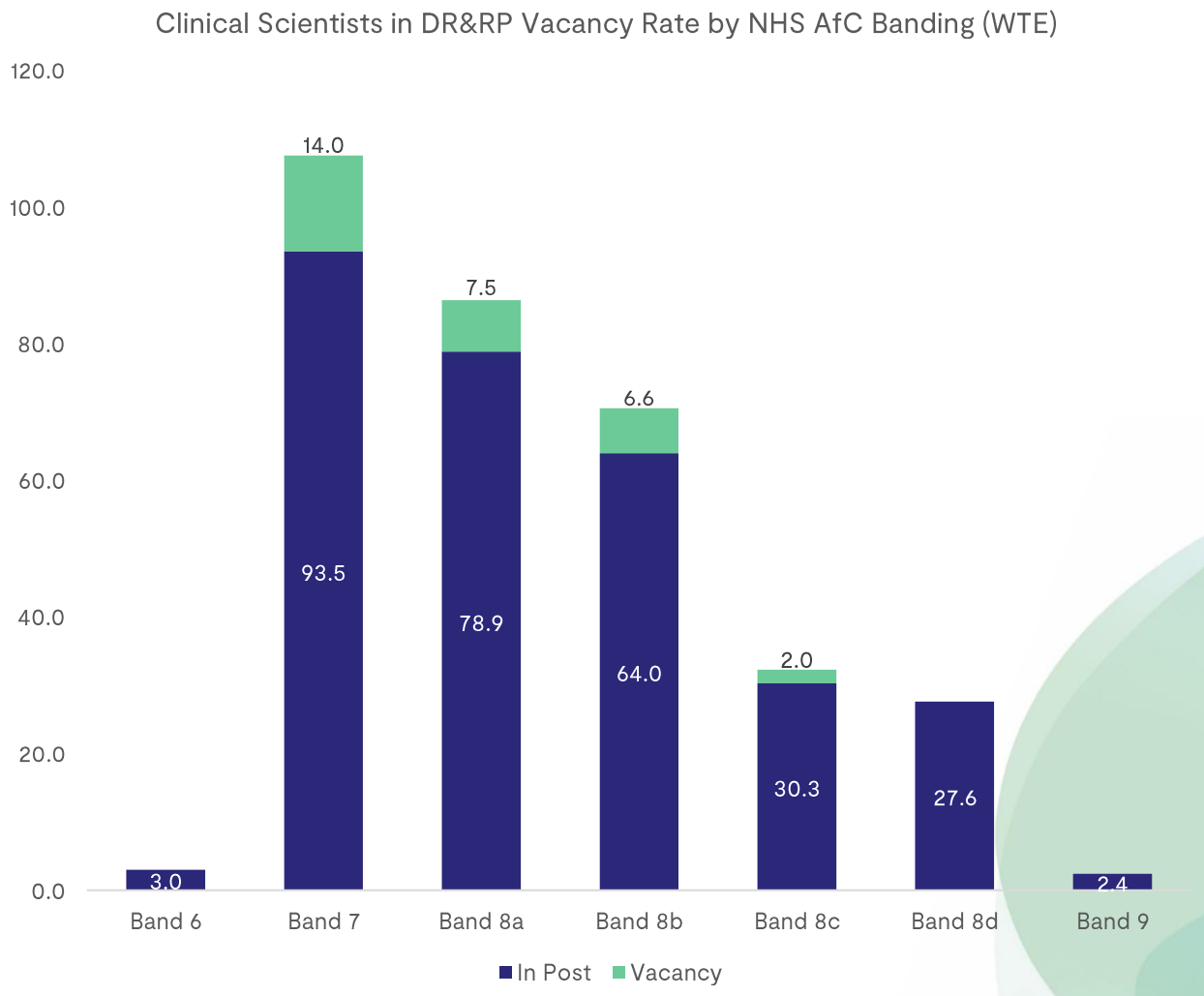
Vacancy Rates compared to other Specialisms		
	Clinical Scientists	**Clinical Technologists**
Diagnostic Radiology and Radiation Protection	9%	7%
Radiotherapy	9%	10%
Nuclear Medicine	6%	5%

Agenda for Change Banding

The below charts show the establishment of the Diagnostic Radiology and Radiation Protection Clinical Scientists and Clinical Technologists split by Agenda for Change banding.

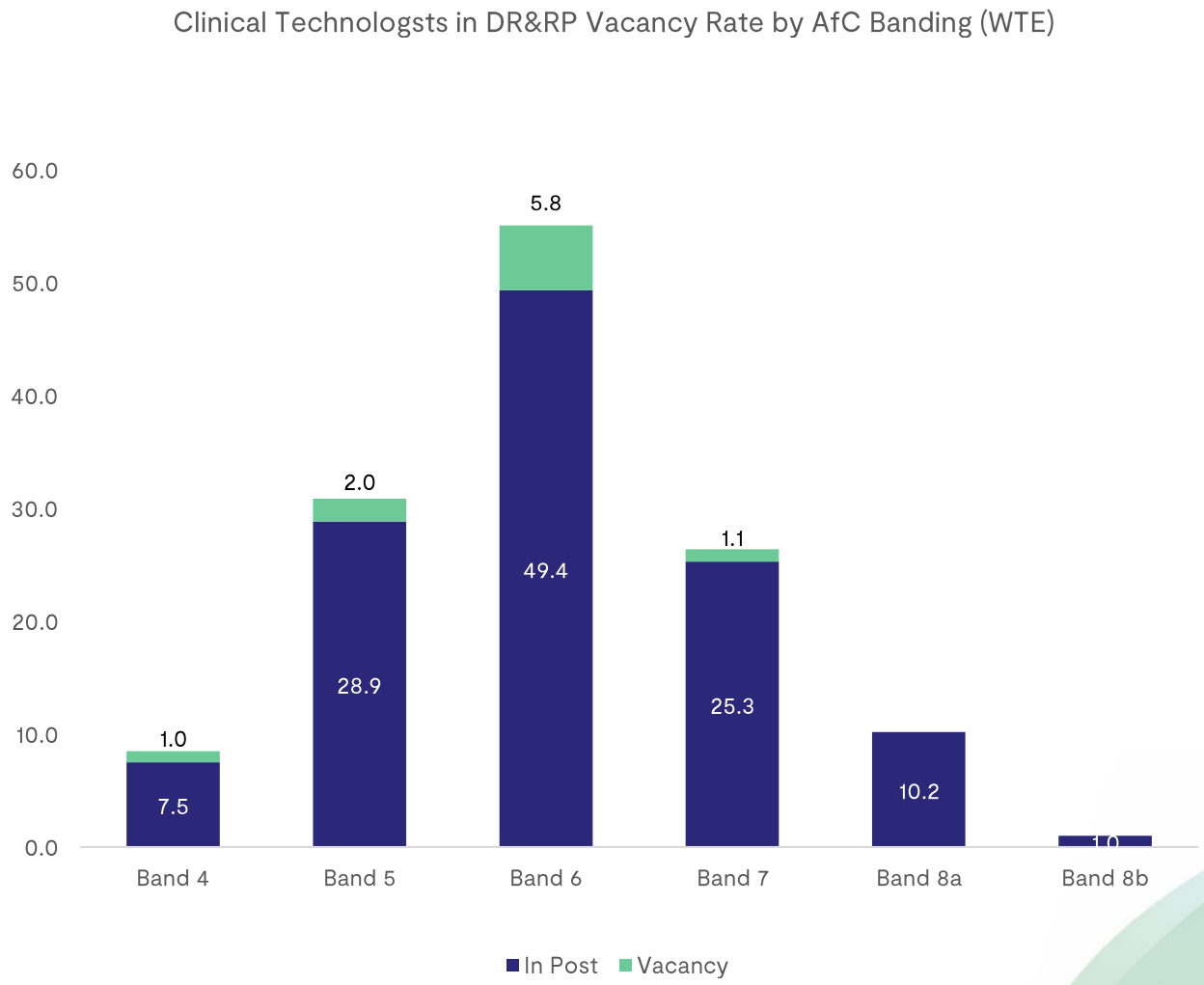
The highest vacancy rates are in Band 7, 8a and 8b for Clinical Scientists, showing a 13% vacancy rate for Band 7 and 9% vacancy rate for Bands 8a and 8b. For Clinical Technologists, vacant posts are relatively small in number but highest at band 6 at 11% .

Clinical Scientists



*two of three the band 6 posts are junior physicists on route 2 training in NHS departments, and one band 6 is employed in the independent sector.

Clinical Technologists



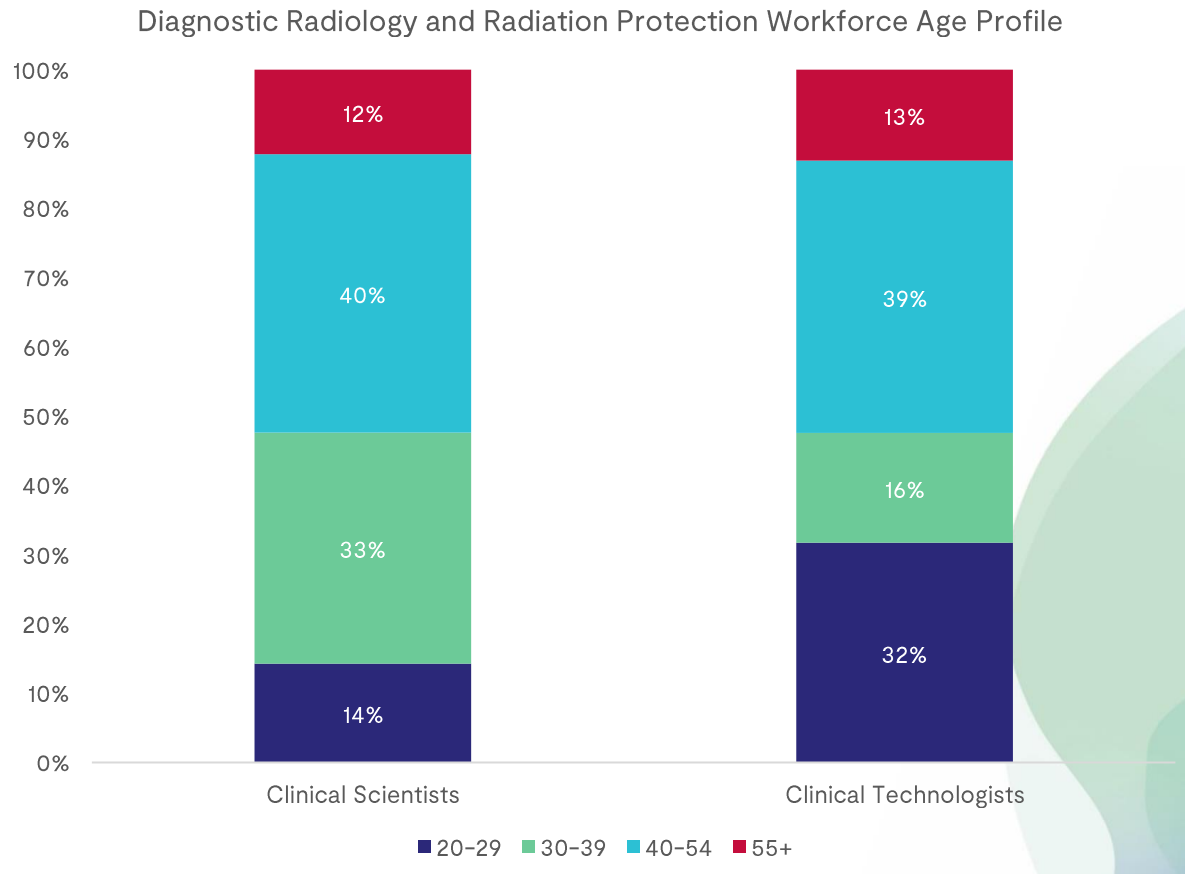
*The Band 4 posts here are Technologists who are in a learning role but not formally on a training scheme or are staff who are employed in the Independent sector.

Age Profile

More than half of the Clinical Scientists (52%) and the Clinical Technologists (52%) are aged over 40 with approximately 13% of the workforce approaching retirement age (aged over 55). For Clinical Scientists this reflects similarly to the demographics of all Clinical Scientists in IPEM membership, and is not unexpected for a workforce in which the minimum entry age is 24.

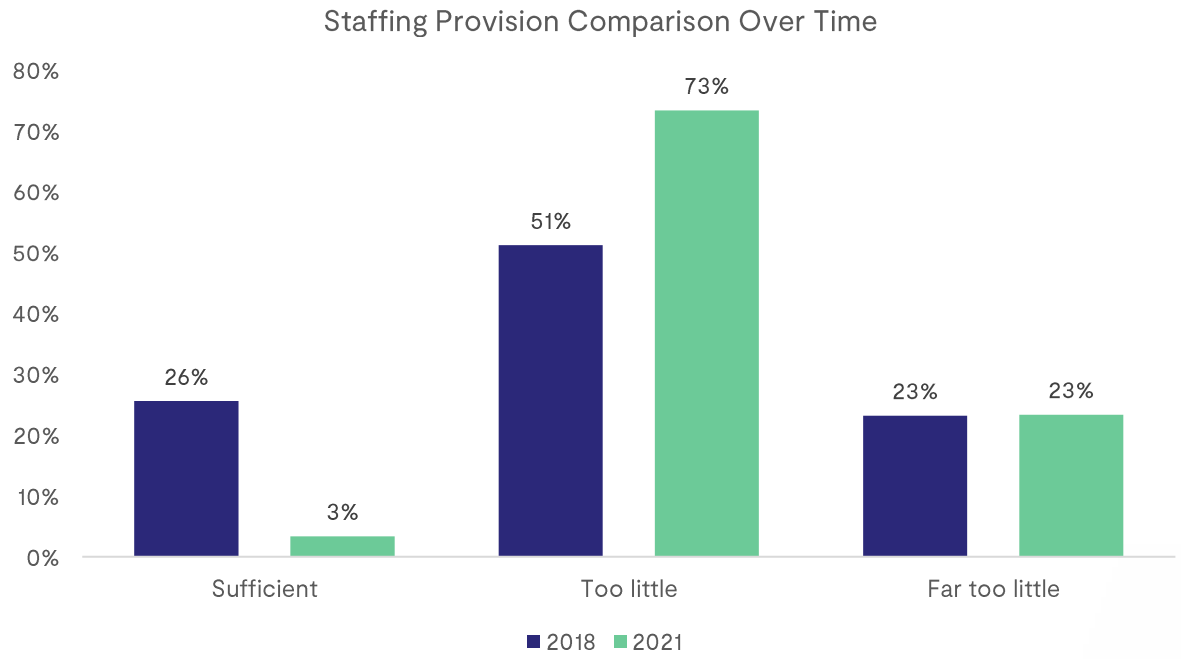
The age profile of clinical scientists is not in itself, a cause for concern, as if the workforce demand were to remain static, there would be adequate replacement for those for whom retirement is imminent. Similarly, the age profile for technologists does not represent in itself a cause for concern. While there are reports of difficulty recruiting into senior positions, it is likely that the workforce difficulties stem from an existing shortage and an anticipated need to expand the workforce rapidly, rather than a skewed age-profile.

The retirement age is likely to rise in line with national practice, although the recent stresses of pandemic and staffing shortage may contribute to a number of early retirements in parallel with other medical staff groups (Moberly, 2021).



Staffing Provision

Only 3% of centres responded stating their staffing provision was sufficient, these centres were small to medium sized NHS centres who do not provide external services. 97% of respondents stated they had too few staff, of these 73% stated too little and 23% stated far too little. This is an even worse situation than 2018, when 51% stated too little and 23% stated far too little.



Many centres are only just managing their workload with the current staffing provisions, stating they can provide a basic service but not a comprehensive one, with little to no capacity for service optimisation or research and development. A few centres state that they are struggling to provide even an adequate service.

There are many factors contributing to individual services' difficulties, but they all point to an underlying issue of a workforce shortage with insufficient supply to meet demand.

Given the existing establishment is in the region of 335 WTE, with 300 WTE currently in-post, it raises the question as to whether this level of increase can be met in the short-term using the current methodology of mentoring through in-service training. Many respondents report that training puts a large strain on the services in general taking time away from routine work with half of services stating they don't have the capacity or would struggle to increase capacity for more trainees.

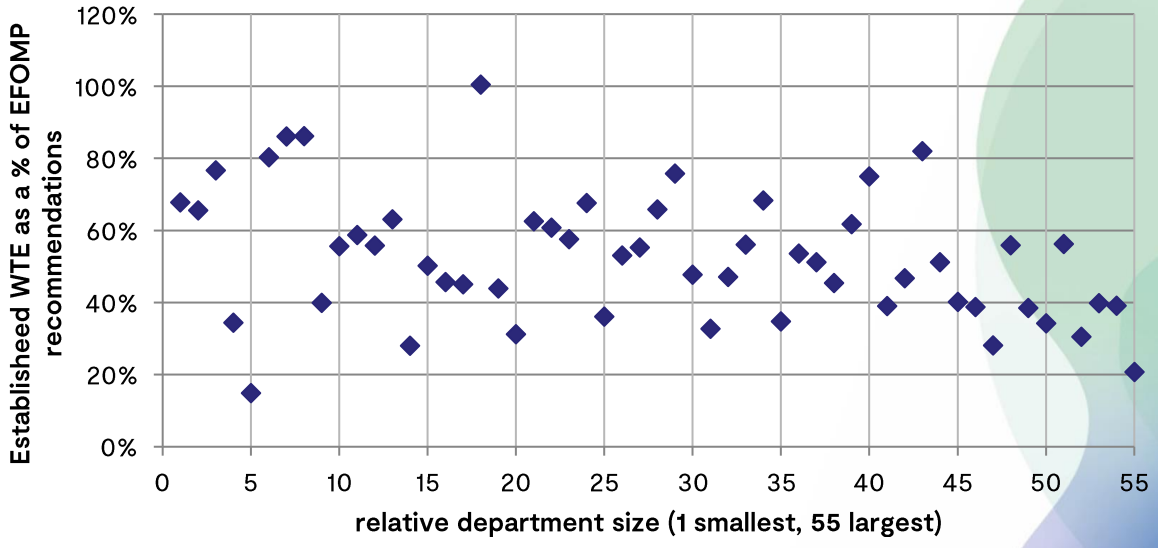
Staffing levels

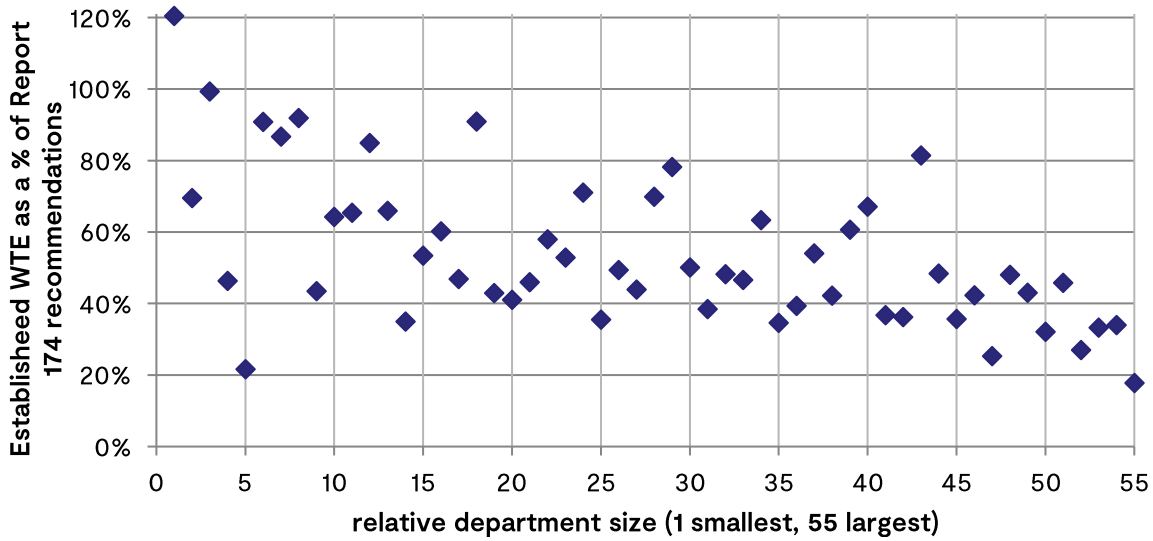
In this survey, DR&RP teams were asked to provide data to inform staffing models from two different publications; European Commission Radiation Protection report 174 – European Guidelines on Medical Physics Expert and Evans et al. – the EFOMP policy statement 7.1 on staffing levels in Medical Physics.

Report 174 recommends staffing levels for medical physics experts (MPE) and medical physics services (MPS) overall. A medical physics service will also include clinical scientists not yet at MPE level, technologists and trainees. The Report 174 model includes whole time equivalent staffing factors including; a range of imaging modalities, patient volume per CT or interventional room, research and training, equipment specification and procurement.

The EFOMP model includes the topics listed under report 174 but has additional factors for; staffing the radiation protection element to a clinical department, staff and patient incidents and factors specific to running a DR&RP service. The EFOMP model recommends the number of medical physicists clinically qualified to at least EQF level 7 with several years advanced experience. The EFOMP figure has been compared to the number of clinical scientists in the UK at band 7 and above. When considering an entire medical physics service, EFOMP references EC Report 174 in that the number of additional staff could be up to two times the number of experienced medical physicists. In this survey the number of whole time equivalent staff in a medical physics services in the UK is approximately 40% larger than the clinical scientist establishment.

The figures below show DR&RP services ranked from smallest to largest based on recommended staffing level and the existing established posts as a percentage of what is recommended by EFOMP and EC Report 174. The figures show that only a handful of services are working at close to staffing levels recommended in either model. There is a trend for the larger teams to have significantly lower establishment than recommended. This could relate to inherent economies of scale from larger physics services, but would need examining in more detail. The UK workforce as a whole averages at 45% of the report 174 model and 47% of the EFOMP recommended staffing level.





Both EFOMP and report 174 models recommend staffing levels considerably higher than respondents requested as desirable. The average desirable staffing level indicated by heads of DR&RP services to cover all aspects of legislative compliance accounted for 71% of the EFOMP and 68% of the Report 174 recommendations respectively.

However, the recommendation of this report is that the profession should work towards meeting the recommendations of both workforce models in the long term. Medical physics departments should be aiming to deliver a comprehensive service with adequate training, development and optimisation work across all aspects of the service.

This existing staffing shortfall is separate to the additional uplift of 220 individuals (likely to be predominantly Clinical Scientists) quoted as being required in the Richards' report to support the recommended expansion of imaging services. If the additional imaging systems recommended within the Richards' report are supported by DR&RP services staffed at the desirable level (as indicated by heads of DR&RP services) approximately 220 additional posts are required, matching the Richards' report. The 220 medical physicists recommended by Richards' also encompasses magnetic resonance physics, and imaging aspects of nuclear medicine and ultrasound so is likely an underestimate.

The table below estimates the additional staff required to meet the existing workforce need and growth according to the Richards' report. The clinical scientist to technologist ratio in the existing workforce is used to estimate future need. This survey shows that technologist roles are underutilised in some services, and that there is scope for growth in these roles as a proportion of DR&RP services.

	Clinical Scientists	Technologists
Establishment	335	134
In post	305	125
Difference	30	9
Additional posts to meet EFOMP/Rep 174	384	151
Additional posts from Richards' report	157	63
Total increase required	**384+30+157=571**	**151+9+63=223**

Desirable workforce levels are lower than this, requiring an additional 362 clinical scientists and 139 technologists. To meet the desirable workforce need over the next five years, an additional 72 scientists and 28 technologists must be trained per year. Using the recommended staffing levels, this increases to 114 scientists and 45 technologists per year.

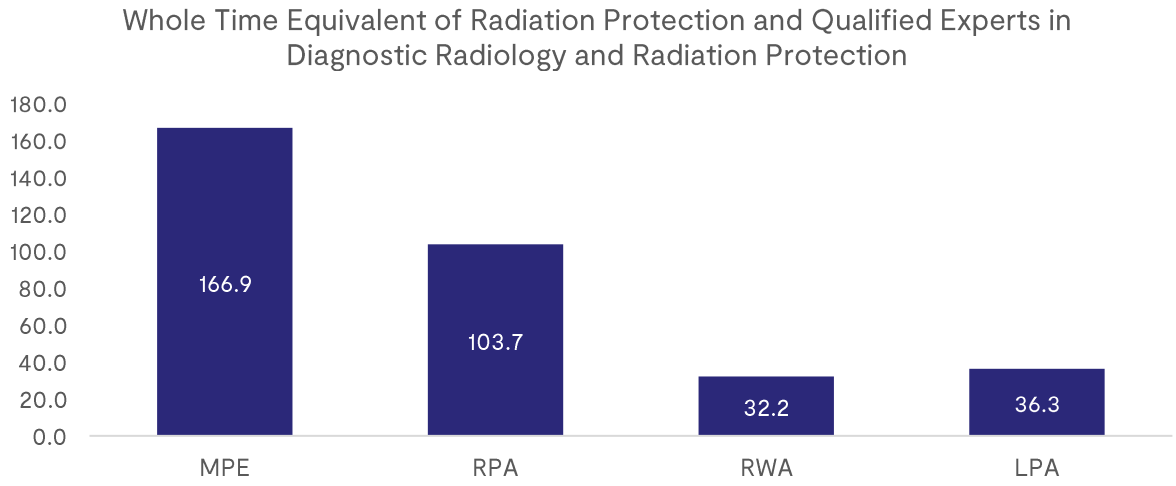
Country and Regional breakdown

	Establishment (WTE)	Recommended workforce WTE (average EFOMP and Report 174)	Difference (WTE)	Establishment as a % of recommendations
ENGLAND	360	804	444	45%
NORTH WEST	40	152	112	26%
NORTH EAST	53	117	64	45%
MIDLANDS	64	125	61	51%
SOUTH WEST	42	61	19	69%
EAST	27	61	34	45%
SOUTH EAST	66	116	50	57%
LONDON	67	171	104	39%
SCOTLAND	46	80	34	58%
WALES	19	52	33	36%
N IRELAND	15	29	14	52%

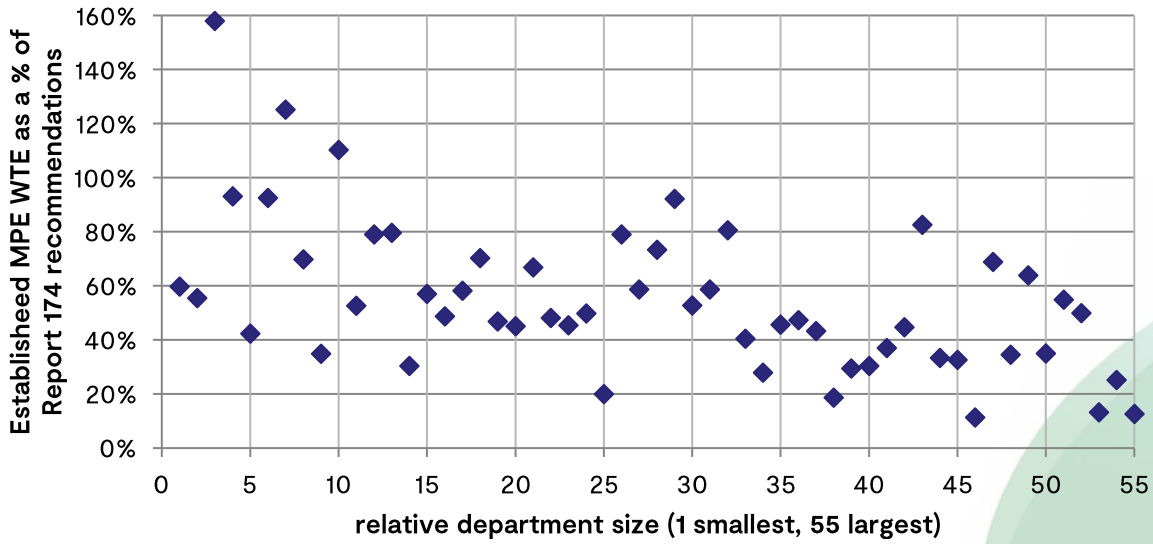
The table above shows a national and regional breakdown of DR&RP service provision against recommended models. There is significant variation between countries and regions though there are some DR&RP departments providing services across regional boundaries which may distort the figures. The data above can be used alongside individual department workforce data to inform regional recruitment strategies.

Certified Experts in Diagnostic Radiology and Radiation Protection

The below chart shows the number of certificated experts, split into their expertise of Medical Physics Expert, Radiation Protection Advisor, Radiation Waste Advisor and Laser Protection Advisor working in Diagnostic Radiology and Radiation Protection.

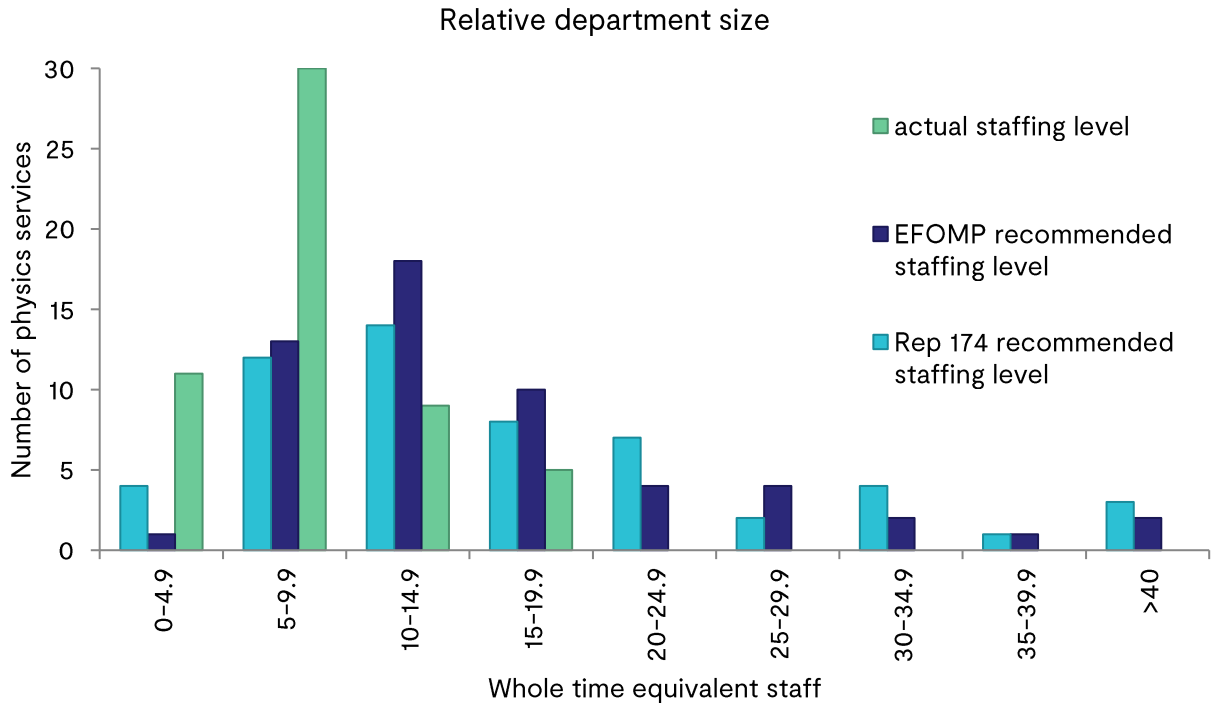


The number of MPEs in DR&RP is well below the recommended level as suggested by Report 174, a shortage of a similar proportion to the overall number of staff as shown in the figure below.



A concerning data point for workforce resilience is that 42% of NHS centres (23 of the 55 who responded to this question) have only a single Radiation Protection Advisor, creating a single point of failure, 33% of NHS centres have 2 Radiation Protection Advisors and 25% have 3 or more.

Department Size



The data above shows the distribution of existing departments nationally. The majority of services fall into the 5 to 9.9 WTE staff, with a small number of very large services with more than 15 WTE. There are a variety of staffing models within DR&RP services;

- Relatively small services that provide medical physics support to their host Trust only
- Medium sized services that support their own Trust and a several external Trusts under contract
- Large services that support a significant number of Trusts in a local vicinity and some much further afield.

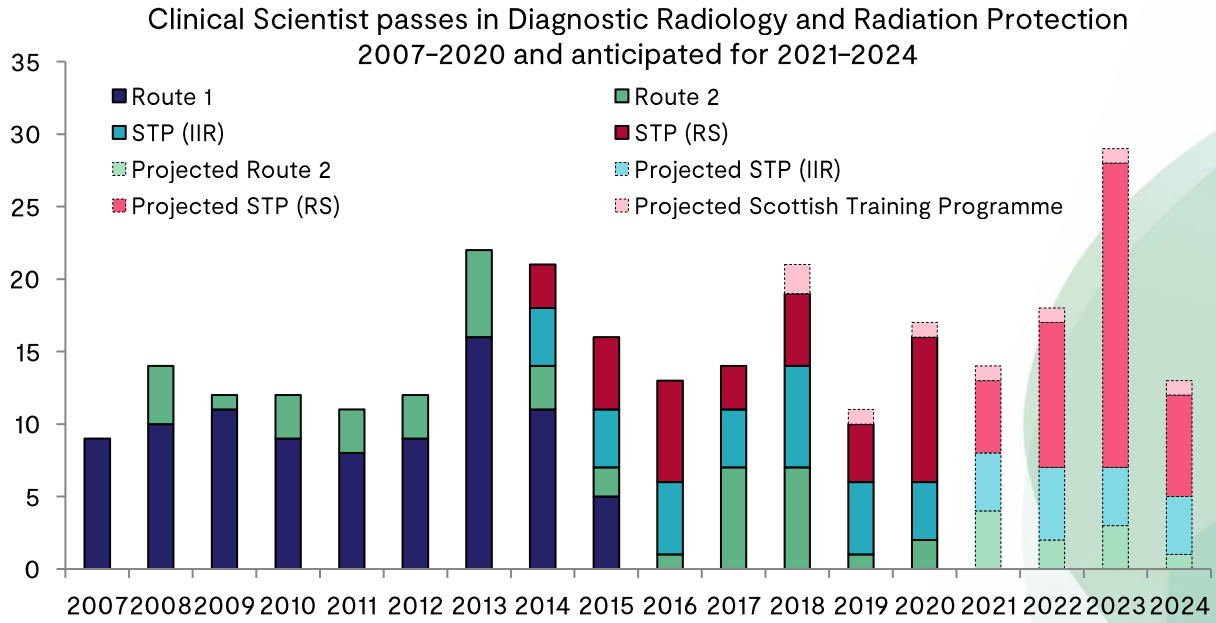
The data on the distribution of WTE required in each service according to the two models used shows a need for a broader spread of department size and indicates that some services need significant growth.

Training

There is a high level of concern regarding training capacity in Diagnostic Radiology and Radiation Protection. It is clear that there are not enough staff being trained to meet current demand, let alone EFOMP/Report 174 recommendations and the uplift advocated in the Richards' report.

Clinical Scientists

The chart below shows the input into the DR & RP Clinical Scientist workforce via all different routes to registration since 2007, and the anticipated numbers in the DR& RP specialisms for the next 3 years. While a larger-than-usual outturn in 2022 is expected, owing to the high number of Radiation Safety STP places commissioned in 2019, the numbers are not significantly higher than over the last 15 years. There are 72 Clinical Scientists in training, who are expected to join the workforce by 2024, exiting in 2022, 2023 & 2024. Based on 2007-2019 data, an input of 17 Clinical Scientists annually is required to maintain the workforce and allow for normal service expansion, thus by 2024 51 of these will be required for maintaining the workforce at the current level. As a result, only 21 of the anticipated DR & RP Clinical Scientists currently in training can be said to be extra input into the workforce. An additional 7 WTE per year is a long way short of the 72 WTE required to meet the desirable workforce level or 114 per year to meet the workforce models.



Training programmes are different across all four countries of the UK, with England and Northern Ireland predominantly using the Scientist Training Programme through the National School of Healthcare Science, Scotland running a Scottish Training Programme, and Wales now opting to solely utilise Route 2. Concerns with training vary geographically. In Scotland a

lower percentage of centres reported concerns than in England, which may reflect the different training models.

DR&RP departments have offered feedback outlining the difficulties in making a localised case for a trainee position, when services are unsure if there will be a post at the end of it to recruit to. There is also a perception of many trainees moving to more desirable positions or location once trained, even if there are vacant positions at the training centre, leaving centres investing in the future workforce but remaining understaffed.

Of the 48 physics services in England responding to this survey, all except 6 have taken a commissioned physics STP trainees in the last 3 years. Half of those lack access to all physics specialisms, thereby limiting participation in the Scientist Training Programme. This survey did not ask what training capacity exists for STP, or other routes, but 21 responses cited capacity concerns in one form or other. Concerns range from training taking a lot of resource from a service where there is already a lack of staff to complete routine work, to insufficient space and additional burden placed by covid-related restrictions. In order to address the shortage, training capacity must be optimised and expanded, along with maximum utilisation of all routes, including ACS Route 2 and apprenticeships. A creative look at optimising synergies in training should be considered, such as:

- Group or on-line delivery of some components/competencies
- Clinical educators
- Consortia to facilitate more departments involved in training, and increase number of trainees per department through synergies
- Promoting and supporting Route 2

Clinical Technologists

It is much harder to quantify the number of technologists who have entered the workforce in the last 10 years. This professional group is not trained via a commissioned, supernumerary route but through on-the-job training in which employers fund the salaries, and in some cases the training costs of the trainees. This, together with no established role guidance for utilising this workforce within DR&RP services leads to there being proportionally fewer technologists within DR&RP than other medical physics specialisms.

At present technologists training routes are

- IPEM's technologist training scheme
- Level 6 integrated apprenticeship, such as those delivered at the University of the West of England and University of Swansea

IPEM's technologist's training scheme has delivered 26 technologists in radiation physics into the workforce since 2011, at a rate of between 1 and 5 annually.

Level 6 apprenticeships in Healthcare science (radiation protection) have been available since 2018, and number exiting are not known, but believed to be fewer than 10 per annum.

While there is still capacity within these routes, it is clear that there are significant organisational barriers, such as access to funding and provision of posts for training, so full capacity has not been reached.

Training of technologists can be supported by;

- a statement or service specification on the best use of skill-mix for technologists and scientists within imaging physics services ensuring staff work to the top of their registration
- growth of IPEM's technologist training scheme
- increased awareness of integrated degree apprenticeships and how to address challenges in using them
- Increased awareness of existing practitioner training programmes
- Funding or other facilitation for Trusts to create training posts

Summary

The DR&RP workforce falls far below recommended staffing levels in the UK, averaging 45% to 47% of what is needed for a comprehensive medical physics service. In order to meet this workforce need, the number of scientists and technologists recruited annually to training posts needs to increase significantly to five times the current intake. This survey shows there is variation in skill mix between services with scope for improvement at some Trusts. An IPEM approved service specification, detailing what DR&RP services should deliver and a staffing model with example role descriptions will help to standardise the DR&RP workforce and level up those departments that are chronically understaffed.

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