Report on the 2018 Diagnostic Radiology Physics and Radiation Protection Physics Workforce Survey

Contents

1. Executive Summary

The Diagnostic Radiology Physics and Radiation Protection Physics workforce has a high vacancy rate, with 11.6% of all established Clinical Scientist posts vacant, rising to 17.8% when only Band 7 posts are considered. In many departments, the appointment of a single Radiation Protection Adviser and/or Radioactive Waste Adviser, often shared between neighbouring Trusts is a single point of failure, both in terms of the implication of the potential loss of one through leaving or long-term absence, and through declining to re-certify.

There is a similar picture of staff shortage amongst the technologist workforce, with a vacancy rate of 12.8%.

There are insufficient staff in training to redress the shortfall in Clinical Scientists, and the numbers in training of Scientists must be increased if demand is to be met. At current rates of training, the Technologist workforce should be out of shortfall in 3-4 years, but this is heavily dependent on the success of a newly established undergraduate distance learning course.

Retention within the medical physics profession is high, so attempts to meet the workforce shortfall should concentrate on increasing training provision, while continuing to facilitate recruitment from abroad to meet the shortfall in the medium term.

On top of the shortage, the number of established posts is widely viewed to be inadequate for an adequate diagnostic treatment provision.

2. Survey

The Workforce Intelligence Unit elected to survey these physics workforces together, as during a pilot survey in 2014, many respondents had been unable to split DR and RP effort for many posts, thus making the survey excessively time consuming, or in some cases, near-impossible.

The survey was carried out via on-line survey software. Sixty-three invitations to complete, with individual access links, were sent to Heads of Diagnostic Radiology Physics or Radiation Protection at Trusts and Health Boards with Diagnostic Radiology (DR) and Radiation Protection Physics (RP) services, and Heads of Medical Physics or other senior members at Trusts/Health Boards where there were believed to be services but for whom we had no contact information. Forty-six responses were received in total.

Questions were asked regarding head count in post, whole-time equivalent of established posts by Agenda for Change or equivalent banding, and whole-time equivalent (WTE) of those established posts which were vacant. There were also free-text questions regarding recruitment experiences and difficulty.

The survey also asked about service provision externally, for example as service level agreements. This was to enable IPEM to assess the coverage of the survey and was used in conjunction with responses to the 2014 services survey and Trust/Health Board websites.

3. Services

The majority of the 46 respondents provide a radiation physics service to Diagnostic Radiology and Radiation Protection services to all or part of the clinical service at the Trust or Health Board in question. Some respondents report that Radiation Physics provide radiation protection services to all except radiotherapy while others provide RP services to all sectors of medical physics. There is significant variation between services as to the extent of their responsibility, and well as between size of provision, both in terms of population served and number of items of imaging equipment supported. Only 4 services are aligned so that the same section provides both Diagnostic Radiology or Radiation Protection ***and*** Nuclear Medicine services.

Services varied in size from 1 WTE Clinical Scientist establishment to 12.6 WTE Clinical Scientist establishment, with technologist establishments varying from 0.1 WTE allocation to 7.3 WTE.

4. Diagnostic Radiology/Radiation Protection Workforce

4.1 Clinical Scientists

A total of 227.6 WTE Clinical Scientist establishment was identified, with a vacancy rate of **11.6%.** There are further established posts which are “frozen vacancies”, and recruitment has either been halted, or not proved possible. Many vacancies have been unsuccessfully advertised several times. The majority of these vacancies are at Band 7 with 13 out of 72.9 WTE vacant, which equates to a 17.8% vacancy rate at this band. Figure 1 below illustrates the establishment, with vacancies by band.

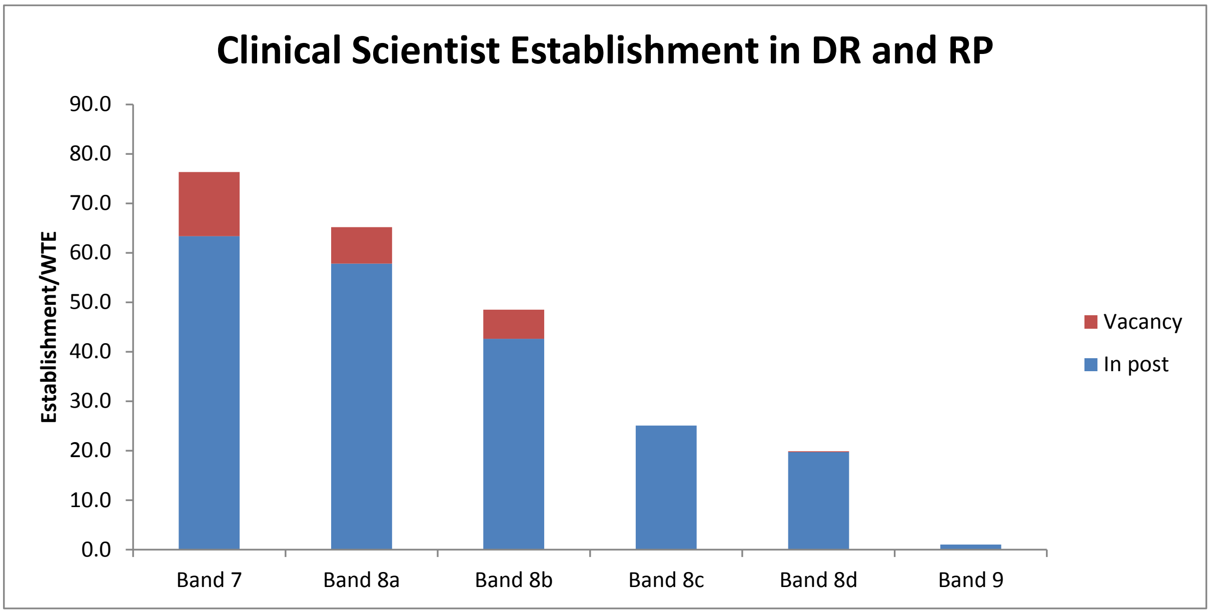


Figure 1: Clinical Scientist Establishment including Vacancies in Diagnostic Radiology and Radiation Protection in the UK, by Agenda for Change Banding

The Clinical Technologist establishment identified is smaller than that of Clinical Scientists, as would be expected for this specialism. An establishment of 107.16 WTE, with a high vacancy rate at 12.8% was identified; this is shown in Figure 2.

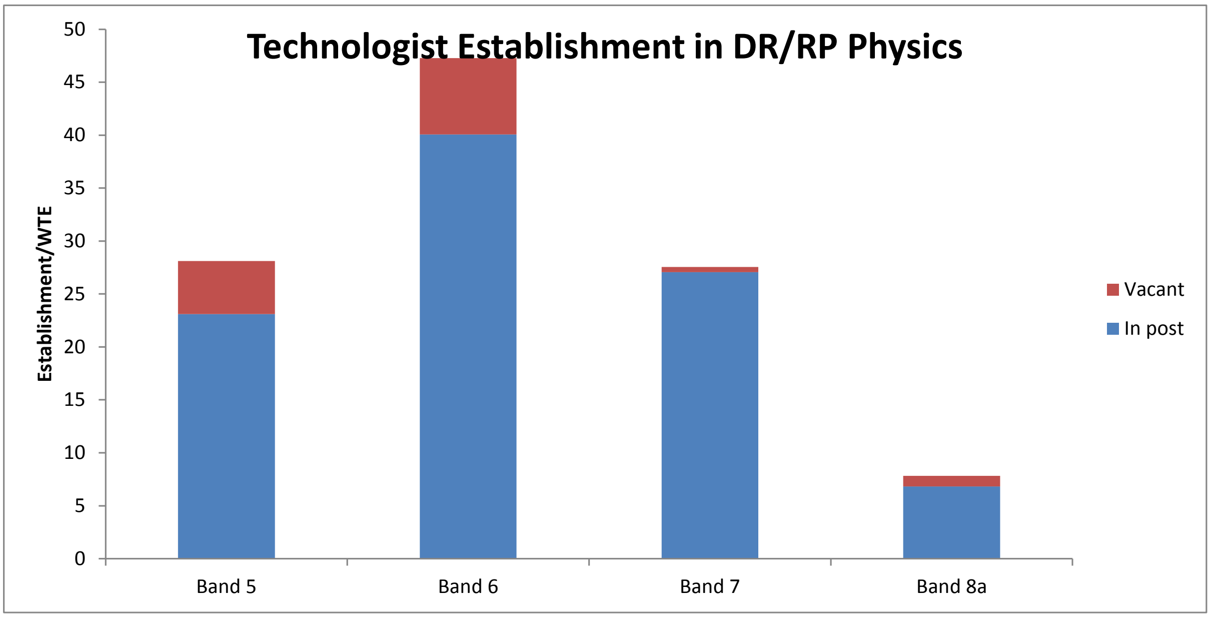


Figure 2: Clinical Technologist establishment including vacancies in the UK by Agenda for Change Band

A small number (19.24 WTE) other science roles relating to the provision of DR & RP service were also identified; these include Healthcare Science Assistants and Associates with 1.8 WTE Radiographers. A further 10 WTE of administrative support was also reported, but this may not represent all administrative support as the question did not explicitly request admin support so this was open to interpretation.

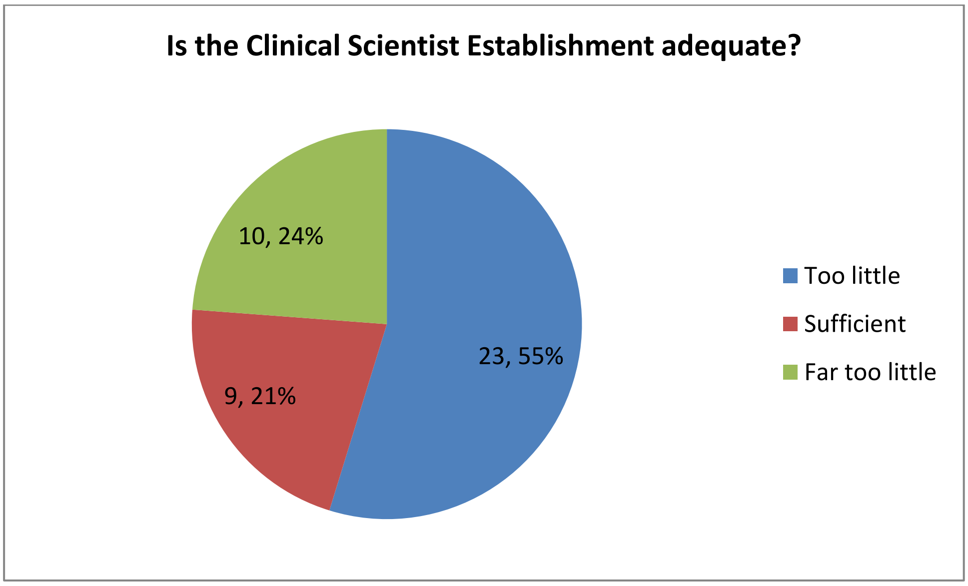


Figure 3: Is the Clinical Scientist establishment sufficient?

Just over a quarter of respondents felt that their establishment was sufficient, with around a half saying it was too little, and a quarter that it was far too little.

Several commented on an inability to cover holidays and emergencies and there are significant difficulties with covering maternity leave because workforce shortages mean that recruiting into a short-term post is very challenging. Arguments at Trust management level for increasing establishment centre on cost, rather than clinical need or robust safety margins. One respondent said

> *"We just about get by, but rarely meeting our targets for QA etc. Would ideally be providing greater level of RPA/MPE support than we are able to accommodate."*

4.1.1 Current Composition of Clinical Scientist Workforce

As well as base establishment there are legal mandates regarding personnel with additional registrations and experience. There are minimums for Radiation Protection Advisers, Radiation Waster Advisors and very shortly a legal minimum for the number of Medical Physics Experts will be instated.

Radiation Protection Advisers

Of the 44 respondents, just over half felt the staffing provision was sufficient, 39% that it was too little, 7% far too little and 2% (1 respondent) that it was too much.

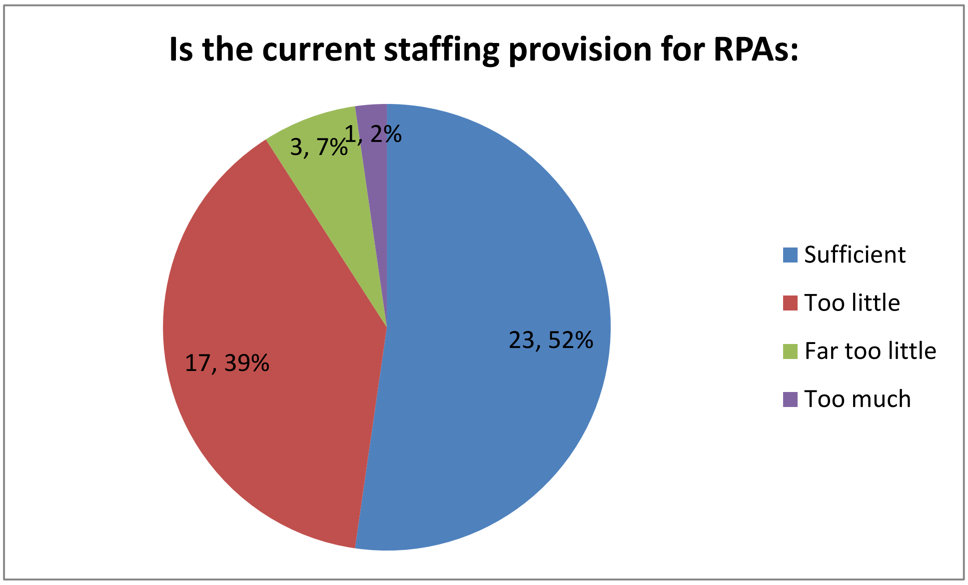


Figure 4: The staffing provision for RPA's is:

Of those who felt it sufficient, one noted that it was a single point of failure in a small department with no resilience for long-term sickness, maternity leave or leaving. Another noted that although there were enough individuals, workload was so high as to impact on the amount of time they could devote to RPA activities.

Of those who felt it was too little, a half also cited resilience problems, and 2 raised concerns around future supply as requirements for registration become more onerous, and the perception that registration provides no career/ or income benefit.

> *"The STP gives no motivation for new Clinical Scientists to work towards RPA. Accreditation offers no career / income benefit. Population of RPAs is ageing.*
>
> *Making RPA part of HSST is inadequate to provide a supply of RPAs."*

"Although currently almost sufficient the burden of completing portfolio for renewal and age of current certificate holders is a cause for concern. Several staff have declined to apply/reapply for RPA certification due to the assessment burden."

"We have to buy in our RWA services due to previous RWA/RPA staff declining to re-certify for both and only doing RPA. The turnaround period for RWA renewal meant cover across the whole of the [AREA] was a serious problem."

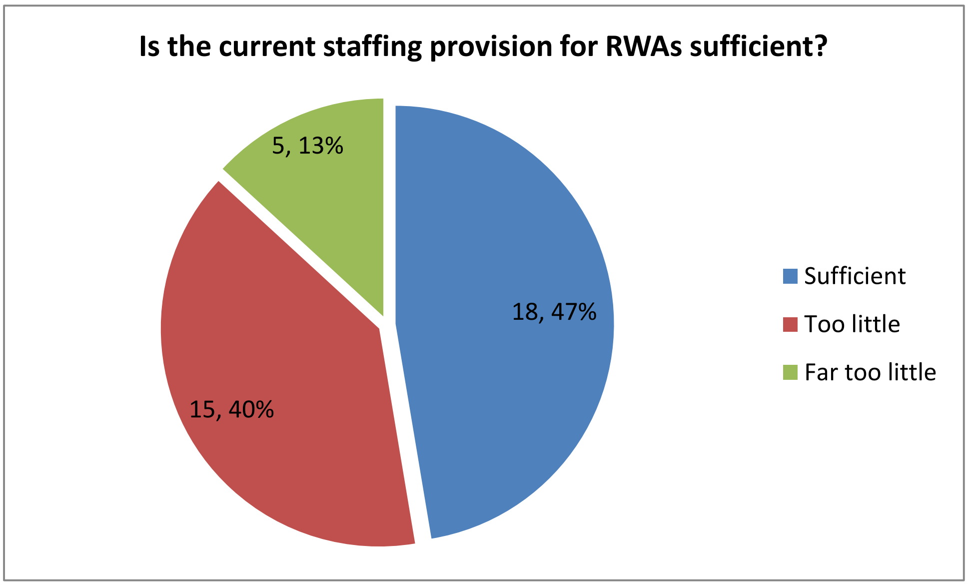
Radiation Protection Advisor position is a legally mandated one, yet there are concerns that healthcare management do not appreciate the significance of this role:

"The duties of the RPA is not understood by senior management. We lost our head of dept who was the only RPA and his deputy was then appointed as the sole RPA of 2 big trusts."

"We currently have only one RPA for 5 NHS Trusts. This person covers DR, Nuc Med and Radiotherapy across all sites."

Having only one certificated RPA across a large area presents an obvious operational risk in the case of long-term sickness, maternity or the sole member of staff leaving the role. Other Trusts with a sole RPA have informal agreements in place with neighbouring Trusts to allow cover in the event of such situations, but in the two instances highlighted above, there would be no neighbouring Trust as one RPA is already being spread over several Trusts.

Radioactive Waste Advisors



Fewer than half of respondents with a need for this provision feel it is sufficient: and of those who do, several acknowledge that while the workload can be adequately covered by one individual, this represents a single-point failure in a small department.

"The RPA acts as RPA, LPA & RWA - too much risk on one person."

"Currently 2 certificated RWAs. One RWA in training. A minimum of 2 is considered essential to maintain resilience, for future workforce planning and to continue to support NHS organisations in the wider locality"

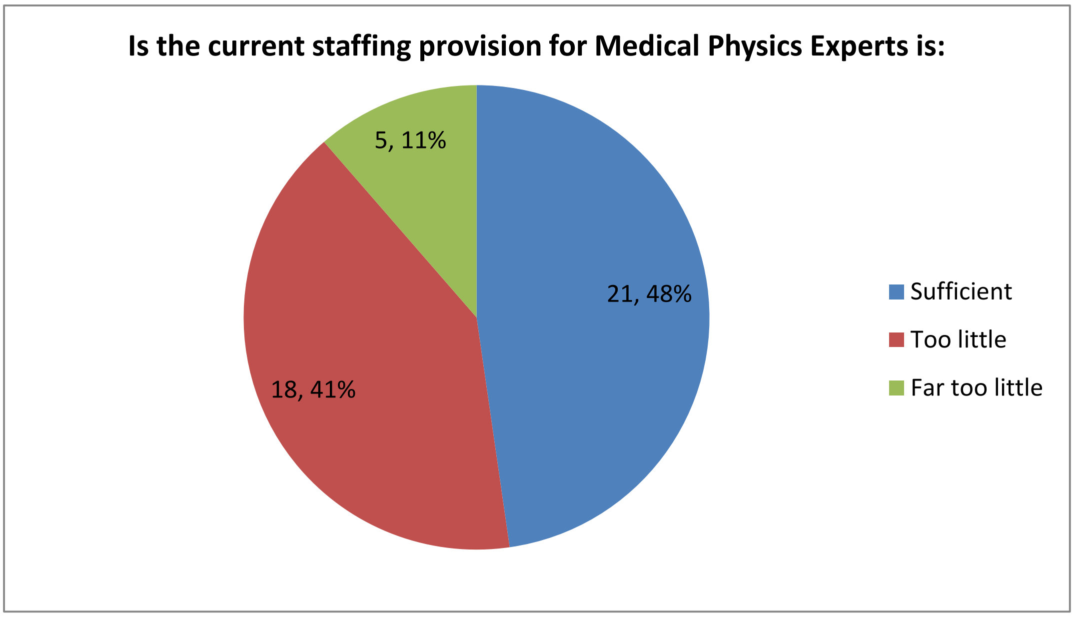
"Very low, with 1 RWA. We require at least 2 further RWA to comfortably cover our requirements and have some cover for staff losses / sick leave. We have put a reciprocal agreement in place with another service to cover when the RWA is unavailable."

"At the moment the organisation is sitting with 1 RWA and this is a single point of failure. WE are trying to address this through the Radiation Protection Committee. To reduce the residual risk we are currently looking at buying additional RWA support."

Medical Physics Expert

A new requirement is a that of a registered Medical Physics Expert . Regulation 9 requires the Employer to have a medical physics expert (MPE) involved in every medical exposure. As yet, no definitive guidance on the required ratio of MPE to exposures, population, scanning units or other service provision measure has been published. Consequently there is no UK-approved definition as to required staffing levels. The European Federation for Medical Physics (EFOMP) has published guidance on staffing levels[i], but the responses received to this survey indicate that few departments in the UK are staffed to the levels recommended by EFoMP, which are largely seen as aspirational.

An assessment and registration system for MPEs is not yet set up in the UK; RPA 2000 hold a list of current MPEs who have been accepted via a grandfathering route which closed on 31st December 2017. The following question was asked on the assumption that "MPE" means on, or could be on the list, although with hindsight, it is apparent that this was not made clear. As far as we can ascertain, respondents interpreted this question as was intended.



The findings reflect the shortage of establishment with a similar number of departments being understaffed to those not having enough MPEs. Some of those who currently feel their department has enough express concern that an over-onerous accreditation process could deter those otherwise qualified from becoming, or remaining registered.

"This depends entirely what the required standard of MPE provision is from DoH / CQC. If it is to EFOMP standards, we need twice as many staff"

One respondent also noted

> *"The increased demand for MPE services in the new IR(ME)R regulations will put pressure on existing MPEs. Training staff to MPE level takes several years post registration, retention and maternity cover are difficult. There is significant demand for MPE work, but too few MPEs in the UK."*

A number of respondents commented on the number of additional registration being very discouraging to both current members and new entrants to the profession. One respondent commented that their previous RWA/RPA had declined to re-certify for both registrations and so they were now short of this expertise.

Age Profile of workforce

The age profile of the Diagnostic Radiology Physics and Radiation Protection Physics workforce combined is approximately as expected, this is shown for both Clinical Scientists (CS) and Clinical Technologists (CT) in Figure 5.

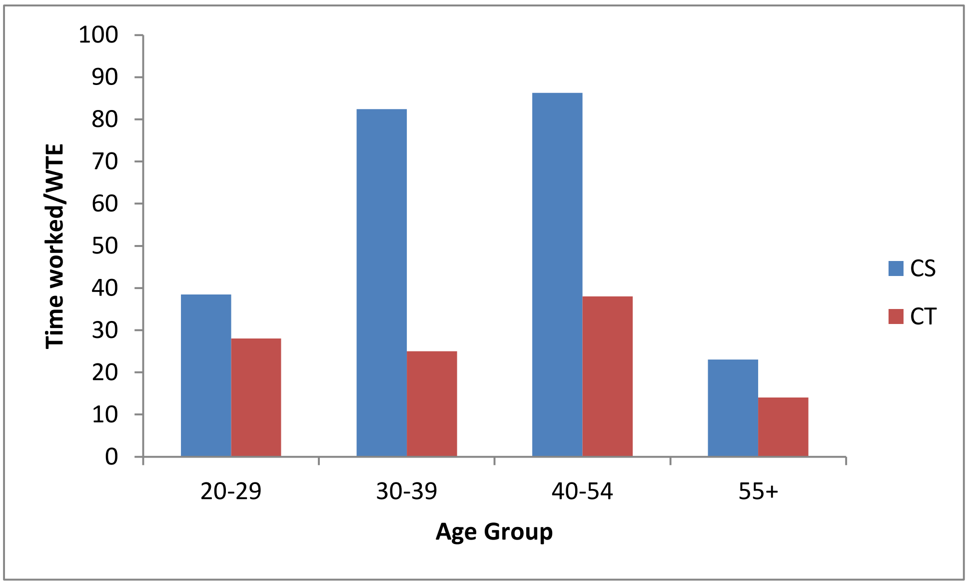


Figure 5: Age profile of both Scientists and Technologists in the combined specialties of DR&RP

The survey did not ask respondents to separate out diagnostic radiology and radiation protection effort, and so we cannot compare differences within these specialties. However, a comparison of specialities within the IPEM membership showed that for radiation protection the age profile is skewed towards the 50-59 age group. This is of concern as retirements in this workforce will be greater than would be normally anticipated over the next 5+ years and there is likely to be a gap in middle-career individuals who would be in line to replace these retirees. There are more individuals specialising in radiation safety in the 20-29 age range than would be expected, compared to diagnostic radiation or medical physics as a whole. This indicates that there is improving supply at the early career stage while there has likely been a shortage in the past; possibly owing to a drop in training opportunities for a period of time. A possible consequence of this is that Scientists become promoted into senior roles at an earlier stage in their career than ideal. If this situation occurs then it would be advantageous to the profession to have support and mentoring structures in place to assist them.

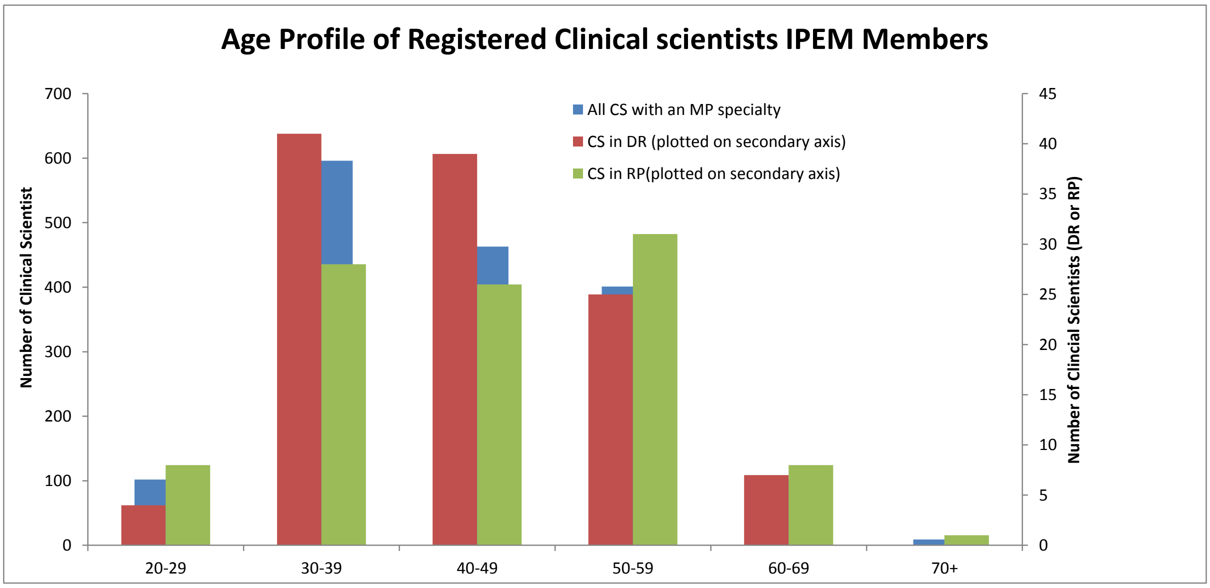


Figure 6: Age Profile of IPEM members who are Clinical Scientists, comparing those with a specialism in DR or RP to the overall age profile

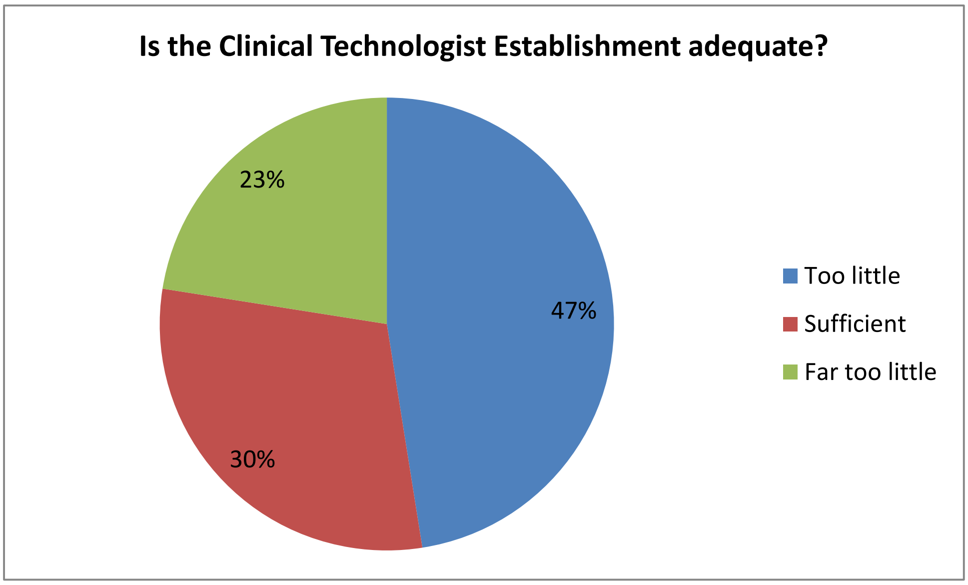
Experiences of recruitment

Respondent's comments confirm what the data in terms of vacancy rates and training numbers suggests: many experience difficulty in recruiting to vacancies, with few appropriate applicants and repeated adverts being required. This problem is particularly acute at Band 7, and it is suggested that higher grade vacancies are predominantly filled by internal promotion.

As might be expected in a workforce suffering from shortages, short-term cover, such as needed for maternity leave is virtually impossible to find and so services are unable to recruit to cover maternity leave. This leaves staffing levels frequently at an even lower level. In a relatively small profession such short-term cover might never be easily available but establishments should be set high enough to allow resilience for this or longer-term sickness absence.

4.2 Clinical Technologist Workforce

While respondents were slightly more positive about the technologist establishment than the Clinical Scientist establishment, there were still of over two-thirds of respondents who believe that the technologist establishment is *"too little"* or *"far too little"*.



Only 30% of respondents felt that the technologist establishment was adequate, with two responding that they do not have any established technologist posts and that technologist skills would benefit their service. Further comments suggest that the service structure is adjusted to the available workforce with some aiming to recruit scientists even though the required skillset is more closely matched to that of a technologist. Many also report that recruiting technologists is difficult owing to a shortage of external training programmes and internal training putting a large burden on the department.

> *"Adverts for CT do not attract any experienced staff. Training program almost non existent meaning that it is a big burden on the department"*

> *"The wte [whole time equivalent] for CT is probably lower than it should be and staffing structure has been altered accordingly"*

In Summary, the technologist workforce has high vacancies and insufficient posts. Any workforce plan for the immediate and medium-term future should consider how best to increase training opportunities and fill vacant posts.

4.3 Workforce Planning: Clinical Scientists

For Clinical Scientists, the available workforce to fill the establishment is comprised of the current workforce, newly qualified entrants, fully-qualified migrants from overseas minus those leaving the workforce either through retirement, career change or emigration

In order to understand the future landscape it is necessary to have an overview of those factors, along with the changes in establishment requirements. We will look at each of the factors in turn to identify potential solutions to the current workforce shortage.

4.3.1 Newly Qualified Entrants to the Workforce

Clinical Scientist Training History 2007-2018

A background and description of the past and present training programmes is given in Appendix 1.

Figure 7 summarises the number of individuals who have achieved Health and Care Professions Council (HCPC) registration through the Association of Clinical Scientists (ACS) since 2007, in the sub-modality of Diagnostic Radiology and Radiation Protection, through either Route 1 or Route 2. This data has been collated by IPEM through the Part I and Part II Training Scheme records, in conjunction with the ACS. The data for the number achieving HCPC registration through the Scientist Training Programme (STP) has been supplied by the National School for Healthcare Science, although it should be noted that as there is no longer a Professional Lead for Medical Physics at the School, the data for the 2015,2016 and 2018 out-turn is unavailable. An estimated figure has been applied, based on the past and future figures. The confirmed data is shown on the chart below with a solid border while predicted figures have a dashed border. It has been estimated that 50% of those completing the STP sub-modality of Imaging with Ionising Radiation (IIR) will opt for posts in Diagnostic Radiology, rather than Nuclear Medicine which is an alternative option for those qualifying in this submodality. The Diagnostic Radiology Special Interest Group (DRSIG) believe that this is a generous estimate and that the figure of those who qualify in Imaging with Ionising Radiation ending up in Diagnostic Radiology roles is closer to 33% than 50%.

Future supply

The anticipated figures for England and Wales shown here have been obtained from the commissions published annually by Health Education England (HEE). Rob Farley (NHS Education Scotland) provided data for Scotland. In England and Wales a small number of posts are commissioned for fixed specialties, including Radiation Safety and Imaging with Ionising Radiation, but many more for are commissioned for undefined medical physics, where the trainee has a choice as to which specialism to take up. This choice may be completely free, or may be dictated by the employing Trust or Health Board, according to local circumstances. For projected figures, an attrition rate of 5% was applied, then 16% are presumed to select Imaging with Ionising Radiation, and 10% Radiation Safety. As for the past data, of those who select Imaging with Ionising Radiation, it is assumed that 50% will finally opt for Diagnostic Radiology roles.

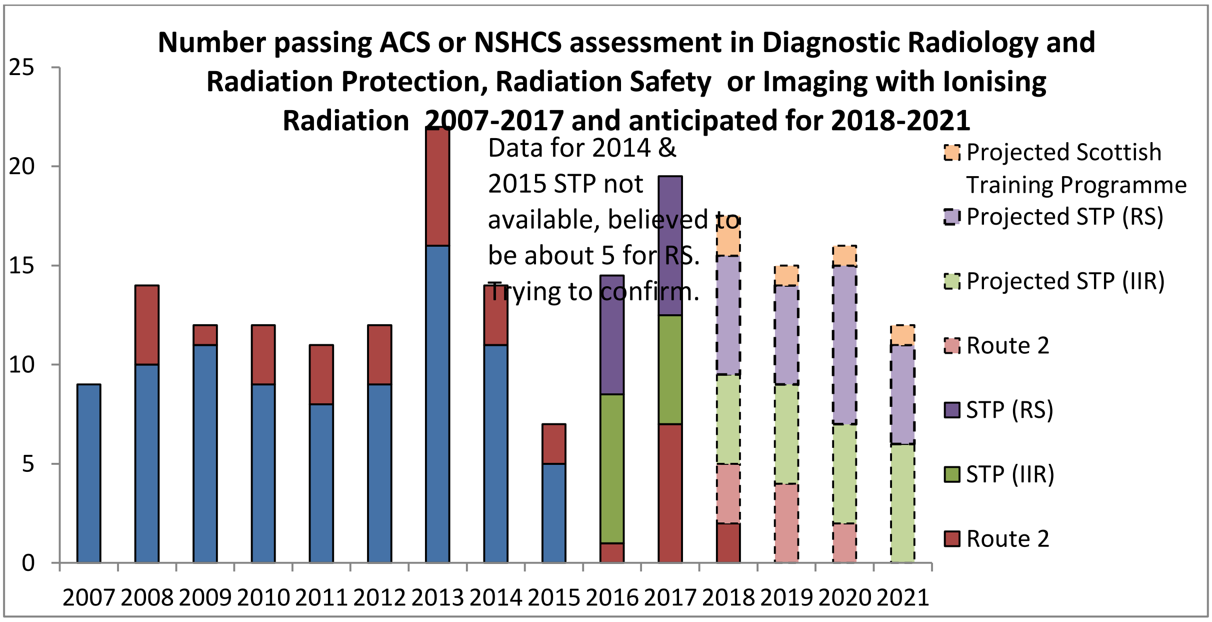


Figure 7: Chart showing number achieving HCPC registration through all Routes available in the UK from 2007-2017 and predicted numbers for 2018-2021 based on recent intake, and available for Diagnostic Radiology or Radiation Protection roles.

A detailed look at the data shows that the number of individuals becoming Registered Clinical Scientists in Diagnostic Radiology or Radiation Protection ***has, with the exception of 2013, increased*** overall since 2007. However, this increase is evidently not enough to keep up with demand, as the high vacancy rate shows. Using the past and present training data, together with the current vacancy rate, the future workforce is forecast as shown in Figure 8 overleaf.

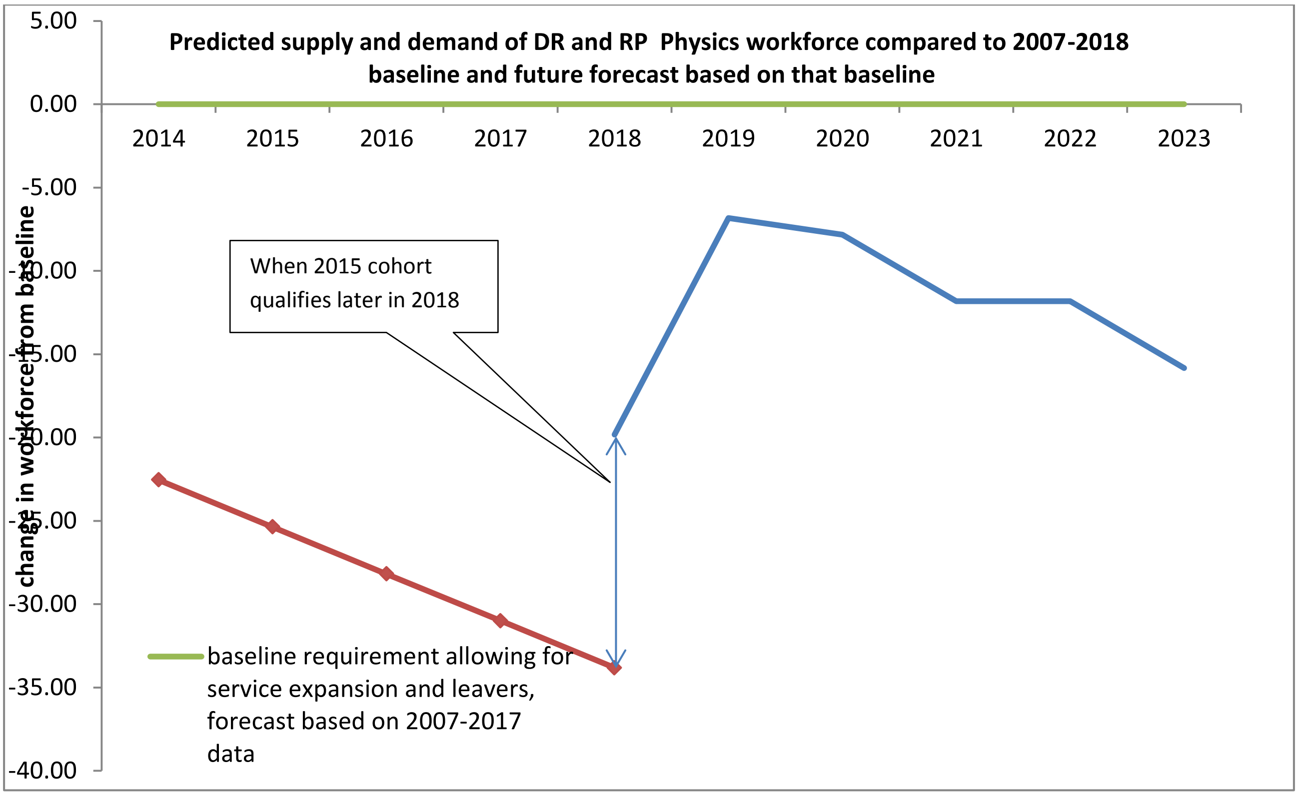


Figure 8: Averaged past and predicted future supply of DR and RP Clinical Scientists compared to the anticipated baseline demand 2007-2021

The chart clearly shows that simply continuing to train at the current rate will not fully redress the shortfall, only prevent it from growing further. This model is based on the assumptions that the other factors affecting supply remain constant.

- Service growth/contraction continues for the next 5 years as it has for the last 7 years
- Recruitment from (and loss to) medical physics overseas remains at the same average over the next five years, as in the previous 7
- Retirement and retention also remain at the same average over the next five years as in the previous seven years

While service growth is likely to remain the same, and there is no indication that retention is about to change, the radiation protection workforce is older than average so retirements should be expected to increase over the next five years.

It also cannot be expected that recruitment from overseas will remain the same through the period of the UK exiting from the European Union. This is discussed further in a later section.

Scientist Training Programme

The current format of the Scientist Training Programme groups diagnostic radiology physics in with imaging in nuclear medicine to form the Imaging with Ionising Radiation specialism. Radiation Safety is a separate specialism. Many respondents reported that this is not a helpful grouping, for a variety of reasons:

- More departments align DR/RP (see section: Services) than DR/NM, thus making the requirements difficult to complete.
- Only a small number of STP trainees are taking up the Radiation Safety Specialism.
- As NM forms a greater part of the IIR requirements trainees are more likely to take up NM posts rather than DR ones.

Other respondent comment that the grouping is scientifically beneficial, and we should instead seek to workarounds any bottle necks thus generated in training, through co-operation. The data shows that the number of DR/RP entrants to the workforce has **not** decreased, despite the realignment of specialisms. It may be that difficulties around completing requirements, limits the throughput of STP, and this should be addressed as part of measures to redress the workforce shortage.

Several respondents commented that the change of training from Route 1 to STP meant that fewer trainees were choosing Diagnostic Radiology.

The data however, does not confirm this, but in fact suggets that the number of trainees completing in Radiation Protection and Diagnostic Radiology combined over the whole UK has increased under STP compared to Route 1 (see Figure 7). However, as Radiation Safety is now a specialism of its own, it is possible that the number opting for Radiation Safety roles after qualifying through Route 1 was greater than the number who now opt for the Radiation Safety sub-modality of the STP.

Alternatively it is possible that this impression of fewer trainees opting for DR/RP is created instead by the workforce shortage compared to the number of roles vacant, or maybe owing to the small numbers they are necessarily not geographically evenly distributed given those in some areas the impression that fewer are being trained while overall in the UK the picture has not changed.

It should also be noted that there are workforce shortages in Radiotherapy (8%[ii]) and Nuclear Medicine (as yet unknown but believed to be 5-10%) as well and that the underlying issue is that insufficient medical physicists as a whole are being trained, not the specialisms that the trainees are choosing.

4.3.2 Retention of qualifiers 2007-2017

When there is an undersupply of training staff, retention of these qualified becomes of critical importance.

The length of time post-qualification that registered Clinical Scientists in Diagnostic Radiology or Radiation Protection, who qualified through either Route 1 or Route 2, stay in medical physics in the UK, is shown in Figure 9. The retention rates do not appear to have appreciably changed over this time period, not withstanding the effect of a small cohort (eg 2012).

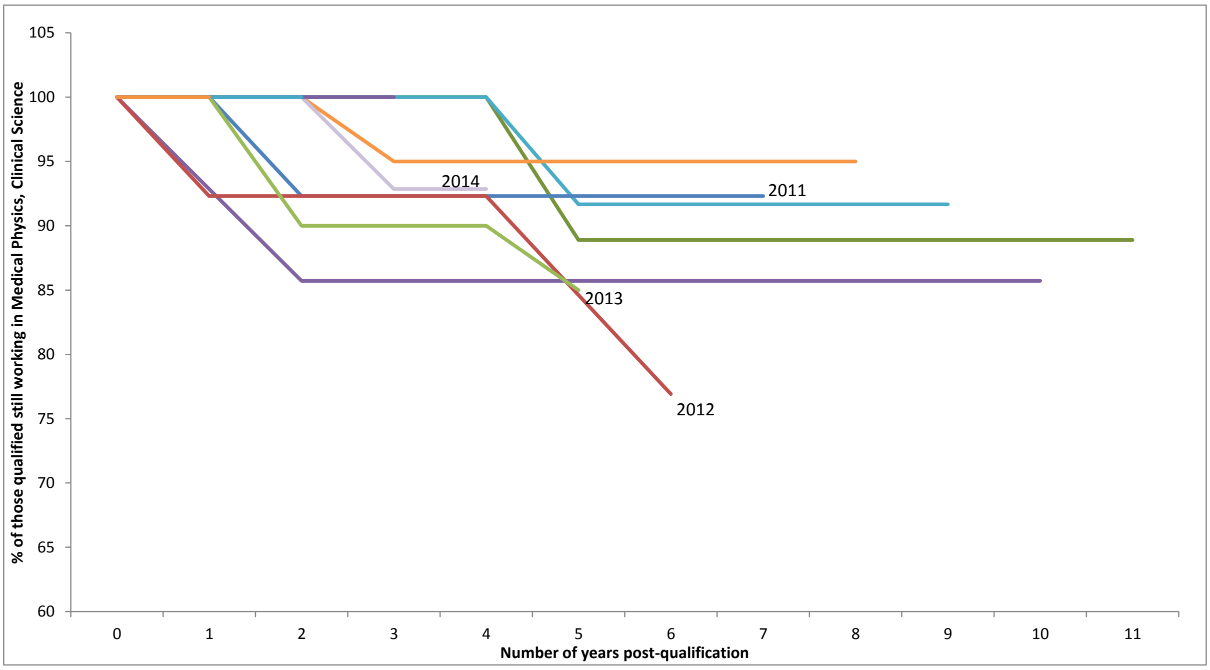


Figure 9: Retention of DR/RP Clinical Scientists past qualification, by cohort

Taking a closer look at the destinations of Clinical Scientists qualifying in Diagnostic Radiology with Radiation Protection, Figure 10 shows where and in what role all those who qualified via Route 1 or Route 2 over the time period 2007-2018 are employed at October 2018. The roles are categorised as:

Category	Description
UK NHS DR/RP	Employed in DR/RP within the NHS
UK Independent employer DR/RP	Employed in DR/RP in the independent sector
Other UK CS	employed in a different specialty
DR/RP not CS	No longer registered with HCPC but employed in the DR/RP sector
Overseas MP	Moved overseas, still employed in Medical Physics of some specialty
Career Change	Have left Medical Physics entirely

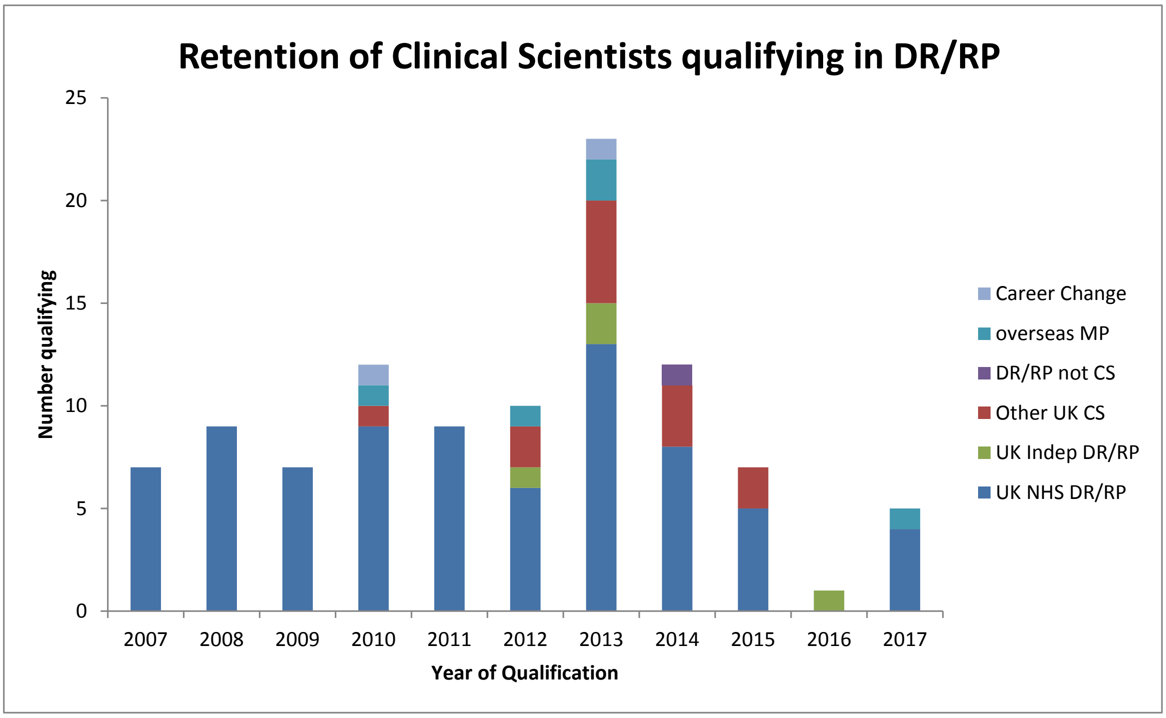


Figure 10: Retention of DR/RP Clinical Scientists over the time period 2007-2018 given employment as of 2018

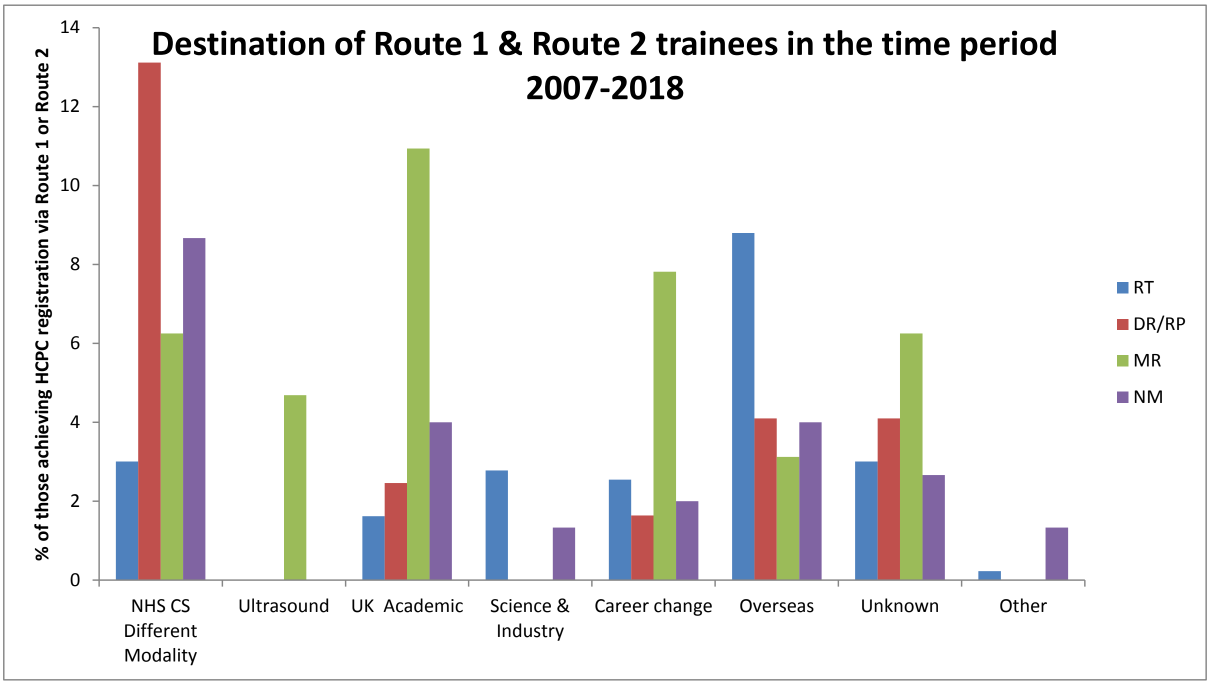


Figure 11: Destination of Route and Route 2 trainees (2007-2018) as at 2018

The retention rate of all medical physicists within clinical science either in direct healthcare or closely related science (such as healthcare science in industry or academia) is high, and the DR/RP specialism is no exception. However, for this specialism the percentage who move to other specialisms is also high: 11% of those who qualified in Diagnostic Radiology and Radiation Protection through ACS in the period 2007-2017 are now working predominantly in another specialism. This is 15 individuals, of which 4 qualified in dual specialisms, so this high rate may simply be an anomaly of the relatively small dataset. However, the rate is significantly higher than for radiotherapy (RT), where just 3% have moved to a different specialism, and even nuclear medicine (NM), where 8% have moved to another specialism. It is possible that some are, for example, providing radiation safety physics within a radiotherapy department, and have reported their area of operation as radiotherapy rather than radiation safety but this is impossible to determine.

Few change careers leaving medical physics behind entirely (6.7%), which compares very favourably with other healthcare professions; recent reports have over 40% of doctors leaving during their second year, and radiographers also report retention difficulties, although no figures have been quoted for this workforce for individuals once qualified. Overall, retention within the profession is very high. In should be noted that a flow of clinically trained scientists into industry and academia is beneficial to the profession, as is transfer to other sub-modalities. Consequently there is little to be gained UK-wide from attempting to increase retention.

Centres located in areas with a high cost of living struggle with retention, as staff relocate to a preferred geographic area. Respondents report that even mid-career salaries are insufficient to get on the housing ladder and so individuals are drawn away from these high cost areas once their career is established. This issue is exacerbated in small workforces with a high vacancy level as the pool of recruits is smaller. This remains a local issue as the percentage leaving medical physics overall is small. Areas with a high cost of living are most likely to struggle to recruit and/or retain: it is unknown how many have utilised the recruitment and retention premia to reduce turnover and whether, if done, this has had a positive effect.

4.3.3 Immigration/Emigration

It is not much of a stretch to predict that the UK's decision to leave the European Union will have an impact on immigration and emigration. A 2017 survey of the Medical Physics and Clinical Engineering (MPCE) workforce found that 11.7% of the Diagnostic Radiology workforce came from an EU country. Many of these will have been trained overseas and so represent an additional source of trained staff other than domestic training programmes. A further 9.8% come from other overseas countries, demonstrating the reliance of this workforce on contributions from overseas. It is unlikely that this level of immigration will continue, without some degree of interruption, so the assumption that immigration/emigration will remain constant is unlikely to be valid. It seems likely that immigration will decrease, since immigration from the EU is a large proportion, and other healthcare professions have seen significant drops in registrations from EU nationals[iii]. As smaller numbers of Clinical Scientists, especially in Diagnostic Radiology and Radiation Protection leave the UK to practice in the EU (2.6%) than are recruited from the EU even if emigration to the EU were to stop at the same time as immigration from the EU there will still be a net decrease in Clinical Scientists. In summary, the forecast shortages are a best case scenario, and will be negatively affected by a drop in immigration.

At present, workers from EU and EEA countries can freely move to the UK to work, and registration with the HCPC is facilitated by the recognition of equivalent qualifications directive[iv]. If an employer wishes to employ a professional from outside of the EU, a Tier 2 visa must be sought, which will only be issued providing the Resident Labour Market Test (RLMT)[v] is met. The RLSM is intended to demonstrate there is no suitable settled worker already in the UK who can carry out the job. The role must also meet salary requirements, which Clinical Scientist roles at a minimum of Band 7, do. The number of Tier 2 visas that can be issued annually is capped, and in 2018, this cap was reached prematurely during January-April. In July 2018 the government announced that some NHS roles would be removed from the cap, freeing up availability. It is unclear which NHS roles, other than medical roles are included. If a role is listed on the National shortage Occupations List (NSOL), then the requirement for a RLMT is waived, and bespoke minimum salary requirements can be applied. Radiotherapy Physics and Nuclear Medicine Physics Scientist (and technologist) roles are listed on the NSOL, and there is sufficient evidence to demonstrate that Diagnostic Radiology and Radiation Protection could be listed too. However one cannot apply to be listed, but must wait for a Call for Evidence during a review of the NSOL. The Migratory Advisory Committee have not commissioned a review for over three years, but the Workforce Intelligence Unit keeps a close watch to ensure that once published IPEM will be able to respond appropriately.

The government plan published on 2/10/2018 regarding future immigration after the UK has exited from the EU requires that highly-skilled migrants (currently referred to as Tier 2) will be required to earn £50,000+ and there will be a cap of 20,000 on the total number admitted. This will encompass all migrants from all countries, and is very likely to be a large reduction from the current situation. It is suggested that there will be exemptions for NHS and other critical services, and IPEM make efforts to ensure that all medical physics and clinical engineering specialties are rightly recognised as critical healthcare service roles.

4.3.4 Retirements

While we have no specific information regarding the retirement rate in the past or at present, it is instructive to look at the age profile of the workforce. As the results in Section 4.1.1: *Age Profile of workforce* show the Radiation Protection workforce in particular has a profile which is skewed towards the older age group compared to medical physics clinical scientists as a whole. We can therefore anticipate that the retirement rate is higher amongst this group than others, although how it compares to recent retirement rates, is unknown.

4.3.5 Summary of the future workforce

We have seen that this model shows that, despite training numbers increasing, there will continue to be a workforce shortage. As previously explained the model is built based on the following factors remaining at a constant rate over the next 3 years, compared to the last ten years.

- Retirements
- Retention
- Emigration
- Immigration
- Service growth

Emigration and Immigration are likely to change, and the direction of that change will be to worsen the workforce shortage. Retirements are also more likely to increase, given the age profile, than decrease, although this effect may be small. At present there are no vacancies in the more senior posts; this will change as these post-holders retire. There is another aspect of concern relating to filling more senior roles, and that is that there is no Higher Specialist Scientist Training Programme in Radiation Safety so no route to becoming a Consultant Clinical Scientist specialising in Radiation Safety, which may also be a barrier to filling senior roles in the short-medium term.

Retention is high, but increasing retention within Diagnostic Radiology and Radiation Protection Physics would potentially have the same effect as increasing training commissions. However, given that in this instance, increasing retention predominantly means reducing transfers into other specialisms, it would of course, have a depleting effect on other medical physics specialisms. The data suggests that the majority move to Nuclear Medicine Physics and Magnetic Resonance Physics. There is a natural overlap between Nuclear Medicine Physics and Diagnostic Radiology, and between Diagnostic Radiology and Magnetic Resonance Physics. It is unlikely to be a successful policy, even if it were possible, to encourage individuals into medical physics but then limit career options by restricting to a particular specialism. It is possible to commission a specific training place: rather than a free-choice medical physics place, but it is generally agreed that restricting **all** training places is likely to be counter-productive as trainees unhappy with their choice would then leave the programme rather than move specialism.

The direction of service growth is unknown, though given that 75% of services believe that they are understaffed, it seems more likely that demand will increase than decrease

As a result, this workforce forecast should be viewed as a best case scenario, and efforts should be made to redress the shortfall.

Effective Action

These efforts should focus on increasing the numbers in training overall, and the capacity for training around the UK. A capacity survey in 2015[vi] identified that the RP/DR rotation in first year was a bottleneck for increasing the number of radiotherapy places, and this bottleneck will affect Imaging with Ionising Radiation and Radiation Safety specialisms as well. It would be desirable to look at training centres within Local Education and Training Boards and identify whether collaborative measures can increase through-put by offering complementary training provision, similar to the consortia that operated during the Route 1 era.

There are evidently more destinations than training centres, especially when independent medical physics employers, alternative science and industry employers are taken into account. Route 2 does not require employment at an accredited training centre and so can be utilised by individuals employed by all types of employers. A greater visibility of Route 2 to registration would hopefully increase uptake and usage of this route by more employers than just accredited training centres.

Respondents also commented on the ratio of trained staff:trainees improving in the near future as more trained staff become available; note that staffing training and demand predictions do not bear this out, and currently it is predicted that vacancies will increase, not decrease. The vacancy rate may well remain high for some years, as establishment will increase in response to availability of staff. It is strongly recommended, therefore, that novel structures and collaborations be investigated with the aim of increasing the number of trainees.

It should also be noted that, inevitably as the training has shifted from a four-year route to a three-year route, newly qualified individuals are completing with less experience than previously. This will have placed a greater mentoring demand on senior members of a service, thus increasing the establishment requirement fractionally but noticeably.

In London, a Regional Tutoring program has managed to achieve an increase of 54% in number of MP and CE STP trainees in London since the project started in 2016[vii] at the same time as reducing attrition rates. They have achieved this through syngergistic provision of training modules across the consortia and a focus on appropriate mentoring provision for trainees, with workshops on enhancing supervision. These, or similar approaches should be considered if they are applicable to be applied nationally.

3.4 Workforce Planning: Technologists

As described in appendix A there are a number of routes to becoming a clinical technologist. The number of entrants in to the profession is harder to track than for Clinical Scientists, as registration is not mandatory and proportionally fewer are members of IPEM than Clinical Scientists. As registration with RCT is not mandatory, and indeed there is another professional register held by the Academy of Healthcare Science[1], although as of. In addition there are almost certainly individuals who are working in a technologist post without being on the RCT, owing to the four-year gap between grandparenting closure and equivalence opening, as well as the non-statutory nature of the register. Neither those who gained the required level through experience, nor those recruited from overseas during this time period would have been able to register, and they still may not have done so now that the equivalence route is open. Figure 12 shows the numbers completing training schemes, both IPEM's and the Practitioner Training Programme (PTP) since 2006, and predicted for the next 4 years .

Because a smaller proportion of those entering the profession have completed a recognised training scheme, predicting future supply based on past training is less reliable for technologists than Clinical Scientists. The model created to predict future supply used overleaf is based on the assumption that the number of career changers, retirees, emigrants and immigrants remains constant over the time period of the model. For technologists there is an additional assumption that the number of entrants who do not follow a training scheme is constant.

[1] As of November 2018 there are no Radiation Physics registrants on the Academy's Practitioner register

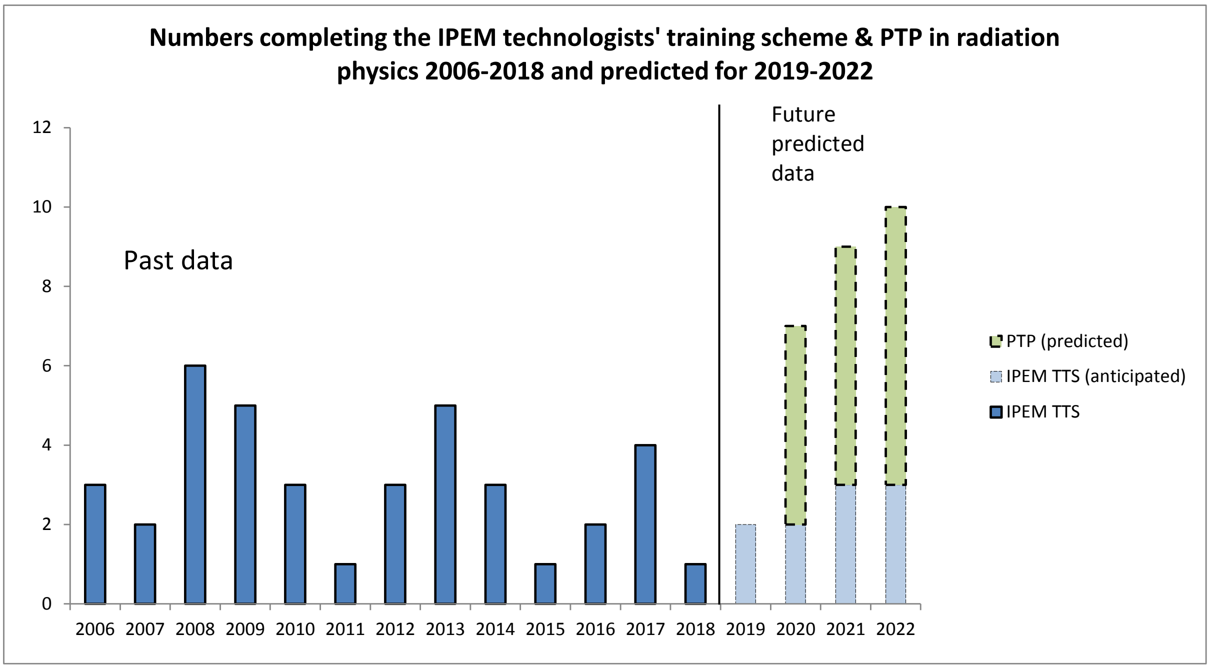


Figure 12: Completers of IPEM's technologist Training scheme in Radiation Physics by year 2006-2018, and anticipated for 2019-2020

Within the limitations of this model there are sufficient numbers currently in training to nearly redress the shortfall by 2022 (see Figure 13), which is very encouraging. As per Figure 12, the biggest impact is the introduction of a PTP course: an out-turn of just 5-7 annually is sufficient to redress the shortfall provided there are no other changes to supply or demand.

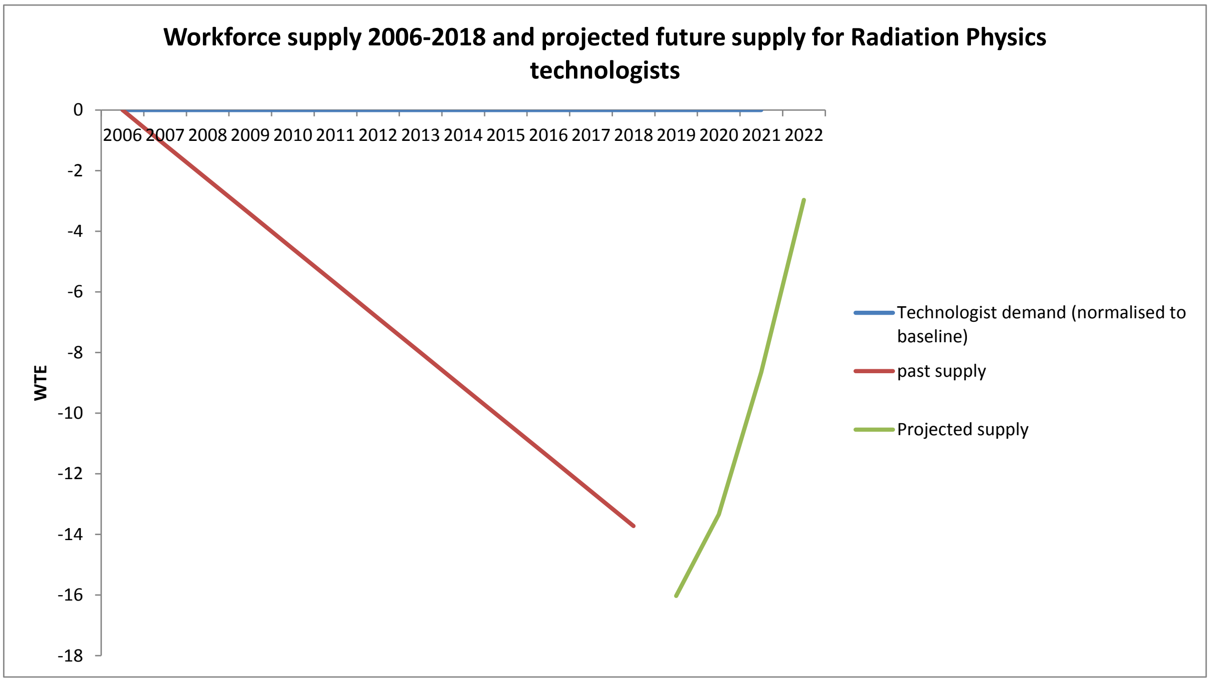


Figure 13: Past workforce 2006-2018 and predictions of future workforce compared to requirement 20-18-202

As explained previously, the model is built assuming that flow in and out of the workforce, other than training, will remain at the 2006-2018 rate over the 2018-2021 period. This is an optimistic assumption, particularly in the case of recruitment from overseas, as was discussed for Clinical scientists. It is believed that there are fewer DR/RP technologists recruited from the EU than Clinical Scientists, so it is possible that the workforce shortages will still be redressed, particularly if the PTP courses continue to remain open or even expand. IPEM's Technologist's Training Scheme has capacity for more trainees, and in-service PTP routes are starting to become available. The new undergraduate PTP courses opened in 2017, the first graduates from these are anticipated in 2021, and are predicted to have a significant impact. An adequate supply in the future is dependent on these routes remaining open and successful.

3.4.1 Retention and recruitment

Those that can recruit technologists then have difficulty in retaining those they do have, reporting that they leave either for STP training posts or for better paid roles outside medical physics. One respondent did report that retention was good but also commented that there was little career framework or progression available.

Others who have not commented on recruiting or retention difficulty have not recruited recently. Only one respondent was positive

> *"We fully expect to appoint and we have a track record of appointing at low scale then growing from within."*

Other respondents had no problems at present but anticipated difficulties in the near future owing to expected retirements. Another commented that

> *"The lack of training available for CT over a number of years has led to extreme difficulties in staffing this part of the workforce. The wte for CT is probably lower than it should be and staffing structure has been altered accordingly"*

And this reinforces the position that the establishment has been tailored to supply rather than need.

One also commented that :

> *"over the next year I foresee scientists having to do jobs that are really Technologist level. This is demoralizing and a waste of resources."*

It can be hoped that the improved supply of trained technologists begins to redress these difficulties/

4. Summary & Recommendations

It is clear that there is a shortage of diagnostic radiology and radiation protection physicists, and currently of technologists. This is in common with other medical physics specialisms who are also experiencing similar workforce shortfalls.

As regards Scientists, it would be counterproductive to encourage uptake of Diagnostic Radiology or Radiation protection at the expense of other medical physics specialisms. Consequently the best way to meet this shortfall is to increase the number qualifying, by whatever route, while continuing to facilitate recruitment from overseas. While many respondents cite lack of funding as a reason that more STP training places are not commissioned if there were capacity for more trainees, along with a clearly demonstrated need in the form of workforce data then a case for more training places might be successful. Some consortia have successfully argued for more training places using workforce data in the past.

The picture for technologists is looking considerably more encouraging, but is heavily dependent on the success of the recently-introduced undergraduate PTP courses. Should these continue to be successful, then the continued supply of technologists should enable service structure realignment which should act to relieve pressure on Scientist posts. This in turn, provided adequate funding for training continues, will permit an increase in training capacity in order to redress the shortfall in Scientists.

The difficulty of filling posts and recruiting is an issue on top of a background of inadequate establishment, compounding the day-to-day difficulty of providing a physics service to Diagnostic Radiology and providing Radiation Protection services. Medical Physics managers may be reluctant to put forward arguments for increasing establishment with little chance of recruiting, and if so, this will mask the extent of the training/establishment gap. With the prospect of sufficient technologists becoming available to fill the vacancies, there is the opportunity to set the achievable standards of staffing establishment as it should be for clinical need.

If minimum standards were set, then the need for greater training provision for Scientists would become apparent. With sufficient technologists available to recruit, providing this training would become achievable. It is IPEMs place, as the professional body, to set standards of minimum clinical service for public safety. To do so would fit IPEM's strategic objective of "Set and influence standards and best practice". The Radiation Protection Special Interest Group (RPSIG) and Diagnostic Radiology Special Interest Group (DRSIG) should consider what additional information would be required to produce guidelines regarding staffing a DR/RP physics service by clinical need, and whether it is possible to reasonably produce such guidance given the diversity of service structures.

Other measures, which IPEM should take include:

- Publicising this data, demonstrating a workforce shortage
- Publicising the ability to specify the specialism of an STP place
- Continuing to support Route 2, developing and expanding as appropriate
- Publicising and increasing awareness of IPEM's Technologist's Training Scheme which has capacity for training more technologists
- Promotion of collaborative efforts to increase training throughput

Apppendix A

Background to Training

Clinical Scientists

Clinical Scientists in Diagnostic Radiology and Radiation Protection use their knowledge and understanding to perform calculations and make measurements to formulate appropriate advice to users of radiation and their employer, and to confirm compliance with regulatory requirements. They play a key role in optimisation, reducing the radiation doses to patients whilst improving image quality for accurate diagnosis

They will be involved in the development and testing of new facilities, equipment, treatment and diagnoses. They will also be involved in the training and education of staff relating to radiation safety, and in research and innovation in healthcare settings.

Prior to 2011, IPEM ran a four year training programme for Medical Physicists, leading to a Diploma from the Institute of Physics and Engineering in Medicine, assessment by the independent Association of Clinical Scientists (ACS) and registration with the Health and Care Professions Council as a Clinical Scientist. The training consisted of two parts; Part 1 and Part 2, each taking a minimum of two years to complete. In 2011, England moved to training via the Modernising Scientific Careers (MSC) Scientist Training Programme (STP), and Part 1 applications were only considered from Scotland and Northern Ireland. Wales adopted the STP in 2012, and Northern Ireland in 2013. Scotland implemented an alternative 3-year supernumerary training scheme in 2014.

ACS Route 1

***Part 1*: Individuals would be registered on the scheme, and join IPEM as Associate Members. Working in a Training Centre, they would be trained in-house, and would specialise in three areas of medical physics and/or clinical engineering. Trainees also completed an MSc in Medical Physics, and some opted to interrupt their clinical training in order to complete a PhD. After a minimum of two years, once their training co-ordinator was satisfied that their work was of the appropriate level, trainees would submit for assessment. This took place by portfolio and viva voce examination conducted by IPEM assessors. Up to two resits, and/or resubmission of the portfolio were permitted. Occasionally individuals left the training programme, either following failure, or for other reasons. Trainees could take more than two years to complete if:

- their training co-ordinator felt they needed longer to reach the required level;
- they opted for a PhD;
- they were required to re-sit, or re-submit a portfolio;
- personal circumstances forced a leave of absence for a period of time, eg maternity.

***Part 2*: for the second part of their training, trainees could take one of two routes.

- Register with IPEM on the Part 2 programme: IPEM would provide a mentor or “external advisor”, who would oversee and comment on their training programme, and assist in ensuring trainees acquired a sufficiently large range of experience to pass ACS assessment.

OR

- Not register on Part 2, but rely on internal assistance from their workplace to acquire a sufficient range of experience to pass ACS assessment.

Often candidates were turned down for registration on Part 2 if too great a period of time had elapsed between completion of Part 1 and application for Part 2 (at one time application was required within 6 months of completion, but this was waived in later years)

Following a further two years of work, amassing a further portfolio and sufficient experience, following successful completion of Part 1, individuals could submit for assessment by the Association of Clinical Scientists (ACS) in one or two of their specialties from which they could progress to registration as a Clinical Scientist. The relevant specialty for this workforce would be "Diagnostic Radiology & Radiation Protection" which was a single specialty.

This route closed in 2012.

Route 2

In an alternative route to registration, known as Route 2, sufficiently qualified and experienced candidates could submit a longer portfolio to ACS and undergo assessment against the same standards as Route 1 candidates. Sometimes, but by no means always, these individuals registered for Part 2 of the IPEM scheme and were provided with an external assessor to guide them through ACS assessment. Route 2 is still open, and Part 2 still accepting applications. There are currently over 40 individuals registered on Part 2 (10 in Diagnostic Radiology and Radiation Protection).

Modernising Scientific Careers (MSC) Scientist Training Programme (STP)

This has been operating in England since 2011, in Wales since 2012, and in Northern Ireland since 2013. Trainees are recruited nationally, and take part in a three-year programme leading to an MSc in Clinical Science (Medical Physics). They undertake four specialty rotations and then specialise in one of these areas. The relevant specialties in the STP programme are "Imaging with Ionising Radiation" and "Radiation Safety", two separate specialties. Imaging with Ionising Radiation modules consist of approximately 1/3 relating to Diagnostic Radiology and 2/3 relating to nuclear medicine. STP trainees are assessed by an Objective Structured Final Assessment (OSFA) in their final year. If successful, they obtain a Certificate of Attainment, which allows registration with the HCPC. As this is a three-year, rather than a four year, programme, individuals are achieving registration with less experience than under the previous scheme.

STP Equivalence

There is an equivalence route to STP assessment, after which a Certificate of Equivalence is issued which allows registration with the HCPC. Candidates must demonstrate that their training, qualifications and experience are comparable to the STP curriculum learning outcomes as well as adherence to all aspects of Good Scientific Practice. As far as IPEM is aware, few, if any registrations via this route have been achieved in Medical Physics

Scotland has elected to run a separate but similar scheme following which trainees are assess using the STP Equivalence route.

England
Training positions on the Scientist Training Programme (STP) are commissioned in England by Health Education England. Heads of Department make requests within their own Trusts for a training place; this varies by Trust as to how it is organised, who assessed need and the criteria against which that need is assessed. The Trust then forward collated requests to the Local Health Education Training Board (now four in England: London, South, North, & East and Midlands), who collate the requests and make a final submission for the area to the HEE.

Scotland
Scotland follow their own route to registration, with around 6 supernumerary training positions being commission by NES annually. Each Health Board requests commissions as appropriate to need.

Wales
Training places on the Scientist Training Programme are commissioned on Wales by WEDS. Each Health Board advertises their positions independently.

Northern Ireland
In Northern Ireland, the head of the Belfast Health & Social Care Trust (BHSCT) Regional Medical Physics Service (RMPS) seeks funding from the devolved Department of Health to allow the recruitment of trainee clinical scientists and technologists. The application for funding takes due cognisance of factors such as service development and projected workforce turn over. To-date, this funding has resulted in the recruitment of both trainee clinical scientists and technologist, the vast majority of whom have taken up posts within medical physics services in Northern Ireland.

Clinical Technologists
Clinical Technologists in radiation physics fulfil critical roles in supporting medical physics service. Such staff will contribute to the more technical, day to day tasks involved in radiation protection service provision, such as testing and calibration of a wide range of equipment to national Quality Assurance standards, to ensure that equipment is working safely and achieving the clinical aim with the minimum radiation exposure. There is some cross over in the activities of the technologist and scientist for DR equipment testing so a broad skill base is required.

Clinical Technologists in Diagnostic Radiology and Radiation Protection are termed Healthcare Science Practitioners within the ESR coding system.

Registration with the Register of Clinical Technologists or the Academy for Healthcare Science Practitioner's Register is voluntary, and while it is a condition of employment for some posts, it is more likely to be listed as a desirable option. Additionally, registrants may de-register once in-post and employers are unlikely to check on the voluntary registration status of an employee unless performance is below par. Consequently, it is harder to track and define this workforce. Respondents were asked for number fulfilling a clinical technologist's role and eligible for registration, whether or not the individual actually maintains registration. There are currently no registrants in Radiation Physics listed on the Academy for Healthcare Science Practitioners Register.

The RCT register grandparenting scheme closed in 2011, and the equivalence route was not opened until 2015 so there will inevitably be individuals who were eligible by experience but did not satisfy the primary criterion of having completed an accredited training course and so had no route to the register until 2015. This is also true of those recruited from abroad. While some of those will have applied for equivalence since, many may not have done, not seeing the need since the register is voluntary, not mandatory.

IPEM Training scheme

IPEM has offered a training scheme for Clinical Technologists since 2001. This scheme offers the opportunity for individuals employed as trainees in an accredited training centre to complete a training program and achieve registration on the RCT. A Diploma in Clinical Technology is awarded.

An education-only route was also available, through accredited degrees, such as the B.Sc. Clinical Technology from De Montford University. Places on these courses attracted significant funding from the (then) Strategic Health Authorities, but this funding is no longer available and the courses have been discontinued.

Modernising Scientific Careers (MSC) Practitioner Training Program (PTP)

This has been operating in England since 2011, Wales since 2012, and in Northern Ireland since 2013. Applicants apply to a university offering an accredited course through the UCAS application procedure, in an analogous way to applying for radiography, nursing or midwifery.Unlike radiographer, midwifery and nursing students, students of healthcare science undergraduate degrees have never been eligible for an NHS bursary nor any financial assistance with course fees.

Only two universities are listed on the National School of Healthcare Science's website as having been accredited in radiation physics[viii]:

- University of Liverpool (Radiation Physics)
- University of Cumbria (Radiation Physics)

Cumbria has started to accept students via an apprenticeship route as of September 2017. No indication of current cohort sizes is available.

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[i] EFoMP Policy Statement 7.1 :https://www.efomp.org/uploads/policy_statement_nr_7.1.pdf

[ii] IPEM 2017 RT Workforce Census
[iii] https://www.nmc.org.uk/news/news-and-updates/new-nmc-figures-continue-to-highlight-major-concern-as-more-eu-nurses-leave-the-uk/
[iv] Insert relevant EU directive
[v] https://www.gov.uk/guidance/immigration-rules, https://www.gov.uk/guidance/immigration-rules/immigration-rules-part-5-working-in-the-uk
[vi] IPEM's Radiotherapy Physics Census 2015
[vii] National School for HCS London Consortium Project on increasing STP throughput
[viii] http://nshcs.org.uk/nhs-practitioner-training-programme