IPEM workforce

Radiotherapy Physics Workforce Review, Projection of Demand 2015-2020 and Implications for Training Programmes

Executive Summary

- A 2014 census of the RT Physics workforce identified the following.
  - 58.5 WTE Clinical Scientist vacancies.
  - 35 WTE physics technologist vacancies.
  - 29.5 WTE engineering technologist vacancies.
- The Clinical Scientist workforce developed a large shortfall in the form of unfilled vacancies in the current establishment (caused by service expansion and leavers) over the period 2007-2014.
  - This shortfall has been only partly redressed by a larger than usual out-turn in 2014, and this larger out turn will not take place again.
  - Projections show that if the rate of service expansion and leavers is maintained, then the following scenarios are likely.
    - If training places are limited by training capacity to 2014 levels, a shortfall will open up again.
    - If training places are increased in line with commissioned places, and training capacity is available to fulfil commissioned places, supply will eventually meet demand in the long term.
    - If demand increases by 10% (a very conservative estimate given planned expansions in service provision) then a large shortfall will rapidly open up.
- The shortfall in the physics and engineering technologist (practitioner) workforce has also been accruing for some time.
  - 30 physics practitioners are anticipated to qualify through the University of Cumbria's Graduate Diploma route by 2016 and a further 20 in 2017, however the majority are likely to be already employed in substantive posts and unavailable to fill the identified vacancies.
  - The IPEM Technologist Training Scheme is providing a small number of qualified staff.
  - Practitioner Training Programme degree courses are not attracting students.

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Abstract

This report uses data collected in the 2014 Radiotherapy Physics Workforce census along with past training records and information on current and future trainees to project future workforce growth and shortages. The effect of service expansion is also considered, as well the effect of increasing commissioned training places, and the possibility that training places may be limited by the capacity of training centres.

1.0 Workforce Background

The radiotherapy physics workforce consists of three staff groups, Clinical Scientists, physics technologists (also known as practitioners) (including dosimetrists) and engineering practitioners (also known as practitioners). This multi-professional team is critical to supporting a clinical radiotherapy service.

Clinical Scientists

Clinical Scientists are scientifically trained and their key roles can be summarized as follows.

- Management, development and scientific direction of the radiotherapy physics service.
- Ensuring the accuracy of radiotherapy treatment through scientific supervision of dose calculation procedures and of ongoing quality control of both equipment and treatment planning.
- Design and implementation of new and innovative treatments.
- Leadership of research and development, especially in the technological basis of radiotherapy.
- Providing advice on appropriate treatment techniques.
- Ensuring radiation safety.
- Management of computer systems including software design and development.
- Equipment management and procurement of radiotherapy equipment.
- Teaching and training of staff (including junior clinical scientists, clinical technologists, doctors, radiographers, nurses).

Clinical Scientists are termed Healthcare Scientists within the ESR coding system, which is used in England and Wales to code all employees. The Health and Social Care Information Centre draw much of their information from ESR codes.

Clinical technologists (practitioners)

Clinical technologists (practitioners) are responsible for producing individualised treatment plans, quality assurance testing, construction of patient immobilisation devices, and preparations of brachytherapy sources. These staff have had training in radiotherapy physics. Technologists solely involved in producing treatment plans are often termed dosimetrists, and these roles are frequently filled by therapy radiographers. While radiographers are a valuable source of dosimetrists, many departments believe that best practice is to employ a mixture of physics-trained and radiography-trained dosimetrists.

Other technologists are responsible for maintaining equipment and instruments necessary for treating radiotherapy patients and these have undergone training in radiation engineering.

Technologists, both in physics and engineering, are termed Healthcare Science Practitioners within the English and Welsh ESR coding system. The term Practitioner is now often used in England, Wales and Northern Ireland. It is not commonly used in Scotland. In this report the term technologist is used when describing the workforce as a whole, and practitioner to

describe those specifically exiting the Practitioner Training Programme or newly created roles in England, Wales or Northern Ireland.

2.0 Radiotherapy Physics Workforce Census 2014

In 2014 IPEM's Workforce Intelligence Unit carried out a census of the radiotherapy physics workforce. The census capture date was 31st August 2014.

This UK-wide census was sent to 66 radiotherapy centres (counting satellite centres separately), of which 56 replied. Two small private centres were not identified prior to inviting responses, so were not given the opportunity to respond. Since 2014 two satellite centres have opened, and a planned large centre has started recruiting bringing the current number of radiotherapy centres employing radiotherapy physics Scientist and Practitioners to 71.

Staff already recruited to work in the two satellite centres which opened since the census date were reported alongside the staff for the corresponding base centre, so in effect responses were received from 56 of the 68 radiotherapy centres treating patients in 2014.

The census identified:

- 58.5 WTE Clinical Scientist vacancies;
- 35 WTE physics technologist (practitioner) vacancies;
- 29.5 WTE radiation engineering technologist (practitioner) vacancies.

3.0 Background to Training in Radiotherapy Physics

3.1 Clinical Scientists

3.1.1 IPEM Training Scheme

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.

1) 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

2) 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.

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.

3.1.2 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. 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.

Scotland has elected to run a separate but similar scheme which maps to the outcomes of STP and enables Scottish trainees to be assessed for equivalence by the Academy for Healthcare Science.

3.2 Clinical Technologist training in Radiotherapy Physics and Radiation Engineering

3.2.1 IPEM Technologist 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 programme and achieve registration on the Register of Clinical Technologists (RCT). A Diploma in Clinical Technology is awarded. This scheme continues to run, but progression through the scheme in radiotherapy physics is currently slow, owing to a shortage of moderators. There is no such shortage of Radiation Engineering moderators.

An education-only route used to be available, through accredited degrees, such as the BSc 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.

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

This has been operating in England since 2011, in 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. Students exit after a 3-year course, involving a clinical placement in years 2 and 3, eligible to join the Academy for Healthcare Science Register or the Register of Clinical Technologists. However, unlike other healthcare disciplines, students on healthcare science undergraduate degrees are not eligible for an NHS bursary or any financial assistance with course fees.

PTP does not operate in Scotland, and IPEM has no knowledge of any Technologist Training in Scotland outwith IPEM's Technologist's Training Scheme.

Radiotherapy Physics

Only four universities are listed on the National School of Healthcare Science's website as having been accredited in radiotherapy physics[i].

De Montfort University (Medical Physics)

University of Liverpool (Radiotherapy Physics)

University of Cumbria (Radiotherapy Physics)

Swansea University (Radiotherapy Physics)

Of these, only Swansea University has ever recruited students[iii] to an undergraduate Healthcare Science (Radiotherapy Physics) course. The Welsh Assembly provides financial assistance for a small number of students (approximately 5 p.a.) undertaking this course.

Two cohorts of students have received funding to follow a Graduate Diploma in radiotherapy physics at the University of Cumbria (commenced September 2013 and September 2014), and two further cohorts will be funded to commence in September 2015 and 2016, but funding for this route is not anticipated to continue in the future. This will leave only one PTP accredited course training radiotherapy physics practitioners in the whole of the UK.

Radiation Engineering

Only one university is listed on the National School of Healthcare Science's website as having been accredited in Radiation Engineering[i].

University of Bradford (Radiation Engineering, accredited September 2013)

Information from the University of Bradford[ii] is that a maximum of 10 students may be recruited per annum, across all four Clinical Engineering (Radiation Engineering, Rehabilitation Engineering, Renal Technology and Medical Engineering) programmes. The cohort due to exit in 2015 is anticipated to number less than 10, across all four programmes. The breakdown per specialty is unknown, but no more than 2 can be anticipated for Radiation Engineering.

4.0 Training Numbers Past, Present and Future

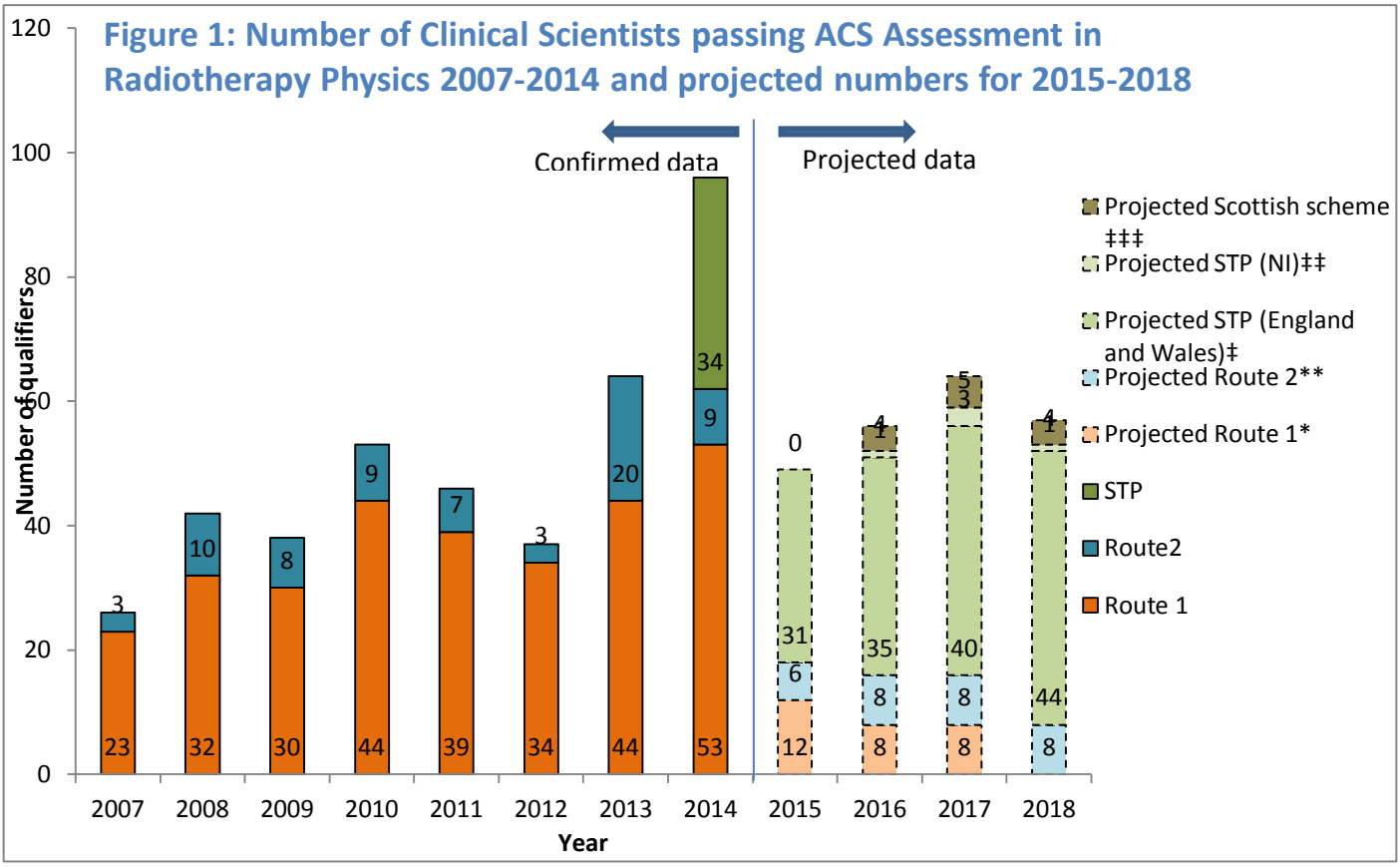
4.1 Clinical Scientists

IPEM's Membership and Training Department holds records on individuals registering for Part 1 and Part 2 of the former IPEM Training Scheme, including completion date and specialty. In addition the ACS sends IPEM a spreadsheet of successful candidates from all routes (including 'Route 2' training, who may not have registered with IPEM) after each assessment round (held three times a year) detailing trainee's name, specialty and assessors. From these spreadsheets the total number of successful radiotherapy candidates

qualifying from all routes in each year have been identified, and cross-checked against IPEM's records to determine which training route they utilised.

The National School of Healthcare Science (NSHCS) has supplied data about the Scientist Training Programme (STP). The combined data is summarised in figure 1 overleaf:

Figure 1: Number of Clinical Scientists passing ACS Assessment in Radiotherapy Physics 2007-2014 and projected numbers for 2015-2018



**Route 2 projected numbers are based on the number currently registered on IPEM part 2 intending to submit via this route, and a presumption that numbers will be similar to those in the recent past.

‡ STP (England & Wales) projected numbers are based on the number of known commissioned STP training posts, combined with either the number opting for RT (if known), or assuming that 60% opt for RT, based on historical data. A 7% attrition rate was also applied; the attrition from the first (2011) STP cohort was 18%, but was 7% for those who chose RT, and the second (2012) cohort was 7%.

‡‡ Projected numbers for the NI STP has been supplied by Canice McGivern, Head of Medical Physics, Belfast Health & Social Care Trust

‡‡‡ Projected numbers for the Scottish scheme have been estimated based on previous training numbers. Representatives have been asked for more concrete data.

The number of Clinical Scientists trained in radiotherapy each year through the IPEM Training Scheme over the period 2007-2013 has fluctuated significantly, but has averaged 43 per year since 2010. An unusually large number of individuals qualified in 2014, because of the changeover from a 4-year training programme to a 3-year training programme with qualifiers from both programmes; this will not be repeated in future years. The dip in 2012 can also be attributed to the change in training arrangements, as commissioners are reported to have commissioned fewer ACS Route 1 places, in anticipation of the upcoming STP.

The number qualifying through Route 2 has also fluctuated over the time period analysed. The unusually large number submitting for assessment in 2013 may be attributed to

uncertainty regarding the change in training scheme and assessment process, and is unlikely to take place again.

4.2 Technologists (Practitioners)

4.2.1 IPEM's Technologist Training Scheme

Figure 2 below shows qualifiers in radiotherapy physics and radiation engineering from IPEM's Technologist Training Scheme:

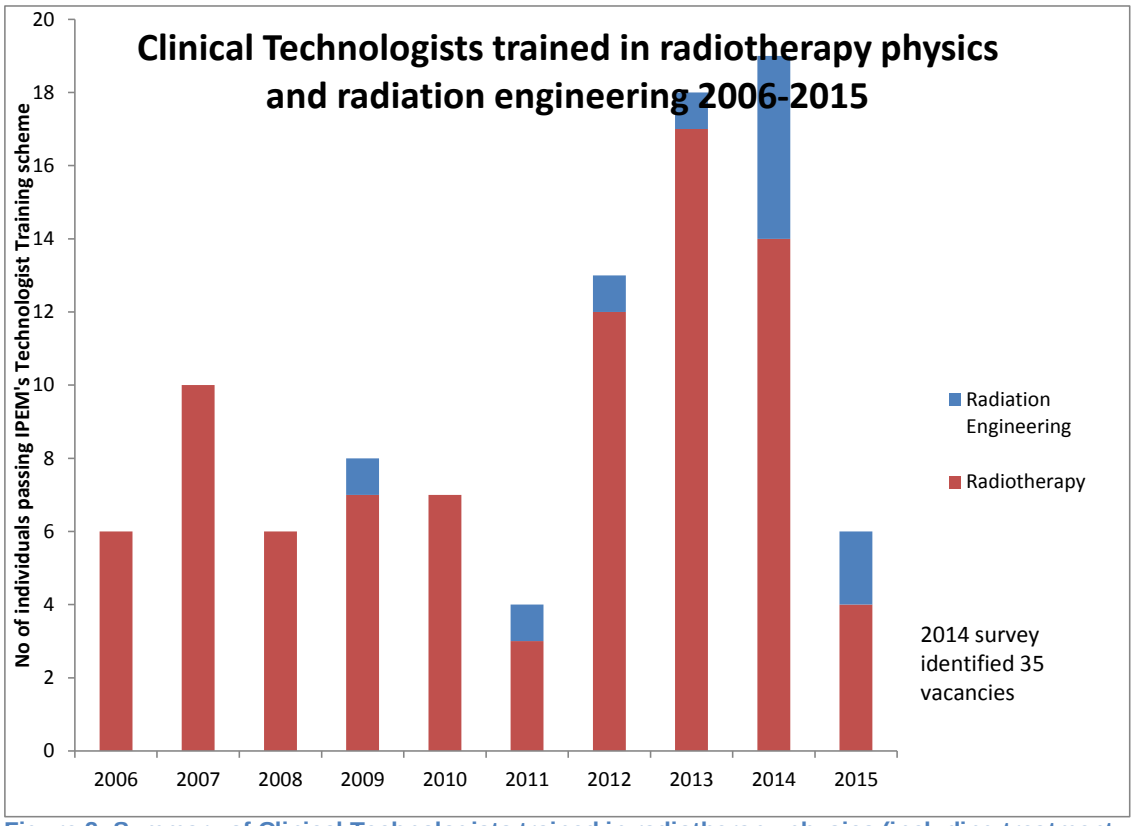


Figure 2: Summary of Clinical Technologists trained in radiotherapy physics (including treatment planning and mould room) and radiation engineering

There are 17 trainees currently registered on IPEM's Technologist's Training Sceme in radiotherapy physics, treatment planning and radiotherapy technology, and 15 in radiation engineering. Some are already overdue for completion, held up by a shortage of moderators.

4.2.2 Graduate Diploma at University of Cumbria

This is a two-year part time, funded, graduate diploma leading to a GradDip (Medical Physics) and registration with the RCT or the Academy for Healthcare Science's Register of Healthcare Science Practitioners. A cohort of 10 is anticipated to exit in summer 2015, and a cohort of 20 is anticipated to exit in 2016. Two cohorts have been funded for September 2015 and September 2016 starts, and numbers are anticipated to be around 20[iii]. This is a welcome and essential addition to the physics practitioner workforce, but does not solve the problem of future supply.

4.3 How do the recently-qualified figures fit in to the shortage identified?

4.3.1 Clinical Scientists

The Workforce Intelligence Unit's 2014 census of the radiotherapy workforce identified 58.5 WTE vacancies in the Clinical Scientist radiotherapy physics workforce.

STP is used by England, Wales and Northern Ireland; Scotland has developed a parallel programme, but no Clinical Scientists on the Scottish programme are due to qualify in 2015. ACS Route 1 was used by all four countries.

The maximum number of STP trainees available to fill these vacancies would be 34. However, by the census date of 31st August many of the trainees would already have secured substantive roles and therefore would not have been available for employment.

We can assume that all those passing ACS assessment in January 2014 and June 2014 are employed in substantive roles by the 31st August census point. That leaves the 20 Route 1 candidates who passed ACS assessment in October 2014. Many centres (e.g. Wales and the Northern consortium) routinely appointed Part 2 trainees to substantive roles to complete their training. Others (eg East of England and Leeds) employed Part 2 trainees on training contracts, but over 50% of individuals transferred to substantive roles prior to completion of training, if a vacancy arose. Consequently, we estimate that 15 of these October qualifiers were already employed in substantive roles at the 31st August census point, which leaves 5 individuals available to fill the vacancies identified in the 2014 census.

One individual qualified through Route 2 at the October 2014 assessment, but since Route 2 candidates are almost always in substantive employment, this individual will not be available to fill a vacancy.

Therefore the **maximum** number of newly-qualified Clinical Scientists to fill 58.5 vacancies is approximately 39 (34 exiting STP, 5 exiting ACS Route 1), which still leaves a significant shortage (19.5). It is likely that the actual number of unfilled vacancies is higher than 19.5, because, for reasons discussed above, the number of newly-qualified clinical scientists available for employment is almost certainly lower than the maximum of 39. Additionally the emergence of newly-qualified Clinical Scientists does not address the difficulty in filling posts requiring experienced members of staff. However, recruitment of early career scientists may allow promotion of more experienced staff into senior positions, provided sufficient vacancies are filled.

4.3.2 Technologists

Those qualifying through the IPEM training scheme will be unavailable to fill the vacancies identified in the 2014 census, as they qualify while employed in an established position.

The 30 practitioners anticipated to qualify with a graduate diploma in Radiotherapy Physics from the University of Cumbria (10 in 2015 and 20 in 2016) will go some way towards redressing the shortage by 2017, but an unknown number of these trainees will already be employed in substantive posts, and will therefore be unavailable to fill vacancies.

Consequently it is unknown to what extent the shortage of physics technologists (practitioners) will be redressed by those exiting from the Graduate Diploma in 2015 and 2016, but it is likely that the shortage will be redressed by 2018 as the Cumbria training route is now available for 40 new recruits (20 starting in 2015 and a further 20 in 2016).

Not all of the vacancies identified are at entry-level, but the availability of early-career staff may allow more experienced staff to move into higher-level positions. However, since demand is anticipated to continue to grow, an even larger shortfall will be created by 2018, unless adequate training provision is in place.

In NHS Grampian, a recent attempt to recruit to several trainee technologist positions resulted in no offers of appointment being made. A second recruitment round is taking place in 2015; but should appointments be made, they will not qualify for some time.

The very small number (<5) of qualified radiation engineering practitioners anticipated to exit from the sole PTP provider at the University of Bradford is insufficient to redress the 29.5 WTE shortfall, either now, or in the future.

The shortage of training for radiation engineering practitioners remains an extreme cause for concern, with only one PTP course provider supplying a very small number of trained staff unable to redress the shortfall.

Training provision in Scotland for radiation engineering technologists is unknown.

5.0 Training Capacity and Other Input to the Workforce

5.1 Clinical Scientist training

5.1.0 Training capacity

The projected outturn of Clinical Scientists shown in Figure 1 is based on an increase in the number of commissioned places. It makes the assumption that all the commissioned places will be filled. However, the majority of training centres have said that they are already operating at capacity and are unlikely to be able to offer more training places. In a recent survey of training centres (28/34 responded), 60% reported that they would be unable to offer increased training capacity, another 25% are limited by the demands of training in other specialties and the remaining 15% may be able to offer limited additional capacity. Several training centres report that they are able to train fewer trainees under STP than under the former IPEM scheme owing to the more onerous supervisory requirements. There may therefore not be the option to simply increase training places to meet demand.

Scotland recruits supernumerary Clinical Scientist Trainees annually through a national recruitment process.

5.1.1 Trainee retention

The IPEM Part 1 training scheme attrition rate in training was around 4.5% over all specialties

Of the two years for which data is available the attrition rate from the Medical Physics theme of the STP scheme has been 18% and 7% for 2011 and 2012 respectively.

5.1.2 Retention after training

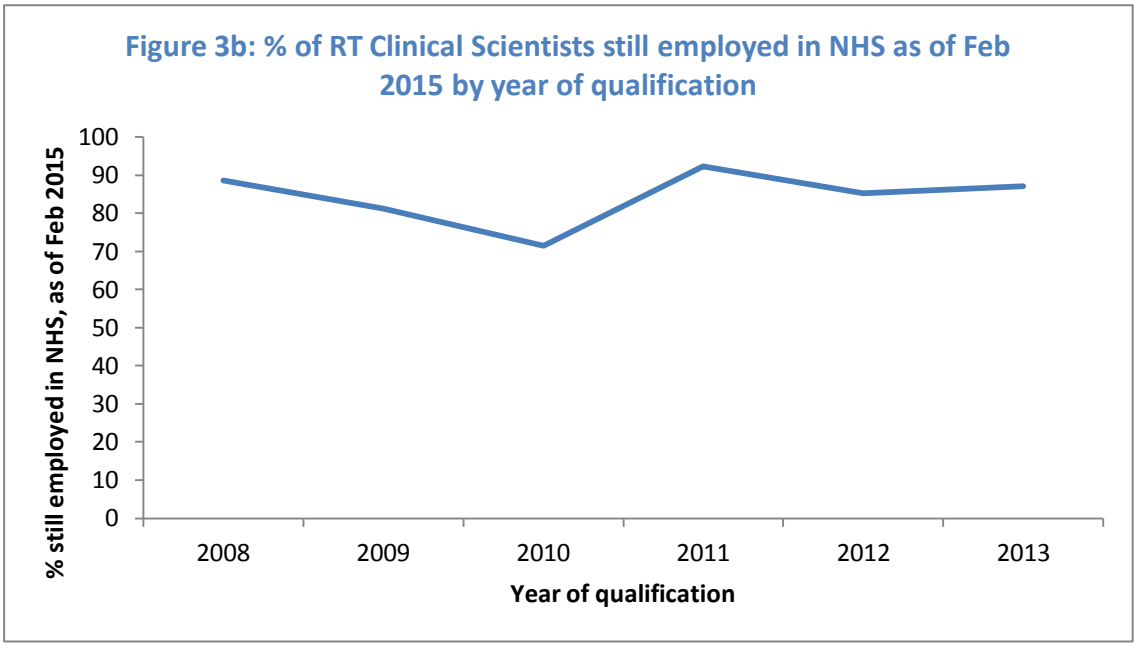
Little historical data is available on the retention of radiotherapy staff. However, of all the individuals who were assessed by ACS in radiotherapy physics during the period 2008-2013, and who were registered with IPEM for either Part 1 or Part 2 (or both), all but 6/243, remain members of IPEM, so IPEM membership records can be used to follow the careers of the vast majority of these individuals.

From IPEM records of current employment, 90% of the individuals from all of these cohorts remain employed by the NHS as of February 2015. Data are shown in chart and graph format in Figure 3a &b overleaf.

Figure 3a: Table showing destinations of Clinical Scientists after training

	2008	2009	2010	2011	2012	2013
Total known to IPEM (reg for either Part 1 or Part 2 or both)	35	32	49	39	34	54
Still in NHS RT Feb 2015	31	26	35	36	29	47
Still in NHS other specialty			1			
Abroad	2	4	5		2	5
Private		2	2	3	1	1
Industry	1		1			
Academia	1		1			1
Unknown*	1		3		2	
Number left NHS	5	6	12	3	5	7
% still in NHS	**89**	**81**	**71**	**92**	**85**	**87**

**Those who are unknown are no longer IPEM members*



Several senior radiotherapy staff have expressed concerns regarding the increasing number of trained personnel leaving, citing staff moving abroad, and to private employers as their main concern.

The individual numbers at present are not high, suggesting that this concern is not yet a reality; however with private radiotherapy provision expanding rapidly, this may well change in the future. If individuals do leave, they are mostly moving abroad or securing employment in the private sector. Very few appear to have left the profession entirely.

The provision of radiotherapy in the private sector is increasing. A NATCANSAT map in 2012 showed that five new private centres had opened since 2009, and it is believed at least another two centres are in the planning stages. In addition, on 4th April 2015, Proton Partners International announced the opening of three new proton and conventional radiotherapy centres in 2016, all of which will require qualified staff.

There is not enough information available at present to predict a trend, but data on the destination of past trainees should continue to be collected.

5.2 Technologist training

5.2.1 Training Capacity

Training capacity is hard to determine; no figures are available as to how many training places are available. The concern in England and Wales is rather the attractiveness of the Practitioner Training Programme. Four accredited centres provide a BSc in Healthcare Science (Radiotherapy Physics), but only one is actually running the course. It should be noted that there is limited visibility of the technologist or practitioner profession, and with no NHS bursary available the course is unlikely to be attractive to A-Level students. Those in work who wish to move into this profession are unlikely to cease paid work, and probably relocate, in order to complete a relevant degree and achieve registration. A radiography degree is also a route to registration, and to working in a technologist role in radiotherapy. Radiography undergraduate degrees attract NHS bursary funding, so until there is parity with the radiography training route, the PTP is unlikely to be successful in attracting potential physics practitioners.

In addition, anecdotally, training placements have been difficult to secure; with reasons relating to lack of funding and length of placement being cited. It is necessary to secure places in a geographically convenient centre for each Higher Education Institution.
The IPEM training scheme provides a valuable route to registration, but throughput at present is insufficient, owing to difficulties in recruiting moderators. In Northern Ireland and Scotland, the IPEM scheme is the only formal training route.

5.2.2 Trainee retention

We have no information on retention of trainees in training.

5.2.1 Retention after training

The current working location of all the individuals who have come through the technologist training scheme since 2006 is shown in Figures 4 and 5 below. The 23% (physics) and 9% (engineering) staff categorised as 'unknown' are no longer known to IPEM. They may have simply resigned their membership of IPEM, or they may have left the profession entirely.

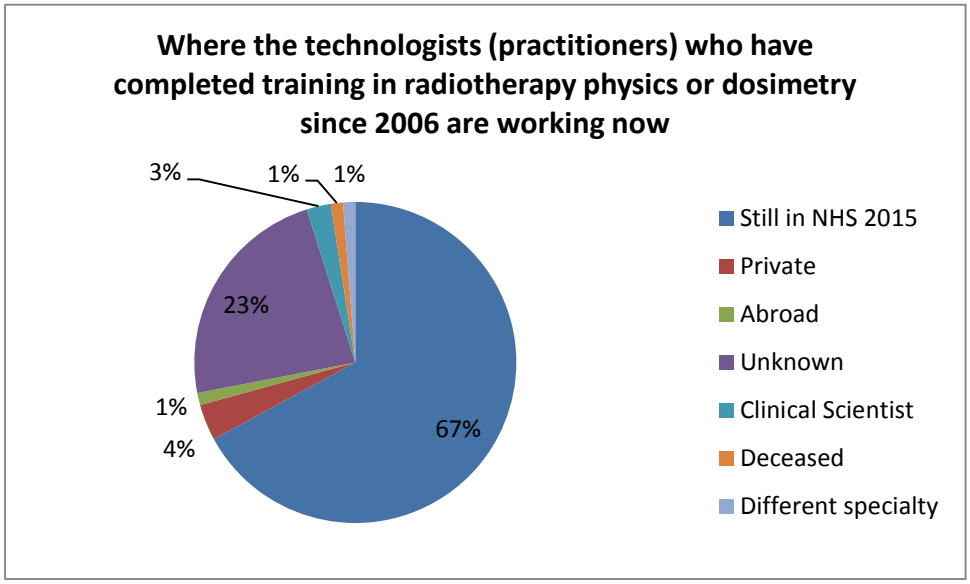


Figure 4: Showing current work situation of all technologists who have completed training in radiotherapy physics or dosimetry since 2006

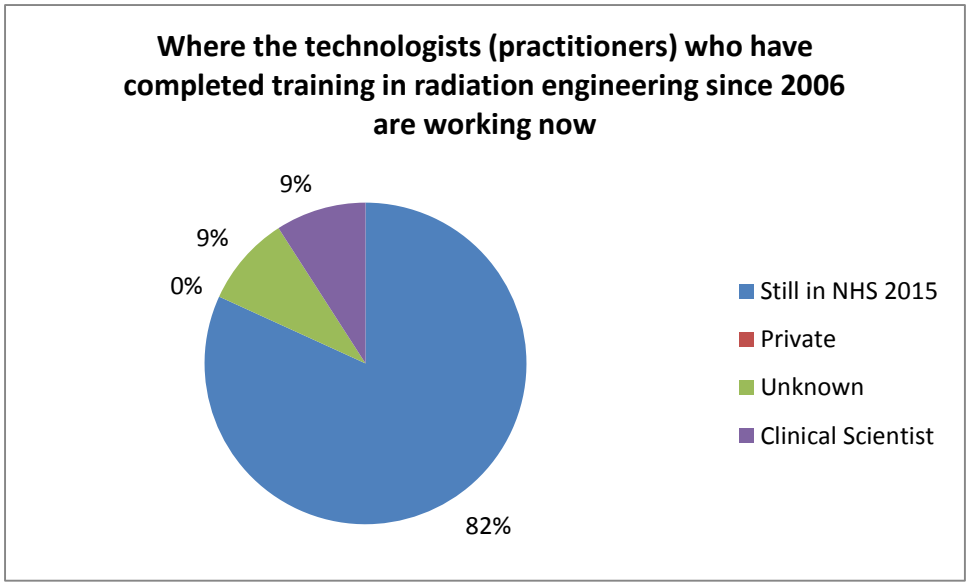


Figure 5: Showing current work situation of all engineering technologists who have completed training in radiation engineering since 2006

At present, retention after training appears to be good. However, concerns continue to be expressed over the possibility of losing trained staff to the growing private sector.

5.3 Other input to the workforce: recruitment from overseas

As well as trainees qualifying either through Route 1, Route 2 or STP, many centres report successfully recruiting from overseas, including from India, Australia and New Zealand. Radiotherapy Physics Scientist and Practitioner have been on the National Shortage Occupation List (NSOL) since 2009 and remain on the list in 2015, following IPEM's contribution of evidence to the Centre for Workforce Intelligence which advises the Migration Advisory Committee (MAC). Retention on the list facilitates application for a visa as it bypasses the need for the resident labour market test. The MAC views the NSOL as a short-term measure and is looking to remove occupations from the list as soon as the shortage is redressed, and the workforce supply is robust. No information is available regarding the number of Clinical Scientists or technologists recruited from overseas in recent years.

5.4 Retirement of existing workforce

IPEM's 2014 radiotherapy physics census found that approximately 70 individuals in the Clinical Scientist workforce were aged over 55, and could reasonably be expected to retire in the next 5 years, creating more vacancies. Additionally approximately 35 individuals in the technologist workforce were aged over 55, and could reasonably be expected to retired in the next 5 years, creating more vacancies. Approximately 30 of these individuals are currently working in England and 5 in the devolved countries.

More work is required to determine how this compares to previous years and to project the impact of retirement in the future.

6.0 Workforce Demand due to Service Expansion

6.1 New centres

In the period 2009-2012 six new radiotherapy centres were opened, with a further four in the period 2012-2015. The table below (Figure 6) details the information available on anticipated demand for radiotherapy Clinical Scientists and physics practitioners.

Figure 6: Summary table of new radiotherapy centres over the time period 2009-2016

2009-2012	2012-2015		2015-	
Exact recruitment figures unknown; included for comparison of number of centres	Scientist	Practitioner (Physics)	Scientist	Practitioner (Physics)
Christie satellite-Oldham	Hereford (fully recruited)	Hereford (fully recruited)	Christie-PBT** (10 vacancies*)	Christie-PBT (8*)
Christie satellite-Salford	Worcester (partly recruited)	Worcester (partly recruited)	UCLH-PBT (16 vacancies*)	UCLH-PBT (6*)
Peterborough	Basingstoke (partly recruited)	Basingstoke (fully recruited)	Altnagelvin (7 vacancies*)	Altnagelvin (11*)
Redhill	Bracknell (fully recruited)	Bracknell (fully recruited)	Basingstoke (2 vacancies*)	
Beacon Centre (Taunton)			Worcester (3 vacancies*)	Worcester (7 in total, 4* vacancies)
Clatterbridge satellite				

*These are vacancies specifically for qualified RT professionals only, not for others in the team.

**Sites labelled 'PBT' are the new NHS England Proton Beam Therapy centres.

This suggests a minimum of 40 new posts for radiotherapy Clinical Scientists to be added to the existing workforce establishment. More centres have opened or are due to open in the three-year period 2012-2015 than in the three-year period 2009-2012, and the expertise and skills demand are different. This is reflected in the greater demand for Clinical Scientists anticipated for the proton centres than for a conventional centre or for a satellite centre (the latter has host centre support which may reduce local workforce needs) .

It is also likely that a minimum of 29 new posts for radiotherapy physics practitioners will need to be added to the existing workforce establishment. The new centres opened and due to open in 2015-2018 appear to require a similar number of staff to those that opened in the 3-year period 2009-2012, suggesting that the increase in workforce demand owing to the expansion of the service will continue in the immediate future. The demand for engineering technologists in new centres is unknown.

We also note that in April 2015 a private consortium announced the opening of three Proton Beam Therapy Centres in 2016, which, should they go ahead, will also require qualified staff. There may also be other private initiatives in the pipeline.

6.2 Seven day working

A full discussion on the staffing impact of seven-day working can be found in an IPEM working party report[iv]. The report recommends that rather than simply scaling by a ratio of new to existing hours, a combination of patient and equipment factors be used. This information is not available at present, but applying a crude ratio method across all centres, a 40% increase in workforce would be required. The actual figure required is likely to be lower than this, but still significant. Even a 10% increased requirement would necessitate an additional 60 WTE Clinical Scientists, 30 WTE physics practitioners and 30 WTE engineering practitioners which in a workforce already experiencing shortages is very significant.

6.3 Other workforce factors

A number of other factors will also impact on the number of qualified radiotherapy physics staff required in the future.

- New techniques and developments in radiotherapy.

- Change in skill mix with more routine tasks being delegated to technologists/practitioners.
- The persistent understaffing owing to vacancies.
- The severe shortage of radiation engineers.
- The lack of a training pipeline for physics or engineering technologists (practitioners).
- The effect of the loss of supernumerary Part 2 trainees who contributed significantly to service delivery. STP trainees, with a shorter training period, do not contribute in the same way.
- The number of qualifying Clinical Scientists who do not remain in the profession or maintain their HCPC registration.

Engineering support in radiotherapy centres is also often provided via service contract agreements with equipment manufacturers, who often train their own staff. For this reason, we have not attempted to model the engineering workforce.

6.4 Is the number of anticipated qualifiers sufficient to accommodate expected service growth?

6.4.1 Clinical Scientists

While the number of vacancies has been reduced, there is still a significant shortage. This leaves the question as to whether this shortage can be duly redressed with time, or whether the deficit will continue to grow. Increasing the number of commissioned places may not be deliverable or sufficient to meet demand, as this will depend on a number of other important factors, including training capacity, trainee retention, retention after training, retirement of existing workforce, other inputs to the workforce, and additional demand created by planned service expansion, which are examined in section 7.1 and 8.

6.4.2 Technologists

Radiotherapy Physics

The main concern regarding the number of anticipated qualifiers is that future supply is unclear. The postgraduate diploma programme at the University of Cumbria is not anticipated to continue past the 2016 intake. The PTP training route is training very few (<5) individuals at Swansea University, with other accredited centres not recruiting. It is probable that the Swansea course, in part funded by the Welsh Assembly, will only supply the needs of the three Welsh radiotherapy centres; it is certainly insufficient for the whole of England and Wales. It is unclear where or how the future workforce will be trained. Even if the postgraduate diploma programme is to continue, the only route now available to individuals without a degree is IPEM's Technologist Training Scheme.

Seventeen individuals are currently registered on IPEM's Technologist Training Scheme, but owing to difficulty in moderator availability, throughput is insufficient.

Radiation Engineering

There are insufficient qualifiers to redress the current shortfall, and serious concerns over meeting future demand with the planned expansion. Fifteen individuals are currently registered on IPEM's Technologist Training Scheme.

7.0 Modelling the Workforce

Service expansion in the form of new centres over the next four years is expected to be comparable to that in the period 2008-2012, if not greater. The opening of at least two new specialised proton centres, and a greater number of conventional centres, means that demand for radiotherapy physics professionals is likely to increase.

7.1 Clinical Scientists

The chart overleaf (Figure 7) shows workforce supply to date (red line) projections based on a baseline case with demand continuing as in the past (green line), and on a 10% increase in demand (orange line), a very conservative estimate of the expansion needed for example to accommodate extending working hours.

The chart overleaf also shows the available data modelled using the following assumptions.

1. Additional demand over and above existing workforce has been calculated from the number of staff qualifying, and the number of vacancies developing.
2. The number of qualifiers entering, and remaining in UK employment as Clinical Scientists remains constant.
3. Retirement remains constant.
4. Leavers, such as those going overseas and to the private sector, remain constant.
5. Recruitment from overseas remains constant.
6. The number qualifying through Route 2 remains similar to past levels.
7. Projected out-turn calculated from projections as in the chart on page 2 combining Route 1, Route 2, STP in England, Wales and NI, and the Scottish Training Programme.
8. Alternative scenarios based on the following assumptions.
    1. 30 of the STP and ACS October qualifiers did not have jobs at the 2014 census point, and therefore are available to fill the vacancies identified in the 2014 census, future STP places as commissioned (see figure 1 for commissioning details).
    2. 30 of the STP and ACS October qualifiers did not have jobs at the 2014 census point, and therefore are available to fill the vacancies identified, future training is limited by capacity to 35 places per annum.
    3. 10 of the STP and ACS October qualifiers did not have jobs at the 2014 census point, and therefore are available to fill the vacancies identified, future STP places as commissioned.
    4. 39 of the STP and ACS October qualifiers did not have jobs at the 2014 census point, and therefore are available to fill the vacancies identified survey, future STP places as commissioned.
9. All individuals still in contact with IPEM, and currently still registered on Route 1 will qualify in either 2015, 2016 or 2017.
10. STP projected out-turn based on commissioned and filled posts for 2015-2017.

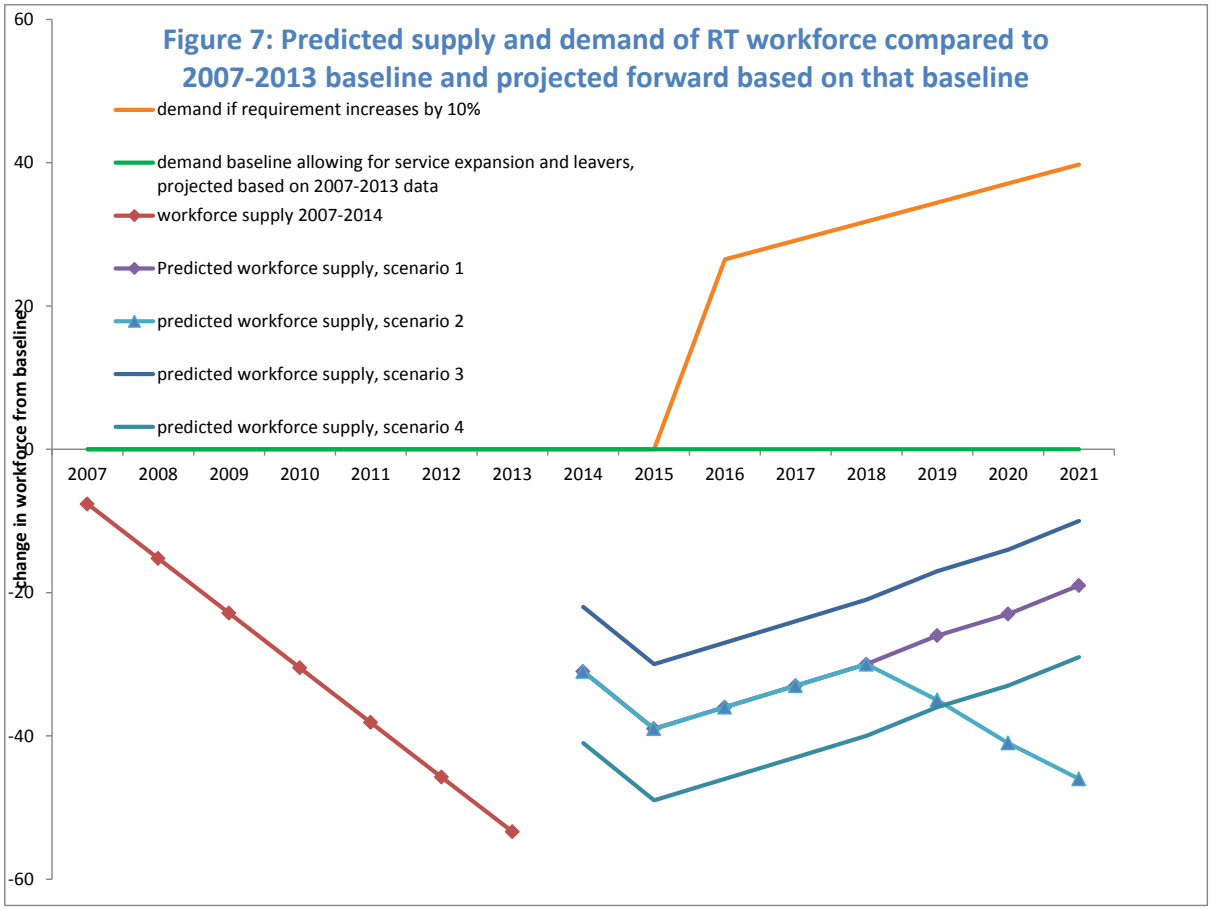


Figure 7: Predicted supply and demand of RT workforce compared to 2007-2013 baseline and projected forward based on that baseline
demand if requirement increases by 10%
demand baseline allowing for service expansion and leavers, projected based on 2007-2013 data
workforce supply 2007-2014
Predicted workforce supply, scenario 1
predicted workforce supply, scenario 2
predicted workforce supply, scenario 3
predicted workforce supply, scenario 4
Change in workforce from baseline
60
40
20
0
-20
-40
-60
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021

7.2 Clinical technologists (physics)

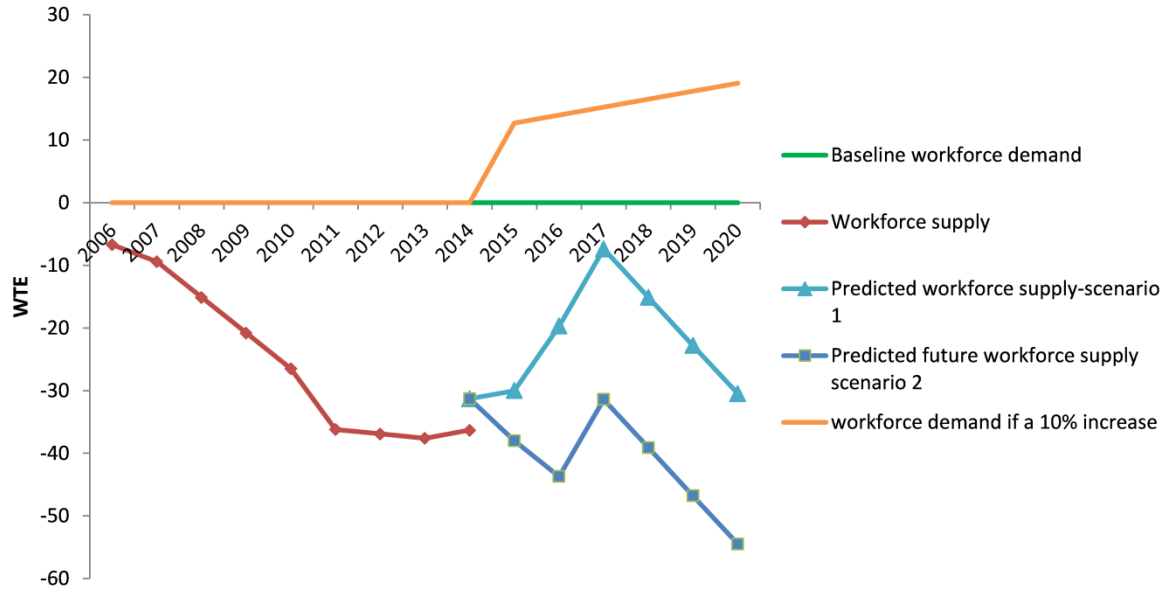
Figure 8 overleaf shows workforce supply to date (in red) and projected workforce demand 2015-2021, based on the following models.

- The workforce demand continues in the near future as it has in the past. This is the baseline demand, shown in green and is based on the following assumptions.
    - Additional demand over and above existing workforce has been calculated from the number of staff qualifying, and the number of vacancies developing.
    - The number of retirees and other leavers remaining constant.
    - Recruitment from overseas remaining constant.
    - There is no source of trained staff other than IPEM's technologist training scheme, the postgraduate diploma route, the Practitioner Training Programme, and recruitment from overseas.
- Demand increase by 10%, shown in orange.
- Two scenarios for predicted workforce supply, shown in blue based on the following assumptions.
    - Known out turn from the GradDip programme for 2015-2017.
    - 5 per annum anticipated PTP outturn from Swansea PTP.
    - 19 staff currently registered on IPEM's Technologist Training Scheme are not included, as these individuals are in employment and therefore unavailable to fill vacancies. However, it should be noted that qualification of these individuals may allow for recruitment of new in-service trainees

        1. Scenario one: 10% of current cohort of graduate diploma trainees were already employed in a substantive post at the 2014 census, and therefore cannot fill vacancies

        2. Scenario two: 90% of current cohort of graduate diploma trainees were already employed in a substantive post at the 2014 census, and therefore cannot fill vacancies.

Figure 8: Predicted supply and demand of RT Practitioner workforce compared to 2007-2013 baseline and projected forward based on that baseline



8.0 Summary

Over the period from 2007-2014 a large shortfall of Clinical Scientists developed in the form of unfilled vacancies in the current establishment, most likely as a result of service expansion. This has been partly redressed by a larger than usual out-turn in 2014 only, owing to the cross-over of IPEM and STP training schemes. However, the shortage of at least 20 WTE is still significant. With service expansion anticipated to continue, but training capacity no greater, or even less, than in previous years, the increased training commissions will not be sufficient to continue to address the shortfall particularly in view of other factors such as retirees and leavers. The projections show that if the increase in demand remains the same as in previous years, which the service expansion in the form of new centres suggest it will, then this deficit will not be redressed. The size of the deficit is dependent on the number of training places available; if training capacity is not increased, or if there is even a 10% additional increase in demand, then a very significant deficit will develop. Even if Scotland and Wales are training enough staff for local needs, then unless England is also training sufficient staff, a vacancy issue may arise in both Scotland and Wales if trained staff are drawn to England.

Similarly, to date, technologist supply has been unable to meet demand, creating a shortfall as of 31st August 2014 of around 35 WTE. For the physics specialty, this will be partly redressed in the short-term by those exiting from the Cumbria graduate diploma programme. The extent to which the shortage is redressed is dependent on how many of the anticipated out-turn from the graduate diploma programme were employed in substantive posts at the 2014 census date. Irrespective of this, there is evidence that demand will continue to increase as the service expands. The projection shows that should a 10% increase in the number of staff be required, such as for 7-day working, then even with the numbers exiting the graduate diploma at Cumbria, a shortfall will rapidly be created again. It is of extreme concern that there is currently no viable training route to produce qualified practitioners. Even should the graduate diploma route continue, the lack of a degree route would be a cause for concern. This concern is UK-wide; only Wales has a robust, on-going training programme in place, and Wales is unlikely to be able to retain trained staff if significant vacancies arise in England.

The IPEM Workforce Intelligence Unit will continue to monitor training factors (capacity, outturn, attrition) and seek additional information on qualifier destinations and retention, retirement rates, recruitment from overseas and the impact of seven day working, amongst other factors.

IPEM is concerned that the pipeline for the future supply of Radiotherapy Physics, Scientists and Practitioners and Radiation Engineering Practitioners is seriously compromised, especially in view of the planned service expansion.

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[i] http://nshcs.org.uk/nhs-practitioner-training-programme

[ii] Information from Peter Twigg, Director of Studies for Medical and Healthcare Technology, University of Bradford

[iii] Information from Claire Hardiman, Professional Lead for Medical Physics, National School of Healthcare Science

[iv] "Position Statement: The Impact of Extended Clinical Hours on a Radiotherapy Physics Service" available at: http://www.ipem.ac.uk/Portals/0/Documents/Publications/Policy%20Statements/Radiotherapy%20Extended%20Working%20Hours%20Position%20Statement%20Sep%202014.pdf