Workforce Review: Radiology

Aligning demand and capacity in a changing healthcare environment

GE Healthcare Partners
July 2018
Executive Summary

There is a national radiology workforce shortage that impacts on the cost and quality of care. Action is needed to address this shortfall and better manage demand. Evidence suggests a number of potential approaches.

This paper evaluates the position of the clinical radiology workforce in the UK and considers the UK against the international position.

In respect of staff numbers, the UK has fewer radiologists per head of population than the European average.

- In 2015, the UK had an estimated 4.8 consultant radiologists per 100,000 people and 7 radiologists (including trainees) per 100,000 people. This is one of the lowest in Europe, and compares to a mean of 12 radiologists per 100,000 population for Western Europe.
- The vacancy rate for radiologists across the UK was 10% in 2015.

This impacts on cost and quality.

Evidence shows that workforce shortages in radiology are impacting:

- Cost: expenditure on overtime, outsourcing and agency staff across the UK increased from £58.3m in 2013/14 to £88.2m in 2014/15.
- Waiting times and reporting turnaround times.
- Overall system performance, e.g. emergency flow.

Looking ahead, radiology services face pressure from the need to replace an ageing workforce and from growth in demand.

- 34% of the UK radiology consultant body in the UK are aged 50 or over.
- An estimated one-third of the current UK consultant radiology workforce will retire within the next ten years (2015 – 2025). Within the next fifteen years (2015 – 2030) around half of the current workforce will retire.

In respect of expansionary pressures, the service is experiencing rising demand (5-10% per year) and the need to adapt to the needs of new models of care (including the trend towards specialisation).

While there are significant challenges before the radiology workforce across the UK, solutions are emerging that can minimise the impact of current and future shortages.

These centre on:

- international recruitment
- increasing retention rates and encouraging return to work
- outsourcing
- increasing training places (with a focus on generalist skills) and potentially new training models; and
- demand management and service transformation (with advanced roles for regional radiology networks).

Whilst no one approach alone will fully resolve the challenges, building a programme of work and nurturing the workforce based on a blend of these approaches can mitigate the impact to cost and quality and can help improve patient care, overall.
Introduction

A reliable imaging service is central to the delivery of effective clinical services.

Why diagnostic imaging matters
Diagnostic imaging refers to a variety of non-invasive practices for diagnosing and monitoring diseases or injuries via the generation of images of internal anatomical structures and organs (NHS Scotland Shared Services, 2016).

Imaging has a central role in modern healthcare, with almost all patient pathways reliant on an effective and efficient service to deliver the best outcomes and patient experience (College of Radiologists, 2016a). More than ever, a radiologist or radiographer report is central to patient decision-making, care and treatment (Royal College of Radiologists, 2014).

The NHS is aware that gaps in the radiology workforce risk undermining its success due to the pivotal role that diagnostic imaging plays in patient pathways. Diagnostic imaging services in England are struggling to meet ongoing growth in demand. Existing demand already exceeds base capacity and forecasts show the capacity gap will continue to widen. Services are unsustainable in their current form.

Current challenges will be exacerbated by new and emerging technologies, an ageing patient population with changing health needs and a drive towards seven day working. Ambitious plans for new care models and improved cancer outcomes require novel approaches, maximising the skills of the entire imaging team. The status quo is no longer an option (College of Radiologists, 2016a).

This report
This report presents a picture, firstly, of the challenges within the sector. It considers the gap in capacity, for both radiologists and radiographers at an international level and then nationally. It looks at both sides of the equation, demand for imaging and the availability of professionals.

It then reviews the evidence regarding the impact of the misalignment and what is known about the consequences of the imbalance.

The first section concludes by looking ahead and how the situation will be exacerbated by predicted changes in key drivers of demand and supply, in the coming years.

Section two looks at solutions and how different systems are working to address the gap.
The Challenge

This section offers an overview of the demand and capacity challenge facing radiology services nationally and internationally.

After evaluating the workforce numbers, it considers the impact of the current skills gap on cost and quality. The section closes by looking at expected future demand.

Key messages:

1. The UK has the second smallest radiology workforce within Europe, with 7 per 100,000 compared to a mean of 12.
2. Whilst the demand for imaging in the UK is growing, requests for CT and MRI scans are still low, compared to other countries (this may reflect the desire to minimise patient exposure to radiation).
3. In the UK, c.10% of radiology posts are vacant and c.8% of radiographer posts.
4. Gaps in the radiology workforce impact on many aspects of service delivery, including extensive overtime working, delays in reporting and the increased use of costly, external providers.
5. Looking ahead, one third of radiologists currently working will retire within the next ten years.
6. In addition to the pressure created by retirements, demand is set to increase, driven by demographics and new care models.
7. By 2025, the UK will need an estimated additional 1,000 radiologists to manage this demand, as well as 325 to meet the current shortfall.
Within this section we consider the radiology workforce challenge by reviewing the current workforce position, assessing the impact that this has on cost and quality and evaluating forecasted demand and capacity.

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<th>Pages</th>
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<td>16</td>
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OECD countries are currently experiencing complex demographic changes which are increasing pressure on healthcare resources. In the field of radiology, there is a widening gap between demand and capacity, driven by a steady increase in requests for cross-sectional imaging (CT and MRI) and a stagnating number of trained radiologists available to report images.

Demand for MRI and CT exams has increased across a range of countries over the past ten years, although the number of exams carried out per capita varies significantly (OECD, 2017). This disparity is reflected in the number of radiologists per 100,000 of the population. Figure 1 illustrates this for a number of EU countries – from 3 radiologists per 100,000 people in Italy to 31 per 100,000 people in Greece.

The UK has an estimated 4.8 consultant radiologists per 100,000 people and 7 radiologists (including trainees) per 100,000 people (RCR, 2016a). This is one of the lowest in Europe, and compares to a mean of 12 radiologists per 100,000 population for Western Europe (Piorkowska, Goh & Booth, 2017).

In the United States, the total number of radiologists increased by 39.2% between 1995 and 2011 (from 27,906 to 38,875) (Rosenkrantz, Hughes & Duszak, 2016). These figures suggest 10-12 radiologists per 100,000 people.

In Canada, there are 2,351 diagnostic radiologists currently practising (including interventional radiologists) - an average of 6.9 diagnostic radiologists per 100,000 people (Conference Board of Canada, 2017).

(Note that there can be inconsistencies in how figures are reported by different sources depending on if they include trainee Radiologists or consultants only, and if they report WTE vs headcount figures).

Figure 1. Radiologists per 100,000 people in EU countries, 2014

Source: Royal College of Radiologists, 2016a
All countries are facing challenges in adapting their imaging workforce to meet growing demand.

As noted, volumes of MRI and CT exams have grown over the past ten years, but this is variable between countries.

UK volumes may be understated as they only include hospital-based exams. However, it appears that the UK conducts fewer exams than its European counterparts, as well as those of other major OECD countries.

Figure 2: Diagnostic exams and MRI exams per 1,000 population

Figure 3: Diagnostic exams and CT exams per 1,000 population

* * hospital exams only. Some UK figures are estimated values.
The challenge of balancing capacity with the growth in demand is significant, although the manifestation of the problem differs by country (Silvestrin, 2016). Accordingly, where a strategy is in place to address the imbalance, different solutions are being implemented.

- **Germany**: Germany carries out twice as many CT and MRI scans per capita than other European countries. The volume is met through the common practice of non-radiology specialists being able to interpret CT scans (Silvestrin, 2016).
- **Sweden**: in Sweden, there are 100 radiologists undergoing training to become specialists, which matches the shortage of specialists currently required. While the shortage is expected to reach 500 within five years, the imbalance is expected to be solved by 2025, through demand management and other initiatives.
- **Denmark**: Denmark has a balanced average demand and capacity situation compared to other EU countries. Alarming growth rates before 2010 have now stabilised. The Danish authorities’ objective is to further control and avoid unnecessary scans in the future (Silvestrin, 2016).
- **France**: France has a high number of CT scans per capita and an ageing consultant radiologist population. In 2010, the average age of a radiologist was 51 years and 65% were 50 or older. Only 35% of the current workforce will still be in employment in 2025 (Silvestrin, 2016). With 15 radiologists per 100,000, France may appear to be in a comfortable situation, but its ability to manage demand is unsustainable as the number of radiologists per population remains flat (Silvestrin, 2016).

It is not only European countries that are facing growing demand and constrained capacity. In Canada, the demand for medical imaging is placing a strain on the health care system and on radiologists and technologists alike. There is a shortage of radiologists in rural and remote areas (Conference Board of Canada, 2017). In 2015, 40% of Canadian GPs reported that they often had difficulty requesting specialised diagnostic imaging tests (including CT imaging, mammograms, and MRIs) higher than the Commonwealth Fund average of 21% (CIHI, 2015).

In summary, while the number of radiologists per capita varies considerably by country, both in the EU and beyond, imaging activity per capita also varies significantly, with the UK operating at levels more akin to smaller European countries than major OECD countries.

All countries are facing challenges in adapting their imaging workforce to meet growing demand, arising from clinical advances and other drivers. Sweden and Denmark are examples of countries where a balance between demand and capacity is being met through increased training and demand management, enabling equilibrium in the short to medium term (Silvestrin, 2016).
In 2015, there were 3,318 consultant radiologists working in a substantive NHS posts in the UK, with 4,784 including trainees and other grades. This equates to 7 radiologists per 100,000 people.

Clinical radiologist workforce numbers
There are 202 NHS radiology Departments in the UK. According to the latest annual Royal College of Radiologists (September, 2016) census, as at 31 March 2015 there were 3,318 consultant radiologists working in an NHS substantive post in the UK. There were also 1,323 radiologists registered in a training scheme. Non-consultant grades make up 31% of the radiology workforce, with consultant radiologists making up the remaining 69%.

According to the census report, the extent of less than full-time working is stabilising at one in five consultants – with women more likely to work less than full time, as are older men (RCR, 2015).

The UK radiology workforce is an international one, attracting radiologists from over 60 countries to work in the NHS. Three in ten consultants are international medical graduates (IMGs) - 50% of whom are from Asia and 31% from a European country. Over 8% of all senior radiologists working in the UK gained their medical qualification from the EU, consistent with the 9% of NHS doctors who are EU nationals (Piorkowska, Goh & Booth, 2017).

NHS workforce figures
According to the Provisional NHS Hospital & Community Health Service (HCHS) monthly workforce statistics as of May 2017, there were 2,889 consultant radiologists and 1,053 specialty registrar radiologists in the English NHS, as well as 103 other staff types (including F1 and F2), for a total of 4,045 clinical radiologists (WTE).

• This number is 1.7% higher than the reported WTE count for England in 2015 via the RCR census, which it is assumed reflects the growth rate between 2015 and 2017, and the fact that one set of data refers to headcount and the other to WTEs.

• When the headcounts for consultant, trainee and other grades are aggregated, there are 4,784 radiologists covering a population of 64,596,752 in the UK, which equates to seven radiologists per 100,000 people (RCR, 2015). As discussed when looking at the international picture, this is one of the lowest in Western Europe and compares to a mean of 12 radiologists per 100,000 population (Piorkowska, Goh & Booth, 2017). The Royal College of Radiographers would like to build the UK radiologist workforce to at least eight consultants per 100,000 population (RCR, 2016b).

Table 1. Headcount of radiologists by UK country, 2015

<table>
<thead>
<tr>
<th></th>
<th>England</th>
<th>Northern Ireland</th>
<th>Scotland</th>
<th>Wales</th>
<th>UK total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants</td>
<td>2,733</td>
<td>121</td>
<td>304</td>
<td>160</td>
<td>3,318</td>
</tr>
<tr>
<td>Trainees</td>
<td>1,120</td>
<td>44</td>
<td>116</td>
<td>43</td>
<td>1,323</td>
</tr>
<tr>
<td>Other grades</td>
<td>125</td>
<td>1</td>
<td>15</td>
<td>2</td>
<td>143</td>
</tr>
<tr>
<td>Total</td>
<td>3,978</td>
<td>166</td>
<td>435</td>
<td>205</td>
<td>4,784</td>
</tr>
</tbody>
</table>

Adapted from: Clinical Radiology Workforce Census 2015 report
1B The National Picture – Clinical Radiologists

There is a 10% vacancy rate in the consultant radiologist workforce in the UK – this gap has now been consistent for over five years.

Clinical radiologist vacancies
The Royal College of Radiology’s (RCR) 2015 UK-wide census, found that 9% of consultant posts were vacant (RCR, 2016a) equivalent to 324 consultant radiology posts (see Table 2), although other sources suggest even higher figures:

- According to the Health Education England (HEE) Workforce Plan 2016, providers have quantified current shortages at 280 WTE or approximately 10% of all consultant posts (HEE, 2016).
- According to the NHS Benchmarking Report 2016, 1 in 6 consultant radiologist posts remain vacant, i.e. 16% of posts (NHS Benchmarking, 2016a).

The five years since 2010 have seen the RCR’s national vacancy rate fluctuate between 7% and 12%, with an annual mean of 9%. This suggests that 1 in 10 consultant posts will be vacant in the future, although some departments may have decided not to recruitment due to the inability to find candidates.

Given this, the true vacancy rate may even be higher (RCR, 2016a). A vacancy level of 10% is consistent with the HEE’s Workforce Plan.

The difficulty in filling posts is reflected in the average vacancy period. 46% of vacancies identified by the RCR survey had been unfilled for eight months or more and 41% for more than one year across the UK.

![Figure 4. Unfilled consultant posts by UK country and region, 2014 and 2015](image)

Table 1. Number of reported filled and unfilled consultant radiology posts in the UK, 2010-2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Total consultant posts</th>
<th>Filled</th>
<th>Unfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3,114</td>
<td>2,869</td>
<td>245</td>
</tr>
<tr>
<td>2011</td>
<td>3,272</td>
<td>3,058</td>
<td>214</td>
</tr>
<tr>
<td>2012</td>
<td>3,457</td>
<td>3,174</td>
<td>283</td>
</tr>
<tr>
<td>2013</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>2014</td>
<td>3,660</td>
<td>3,239</td>
<td>421</td>
</tr>
<tr>
<td>2015</td>
<td>3,642</td>
<td>3,318</td>
<td>324</td>
</tr>
</tbody>
</table>

Information for 2013 is not provided due to the timing of the RCR census being altered from calendar to financial year. Adapted from RCR 2016a
Consultant radiologist growth trends

The consultant radiology WTE workforce in the UK has increased at an average rate of 3% per annum in the past five years. England saw a 17% increase in WTE consultants between 2010 and 2015, compared to a UK total of 15% (RCR, 2016a).

Whilst radiology staffing levels have increased marginally in absolute numbers in the last year, when benchmarked using activity denominators, staffing levels have reduced which demonstrates a clear productivity gain for radiology departments (NHS Benchmarking, 2016a).

Imaging activity

While imaging activity levels in the UK, in particular in MRI and CT, continue to be substantially lower on a per capita basis than in peer OECD countries (OECD, 2017), there is evidence that the UK would not want to actually increase its rate as high as some of these countries. In the UK, practice has been to limit radiation dosages to patients (2020 Delivery, 2015).

With regards to MRI exams, the judgement of clinicians is that in some areas of clinical practice (e.g. back pain, knee pain), evidence of the benefits of scanning is low, despite high rates internationally (2020 Delivery, 2015).

Table 2. WTE consultant radiologists by UK country and region, 2010-2015

<table>
<thead>
<tr>
<th></th>
<th>2010 WTE</th>
<th>2014 WTE</th>
<th>2015 WTE</th>
<th>% change 2014-15</th>
<th>% change 2010-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>England - total</td>
<td>2,195</td>
<td>2,503</td>
<td>2,575</td>
<td>3%</td>
<td>17%</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>101</td>
<td>114</td>
<td>114</td>
<td>0%</td>
<td>13%</td>
</tr>
<tr>
<td>Scotland</td>
<td>279</td>
<td>288</td>
<td>288</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>Wales</td>
<td>140</td>
<td>143</td>
<td>147</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>United Kingdom - total</td>
<td>2,714</td>
<td>3,048</td>
<td>3,125</td>
<td>3%</td>
<td>15%</td>
</tr>
</tbody>
</table>

Adapted from RCR 2016a

Table 3. Headcount of consultant radiologists by UK country and region, 2010-2015

<table>
<thead>
<tr>
<th></th>
<th>2010 headcount</th>
<th>2014 headcount</th>
<th>2015 headcount</th>
<th>% change 2014-15</th>
<th>% change 2010-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>England - total</td>
<td>2,323</td>
<td>2,663</td>
<td>2,773</td>
<td>3%</td>
<td>18%</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>108</td>
<td>119</td>
<td>121</td>
<td>2%</td>
<td>12%</td>
</tr>
<tr>
<td>Scotland</td>
<td>291</td>
<td>307</td>
<td>304</td>
<td>-1%</td>
<td>4%</td>
</tr>
<tr>
<td>Wales</td>
<td>147</td>
<td>150</td>
<td>160</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>United Kingdom – total</td>
<td>2,869</td>
<td>3,239</td>
<td>3,318</td>
<td>2%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Adapted from RCR 2016a
The NHS diagnostic radiography workforce has grown by 11.9% between 2010 and 2015, to 13,358 WTE, with an estimated average three-month vacancy rate of 8.8%.

**Diagnostic radiography: Workforce numbers**

In May 2016, the College of Radiographers carried out a census of the diagnostic radiography workforce in the UK. 86 providers (including eight non-NHS organisations) responded to the online questionnaire, 76 of which were from England (CoR, 2016b).

Key findings from the census include:

- The average number of diagnostic radiography establishment staff by WTE per respondent is 66.7.
- On average, each respondent has 11.7 radiographers, sonographers and/or nuclear technologists (headcount) carrying out advanced practice and 0.5 carrying out consultant-level practice as of 1 May 2016 (census date).

Electronic Staff Record (ESR) data shows that there are 15,050 radiographer posts in England with 1426 vacancies (9%).

**Radiography vacancies**

However, according to the Radiology National Benchmarking Report 2015/16, radiographer vacancies (in England and Wales) have increased for the last 3 years, from 6% in 2014, to 9% in 2015, to 11% in 2016 (NHS Benchmarking Network, 2016a).

The 2016 Diagnostic Radiology Workforce Report (CoR, 2016b) found that the average current vacancy rate for the diagnostic radiography workforce was 13.1% at time of census, i.e. 1 May 2016 (although they note that this is just before largest intake of diagnostic radiographers in the year in summer).

The average reported current vacancy rate varies by UK country: England 13.5%, Scotland 4.6% and Wales 12.4% (with insufficient data to provide a figure for Northern Ireland). The average three-month vacancy rate across all respondents is 8.8% (note- the survey did not have a 100% response rate, and therefore may not be representative of the overall diagnostic radiography workforce position in the UK (CoR, 2016b). The greatest reported radiographer vacancies are in Band 5 posts – see Figure 5 on the following slide.

**Radiography growth trends**

According to HEE, the NHS diagnostic radiography workforce has grown by 11.9% between 2010 and 2015, to 13,358 WTE (while the NHS therapeutic radiography workforce has grown by 20% to 2,505 FTE).
The Breast Screening Radiography workforce has a reported vacancy rate of 15%, with ~50% of practitioners likely to retire within 15 years.

Radiographer vacancies continued
In respect of filling vacancies, opportunities for training and progression have historically been unclear or not widely available and there is a view that the NHS loses ambitious radiographers to other professions and the private sector (RAD Magazine, 2016). In order to address vacancies, it was reported at the 2017 National Benchmarking Conference (Diagnostics) in London that UK Trusts are now recruiting from Italy and Portugal due to an oversupply of radiographers in those countries.

In addition to managing vacancies, long-term absence runs at an average of 4.5%. This is due to career breaks (0.6%), long-term sickness absence (1.5%) and parental leave (2.4%).

Other radiography and radiology clinical staff
In addition to diagnostic radiography, there are specialised teams that manage breast screening services as well as fulfilling other clinical roles that contribute substantially to services.

Gaps in these groups should also be noted due to the impact they have on the wider picture.

- **Breast screening radiography workforce** - Public Health England (PHE) carried out a 2016 survey of the four-tier radiographic workforce in the NHS Breast Screening Programme (i.e. consultant practitioners; advanced practitioners; practitioners; and assistant practitioners) in order to inform future workforce training and planning.
  
  The survey, which had a final response rate of 65% (52 out of 89 services), found a current vacancy rate of 15%. The workforce is also ageing, with 50% of all practitioners aged 50 plus and likely to retire in the next 10 to 15 years (PHE, 2015).

- **General radiology workforce vacancies** - According to the NHS Benchmarking report, the highest vacancy rates are in ‘Other radiology/medical staffing (over 30%) and sonographer (over 20%)’ (NHS Benchmarking, 2016), suggesting there are further gaps in the workforce beyond the core roles of radiologist and radiographer.

![Figure 5. Three-month vacancy rate by AfC band (n=84)](image-url)

**Source:** College of Radiographers 2015
2 Impact of Gaps on Cost and Quality

In 2014/15, 75% of radiology departments outsourced some of their reporting work. Spending has increased by an estimated 51% since 2013/14.

**Impact of radiology workforce shortages**

Nationally, shortages in the diagnostic workforce are hampering the drive to improve patient care, experience and outcomes, with a considerable volume of investigations waiting more than 30 days for a report. In terms of cost and quality, spending on overtime has increased as has the use of outsourced support and the number of agency staff employed. For patients, waiting times have lengthened and reporting turnaround times slowed. This impacts on the overall performance of the system, particularly the ability to ensure effective flow within emergency care.

**Overtime, outsourcing and agency staff**

Most UK departments are struggling to meet their reporting targets and are becoming heavily dependent on outsourcing (Piorkowska, Goh & Booth, 2017).

- 75% of departments reported that, in 2015, they outsourced some of their reporting work to commercial companies and 92% made overtime payments to radiologists (RCR, 2016a).
- Spending on these activities has increased from £58.3m in 2013/14 to £88.2m in 2014/15. The existing workforce is working substantial amounts of overtime. This was reported in almost every Trust interviewed [as part of the 2020 Delivery report], and applies to radiographers, sonographers and radiologists (2020 Delivery, 2015).
- The excess hours worked in the UK in 2015 equated to 233 WTEs (RCR, 2016a). Three out of ten of the unfilled consultant posts were covered by temporary locums (RCR, 2016a).

### Table 4. National and regional spending on outsourcing, 1 April 2014 to 31 March 2015

<table>
<thead>
<tr>
<th></th>
<th>Departments submitting expenditure data</th>
<th>Known expenditure</th>
<th>Mean expenditure</th>
<th>Depts. outsourcing</th>
<th>Estimated total expenditure</th>
<th>% increase in estimated total expenditure 2013-14 to 2014-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>140</td>
<td>£64,598,836</td>
<td>£461,420</td>
<td>160</td>
<td>£73,827,241</td>
<td>57%</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>6</td>
<td>£4,311,384</td>
<td>£718,564</td>
<td></td>
<td>£6,467,076</td>
<td>25%</td>
</tr>
<tr>
<td>Scotland</td>
<td>11</td>
<td>£3,209,419</td>
<td>£291,765</td>
<td>18</td>
<td>£5,251,777</td>
<td>50%</td>
</tr>
<tr>
<td>Wales</td>
<td>9</td>
<td>£2,232,090</td>
<td>£248,010</td>
<td>10</td>
<td>£2,480,100</td>
<td>28%</td>
</tr>
<tr>
<td>UK - overall</td>
<td>166</td>
<td>£74,351,729</td>
<td>£447,902</td>
<td>197</td>
<td>£88,236,690</td>
<td>51%</td>
</tr>
</tbody>
</table>

Adapted from RCR 2016a
While 8% of pay costs in 2015/16 are attributable to locum/agency staff, overall workforce shortages mean that the market does not have the flexibility to provide reactive, short-term imaging solutions.

Overtime, outsourcing and agency staff – continued

- According to the NHS Benchmarking report, 8% of pay costs in 2015/16 are attributable to locum/agency staff (NHS Benchmarking, 2016a).
- Much of this outsourced reporting activity is provided by NHS radiologists working additional hours for reporting companies. Constraints on the availability of radiologists mean that outsourced reporting services have limited ability to respond at short notice to demands for additional reporting. On a longer-term basis, it seems likely that this sector will continue to grow (2020 Delivery, 2015).
- Due to vacancy rates and the amount of overtime already being worked, demand and prices for agency staff/locums are high. This is especially the case for sonographers, where the vacancy rates are so high that prices have risen to the level where the rational economic decision for sonographers is to leave the NHS and work for an agency (2020 Delivery, 2015).

Due to the competition for a limited pool of staff across sectors, independent providers – which themselves can only recruit at short notice by attracting staff from the NHS – are not in a position to alleviate fully the pressure on Trusts. Overall, workforce shortages mean that the market does not have the flexibility to provide reactive short-term imaging solutions (2020 Delivery, 2015).

Financial efficiency

Given this, there is evidence that, in recent years, financial efficiency has decreased:

- There has been cost inflation for agency staff/locums, in particular for sonographers
- Trusts are employing strategies such as paying ‘recruitment and retention’ premia to radiographers and sonographers, or re-banding Band 7s to Band 8A, in an effort to avoid losing staff to agency employers (2020 Delivery, 2015).
- Consultant radiologists are working substantial amounts of overtime, either on a sessional basis or a piece-rate basis for their Trust, or an outsourced provider. There are concerns about the impact of fatigue on error rates, as well as whether radiologists can continue to report as productively in-hours when they are working so many additional hours (2020 Delivery, 2015).

Some Trusts are making unbudgeted, increased use of independent providers for both imaging capacity and outsourced reporting, in order to meet demand (2020 Delivery, 2015).
2 Impact of Gaps on Cost and Quality

Nearly all radiology departments in the UK state they are unable to meet the reporting requirements for diagnostics. This impacts negatively across all care settings, including patient flow in acute hospitals.

Waiting times and impact on acute patient flow
- Nearly all radiology departments in the UK stated that they were unable to meet their diagnostic reporting requirements in 2015 (RCR, 2016a). Around 230,000 patients in England are waiting more than a month for their imaging test results (RCR, 2016a).
- Despite the increasing activity levels, waits for urgent plain film x-ray, CT scans, ultrasound and PET scans have remained stable in the last 12 months. MRI and DEXA waits have increased. Routine waits have decreased or remained stable (NHS Benchmarking, 2016a).
- The wait for an inpatient to undergo a routine CT scan is a key element of the pathway for many inpatients – data from participants suggests a median 1.4 day wait to schedule and deliver non-urgent inpatient CT scans, with a longer mean average wait of almost 2 days (NHS Benchmarking, 2016a).
- Over half of Trusts and LHB’s cannot support a same-day request for a routine inpatient CT scan. A total of 15 organisations reported CT scanning waits of more than 2 days. This demonstrates risks of sub-optimal inpatient flows with patients waiting for scans and results, which can impact on the discharge planning process (NHS Benchmarking, 2016a).

Sustainability of services
- Radiology is a key component of acute services and without radiology hospitals are unable to deal with emergencies and other unscheduled referrals (NHS Scotland, 2015).
- The increasing demands for complex imaging in the acute and planned care environment have resulted in the main focus being support of hospital services. This has led to some reported dissatisfaction among primary care physicians and the resultant commissioning of less complex imaging services (mainly radiography and ultrasound) from alternative providers (RCR, 2014).
- With regards to the breast screening radiography workforce, unless there are mechanisms to ensure that suitable training is available and recruitment is encouraged, the future of the screening programme may be at risk (RCR, 2015).
3 Future Demand and Capacity

1.3% - 2.3% of the consultant radiologist workforce leaves the profession each year, mostly due to resignation or retirement. An estimated one-third of the workforce will retire within the next ten years (2015-2025).

Within this section we will look firstly at the pressures on demand and capacity for radiologists and consider the impact of:
• Retirement
• Resignations
• Current training plans
• Increasing demand
• Changing models of care (including increased specialisation, national initiatives and seven day working).

Secondly, we will look at the position for radiographers.

Retirement
34% of radiology consultants in the UK are aged 50 or over, (RCR, 2016a). Of all consultant radiologist WTEs in the UK, between 15-20% are expected to retire by 2020 (depending on whether people retire at the age of 60 or the age of 62) (England: 15-20%; Scotland: 13-19%; Wales: 26-30%; and Northern Ireland: 9-12%).

29%-35% of the radiologist consultant headcount will be retired by 2025, and 46%-52% will be retired by 2030. These figures are broadly in line with UK-wide figures – see table 9. As these figures suggest, an estimated one-third of the current UK consultant radiology workforce will retire within the next ten years (2015 – 2025). Within the next fifteen years (2015 – 2030) around half of the current workforce will retire (RCR, 2016a).

Table 5. Number of consultants leaving the NHS radiology workforce and reasons, 2010-2015

<table>
<thead>
<tr>
<th>Reason for leaving</th>
<th>2010</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retire from the NHS</td>
<td>42</td>
<td>34</td>
<td>24</td>
</tr>
<tr>
<td>Resign from the NHS</td>
<td>14</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Not known</td>
<td>11</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>48</td>
<td>45</td>
</tr>
<tr>
<td>% of consultant workforce leaving</td>
<td>2.3%</td>
<td>1.5%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Table 6. Percentage (and headcount) of the current consultant workforce expected to retire in each UK country and region in the next 10 to 15 years

<table>
<thead>
<tr>
<th>Country</th>
<th>Next 10 years: 2015-2025</th>
<th>Next 15 years: 2015-2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retire age 62</td>
<td>Retire age 60</td>
</tr>
<tr>
<td>England</td>
<td>29% (795)</td>
<td>35% (947)</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>21% (25)</td>
<td>26% (32)</td>
</tr>
<tr>
<td>Scotland</td>
<td>30% (92)</td>
<td>36% (109)</td>
</tr>
<tr>
<td>Wales</td>
<td>28% (61)</td>
<td>43% (68)</td>
</tr>
<tr>
<td>United Kingdom - overall</td>
<td>29% (973)</td>
<td>35% (1,156)</td>
</tr>
</tbody>
</table>

Adapted from RCR 2016a
The UK will therefore need to produce at least an additional 1,000 radiologists by 2025, in addition to the 325 needed now. The radiology workforce also faces expansionary pressures.

**Resignation**

In 2010, 2014 and 2015, 8% - 31% of staff attrition was due to resignation from the NHS (RCR, 2016a). Staff from NHS organisations are often incentivised to move to employment within the independent sector, leaving gaps in the NHS radiographic workforce (McVey, 2017).

**Current training plans**

Based on anticipated attrition rates, the UK will need to produce approximately 1,000 additional consultant radiologists in order to fill new gaps in the workforce by 2025. This is in addition to the additional 324 consultant radiologists needed immediately to fill existing vacancies across the UK. However, according to the RCR, radiology has the lowest proportion of trainees to consultants when compared to other hospital-based specialties (RCR, 2016a).

In its 2016 Workforce Plan, HEE has, for the third consecutive year, increased the number of training posts in clinical radiology - the number of posts will increase from 1,112 to 1,144 (2.88% increase). They forecast that new Certificate of Completion of Training holders will grow the current average annual output of 170 to 230 in 2021/22. This will ameliorate current shortages but, according to HEE, will not be sufficient to meet medium to long term demand (HEE, 2016).

**Increasing demand**

England’s population is rising at a rate of 1%pa with an increasing proportion of frail patients. The desire for earlier diagnosis is increasing the demand for diagnostic imaging, along with the attraction of less invasive procedures. As well as the demographic pressure, the radiology workforce is under duress from new clinical guidelines which specify imaging as part of the pathway (particularly MRI/CT and Positron Emission Tomography-Computed Tomography); awareness campaigns; progressive changes in doctor/patient behaviours; and increased survival rates in particular conditions (2020 Delivery, 2015).

Imaging activity has been growing at nearly 6% per annum over the last ten years - this figure (5.7%) represents growth rates across all modalities (2020 Delivery, 2015). According to NHS Benchmarking, in the past four years, there has been a 38% growth in CT and 41% growth in MRI (NHS Benchmarking, 2016a) and, in the last two years, an 8% increase in MRI scans and a 7% increase in CT. The number of non-obstetric ultrasound planned tests increased by 8.4% per annum between 2007/08 and 2014/15 (CFWI, 2017).

It is likely that, in future, demand for MRI and CT will grow at 9% per annum or more (2020 Delivery, 2015). Despite these increases, imaging rates in the UK remain significantly below those found in other healthcare systems for most tests, suggesting that further growth is to be expected (noting there are clinical reservations about the high rates of scanning in some countries).
Increased specialisation means that generalists are harder to find and recruit, although general imaging and diagnostic skills are key to patient care in hospital.

Changing models of care
Changing models of care may also place expansionary pressure on the radiology workforce. Of particular note is the trend towards greater specialisation in radiology and new national initiatives intensifying demand.

Increasing specialisation
Trends point towards a shift away from generalists to more specialty interest forms of practice undertaken by consultant radiologists (RCR, 2016a) – as the extracted figure on this page demonstrates.

The gradual increase in radiologists who choose to practise in one or more specialty interest areas means that generalists are becoming harder to find and recruit. This is a particular concern for non-teaching hospitals where there is a requirement for consultants with general imaging and diagnostic skills as they are key to patient flow (RCR, 2016a). 22% of unfilled consultant posts in 2015 were 'General' and 50% were General with one main area of interest.

National initiatives
The national cancer strategy indicates that a diagnosis conclusion should be reached within 28 days of GP referral. Although this will not directly increase the volume of requests (demand), it will increase the pressure on turnaround times, and hence on the already stretched capacity.

With regards to the breast screening programme, the core screening population (50-70 years) is expected to increase by 8% by 2026 and demands from the age extension trial are likely to potentially increase the screening population by a further 28% (PHE, 2016).

Source: RCR 2016a

Figure 6: Type of radiologist as a percentage of the UK consultant workforce 2010-2015

*Information for 2010 is not provided due to the timing of the RCR census being altered from calendar to financial year. Note: Specialist with one or more main areas of interest – for the 2014 and 2016 censuses, data was collected across two categories, ‘specialist with one main area of interest’ and ‘specialist with two or more main areas of interest’.
A range of other factors may also drive expansionary demand, including increasing complexity, 7 day working, and changes in clinical protocols (such as radiology involvement in treatment of acute stroke).

Other care model changes that impact on demand for radiology

In addition to specialisation and national initiatives, note should also be made of the consequences of:

- **7 day working**: there is a national drive towards 7 day working, although it does not have to mean a whole department running for 7 days – it could mean a minimum amount of machines and reporting radiologists in a network to manage a 7 day service.

- **Non-reporting time**: the frequency of multidisciplinary (MDT) meetings between 2008 and 2011 shows a rise of nearly two-thirds, and their average length has almost doubled. These meetings are a core part of the radiology workload but they reduce radiologists’ time available for reporting.

- **Complex images**: newer, more accurate equipment can be more efficient. However, the images provided by newer equipment require more detailed reporting, adding to the time pressures for staff. Complex imaging, which is more consultant intensive, is increasing as a percentage of total imaging (CfWI, 2012). There is growing demand for complex image interpretation where only radiologists’ skills can meet the need (RCR, 2016b).

- **Scale**: about a third of NHS Trusts and health boards employ fewer than 10 radiologists. Smaller services are challenged in responding rapidly to significant variation in demand and capacity (RCR, 2017a). As imaging has increased in its complexity it is not feasible in most hospitals to deliver the range of specialist support in a timely fashion across all clinical presentations. This is most evident in relation to ‘out of hours’ services where often only a single radiologist is available for consultation (RCR, 2017a).

- **Academic activity**: there is a consensus within the profession that increased academic activity would be desirable and the RCR is looking at various models of academic training to develop effective and sustainable pathways in order to encourage academic activity in the profession (CfWI, 2012).

- **Clinical developments**: the RCR also identifies the following new developments as further drivers of increased radiology activity:
  - Interventional oncology
  - Scottish trauma centres
  - The likely increased radiology involvement in the treatment of acute stroke (mechanical thrombectomy) (RCR, 2017a)
Although demand and capacity modelling has been undertaken by HEE, there are questions regarding the accuracy of assumptions and the likelihood of planned training programmes to meet shortfalls.

Balancing future demand and capacity
The rising demand for diagnostic tests and subsequent pressure on services means action is needed now. For example, addressing future demand ensuring diagnostics can cope will be essential to improve cancer outcomes through early diagnosis. When cancer is diagnosed at an early stage, treatment options and chances of a fully recovery are greater. Survival for some of the most common types of cancer is more than three times higher when the disease is diagnosed in its earlier stages (2020 Delivery, 2015).

The same factors that have driven growth, to date, will continue to apply:
• Population growth and an ageing population
• Clinical guidelines will continue to drive switching of modality to cross-sectional imaging
• Clinical guidelines will continue to drive referral at lower thresholds (e.g. NICE guideline 12 on referral for suspected cancer)
• Survival rates, and prevalent patient populations, will continue to rise for imaging-intensive conditions (2020 Delivery, 2015)

While detailed modelling would be required to calculate predicted replacement and expansion demand at the UK level, given that radiology tests are increasing by 6% each year, it is likely that there will be expansion demand of at least that level.

A 6% increase per year in consultant radiologists would imply an additional 200 consultant radiologists per year across the UK. This would be on top of the additional radiologists required to replace those leaving due to retirement or resignation, and those required to fill existing vacancies.

HEE is planning to introduce a further 35 programmes from 2017 (Smith, 2017). Although the consultant workforce has been growing at approximately 100 FTE per annum (3.1%) and HEE has already implemented the recommendations from the previous Centre for Workforce Intelligence review, the level of demand anticipated in the Cancer services review and the level of current shortages (284 WTE reported by NHS providers in 2016) indicate a strong case for further expansion to ensure future supply resilience (Smith, 2017). Cancer Research UK (CRUK) has previously recommended that a joint approach to modelling the future demand for the radiology workforce be developed by key stakeholders to accurately inform workforce planning and training (2020 Delivery, 2015).
3 Future Demand and Capacity

NHS providers have indicated they require 16.5% growth in the diagnostic radiography workforce by 2020 to address current shortages and meet increased demand. This represents 2,200 additional WTE.

Radiography workforce

Effective planning for the clinical radiology workforce cannot be considered in isolation from other workforces providing essential support, particularly radiographers. There is a need for a whole-team approach to clearly understand the scope, boundaries and overlaps (CfWI, 2017). Growth of the non-medical workforce, particularly radiographers, is required to support any workforce expansion in clinical radiology (CfWI, 2017).

According to the Diagnostic Radiographer Workforce Survey, 4.4% are due to retire in the next two years (CoR, 2016b). The main other reasons respondents gave for radiographers leaving their posts are promotion (in another location), retirement and personal reasons (CoR, 2016b).

NHS Provider Partners have indicated to HEE they require approximately 2,200 FTE (16.5%) growth in the diagnostic radiography workforce by 2020 to address current shortages and meet increased demand. HEE believes that the growth in this workforce of over 1,400 FTE over the past five years will meet this requirement, but that providers must maximise the existing supply (HEE, 2016).

In therapeutic radiology, NHS Provider Partners indicate that they require approximately 540 FTE (21%) growth in the workforce by 2020 to address current vacancies and meet increased demand. Both observed growth and forecast growth indicate this can be exceeded (HEE, 2016).

The demography and activity drivers in each area of imaging are complex and real, apart from the other variables such as extended roles for radiographers in relation to work currently done by medical colleagues (HEE, 2016).
Solutions

This section provides an overview of potential solutions to the workforce challenges identified.
It considers:
• HR options- including approaches to recruitment, retention and training
• the use of external support: and
• service transformation as a means of improving the use of expert resources

Key messages:
1. In the short term, international recruitment can be an effective option, whilst the benefit of increased training places comes into effect
2. There is scope to improve the offering to trained staff, to retain and attract back to work qualified clinicians. There is evidence of success where new career frameworks are in place, training and development packages are robust and research opportunities are forthcoming.
3. Outsourcing can be costly and introduce risk but is a further alternative, as an interim measure.
4. There is evidence of the successful implementation of collaborative networks, in respect of managing demand and overcoming the challenge of greater specialisation.
5. A focus on demand management is critical for the quality of patient care and ensuring that expert resources are most effectively employed.
6. Artificial intelligence can contribute to more streamlined and efficient patient pathways.
While there are significant challenges in the radiology workforce, a range of options have been used, with some success, to minimise the impact of current and future shortages. These include:

- **Addressing HR issues** through:
  - International recruitment
  - Retention and return to work schemes
  - Training

- **Using external support** through:
  - Outsourcing
  - Regional radiology networks

- **Transformation** within services
  - Demand management
  - Advanced roles
  - Other efficiencies and service improvements, including artificial intelligence

Within this section, we will explore each area in turn.
International recruitment is one option for employers looking to fill vacancies or expand their workforce. Diagnostic radiographers, sonographers and consultant radiologists are all on the Migration Advisory Committee’s list of occupations where there is a shortage (2020 Delivery, 2015). The UK is more reliant on international doctors and nurses than most other OECD countries -approximately one in three doctors trained outside of the UK (The Health Foundation, 2016). However, only a third of UK radiology departments have tried to recruit from outside the UK (RCR, 2016a).

The Health Foundation advocates for a nationally led approach that focuses on achieving overall health workforce sustainability and which integrates any nationally led international recruitment approach into overall health workforce planning and policy. It also notes the need for ethical recruitment (The Health Foundation, 2016). CRUK suggests that HEE should implement a short-term international recruitment effort for sonographers, radiographers, and radiologists as the only measure that can credibly reduce vacancy rates in time before increased training takes effect (2020 Delivery, 2015).

Whilst a viable approach, international recruitment does require careful consideration. Issues can arise with:

- **Engagement:** whilst a coordinated, regional/national approach is recommended, engagement has been limited and slow (RCR, 2017a), with only a third of UK departments in 2015 committing to this as a solution (as above).

- **Success rates:** only half of recruiting UK departments in 2015 were successful in their efforts as many lacked guidance and the ability to attain visas (RCR, 2016a). Specialist recruiting agencies are available who will target parts of the world where there are radiologists willing to come to the UK, on fixed short-term contracts (generally for one year). A radiologist-focused recruitment website Radjobs is also available (RCR, 2017a).

- **Entering the UK:** getting into the UK, especially for non-EU doctors, can be difficult, expensive and slow (Radiology training 2016-2026). There are issues around General Medical Council requirements and NHS HR engagement. The RCR has developed supporting resources to assist both those coming to the UK, and receiving radiology departments (RCR, 2017a).

- **Brexit:** there is now additional concern that difficulties in recruitment and retention of staff may be exacerbated after Brexit by additional immigration bureaucracy. The free movement of workers, work permits and recognition of qualifications may all need to be renegotiated as part of the UK exit deal (Piorkowska, Goh & Booth, 2017).
Retention and return to work: Staff engagement

While international recruitment can close a number of gaps in the short-term, the retention of existing staff and trainees is fundamental to addressing the challenge. Good, experienced radiologists need to be retained and nurtured in a way that reflects staff needs across the NHS (The Lancet, 2016). There needs to be a move away from traditional working practice towards more flexible arrangements, particularly to retain working parents. Valuable individuals need to feel valued (The Lancet, 2016).

Potential incentives to retain the radiography workforce could include employment guarantee schemes, work benefits, continuing professional development opportunities, return to practice support (McVey, 2017) and learning through examples from other UK radiology departments. Over recent years, it has become apparent that some organisations struggle to attract the right quality of clinical workforce which has compounded the issue of clinical variation for Trusts that are already challenged. Evidence shows that staff engagement has significant associations with patient satisfaction, patient mortality, infection rates as well as staff absenteeism and turnover.

Actions taken by Trusts can make a difference. For example, the proactive training and role extension of sonographers has improved retention at one acute hospital– they report to be up to full complement and are one of a few departments not using agency/locum staff in ultrasound (CoR, 2016a). Other examples are identified in the table on this page.

Table 10: Retention Initiatives- examples from UK radiology departments

<table>
<thead>
<tr>
<th>UK examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preceptorship programme for graduate radiographers, partnership forum, regular drop in sessions for training &amp; development (Heart of England)</td>
</tr>
<tr>
<td>Research radiographer and active research group (Mid Yorkshire Hospitals)</td>
</tr>
<tr>
<td>Low level of staffing highlighted in business case for additional staff and recruitment &amp; retention incentives (Southend University)</td>
</tr>
<tr>
<td>Designed bespoke induction package for all disciplines (Walsall Healthcare)</td>
</tr>
<tr>
<td>Learning &amp; Development Group established to identify training needs/opportunities and agree funding for non-medical staff. CPD opportunities each year (3 days) per year for all staff (Aintree)</td>
</tr>
<tr>
<td>University Hospital Morecambe Bay has a 4-tier structure from assistant practitioners to consultant radiographer (University of Morecambe Bay)</td>
</tr>
<tr>
<td>‘Perform’ methodology has been embedded within the department to support effective communication, vision sharing, and effective capacity &amp; demand management (South Tyneside)</td>
</tr>
<tr>
<td>New radiographer preceptorship programme (East Cheshire NHS Trust)</td>
</tr>
</tbody>
</table>

Source: NHS Benchmarking 2016b
Retention and return to work: Career frameworks

Career frameworks are of particular area interest with regards to retention and CRUK has recommended that Health Education England and the Society and College of Radiographers, in collaboration with the Royal College of Radiologists, should develop and publicise the career framework for radiographers and sonographers from Band 2 to Band 9, and the required underpinning education and training (2020 Delivery, 2015). This work should focus on skill-mix and the opportunity to use assistant and advanced practitioners to make imaging services more efficient and effective. The NHS in north-west London has developed a competency-based career framework that will increase exposure to learning opportunities and enable implementation of the Society and College of Radiographers (SCoR) career progression framework, creating a clear career pathway for health professionals working across radiology services (RAD Magazine, 2016).

A number of related initiatives are underway to strengthen the career framework:

• **Health Education England**: HEE intends to work with partners to address the current diagnostic radiographer gap through measures including valuing and retaining current staff, ensuring newly qualified staff are employed by the NHS and maximising the output from our education programmes by addressing course attrition (HEE, 2016).

• **HEE’s Integrated Imaging Workforce Group**: This group has commissioned Skills for Health to develop a career and competence framework for diagnostic radiography and sonography, linked to the National Occupational Statistics.

• **NHS Improvement**: In June 2017, NHS Improvement (NHSI) launched a major new programme to improve staff retention in Trusts across England and bring down the leaver rates in the NHS by 2020. This programme will highlight why there’s been an increase in staff choosing to leave and provide support to Trusts so they can hold on to this expertise and experience. It will bring together support from national partners to ensure a system-wide approach to securing and sustaining the future NHS workforce (NHS Improvement, 2017a).

A further benefit of retention initiatives may be to reduce sickness levels, which have risen to an average 4% (from 2.1% in 2014/15) (NHS Benchmarking, 2016a). This would have an additional impact on available capacity.
Radiology training
It is of vital importance that the training pipeline secures sustainable numbers within all parts of the professional workforce (Imison, Castle-Clarke & Watson, 2016). Increased radiology training is clearly needed across the UK (The Lancet, 2016). In 2016, in the context of tight financial constraints, HEE chose to act explicitly to increase supply in clinical radiology (HEE, 2016), although they also identified that this will not be sufficient to meet medium to long-term demand. The RCR also believes that a significant increase in radiology trainee numbers is required to fill the shortfall and to take into account the rate of radiology consultant retirements (RCR, 2017a).

Workforce modelling is needed to ensure that adequate training posts are in place to train the next generation of radiologists, as previously discussed. CRUK has recommended that a joint approach to modelling the future demand for the radiology workforce be developed by key stakeholders to accurately inform workforce planning and training (2020 Delivery, 2015). In addition to numbers of posts, there is discussion about the nature of radiological training.

The RCR’s vision for training 2016-2026 proposes building on previous models and includes enriched e-learning, experiential learning and simulation (including for interventional radiology training) in order to enable the rapid increase in radiologist training numbers, facilitate multi-professional education and training, and support a networked model of service delivery (RCR, 2016b). The RCR’s vision is to establish academies in all parts of the UK that will significantly improve access and that these will link with their surrounding hospitals, training schemes and reporting networks.

Networked reporting centres would support training in emergency studies and large-scale interpretative work such as cancer imaging. They would also improve access to specialist imaging advice (RCR, 2016b). The RCR also suggests increasing numbers of district general hospitals taking radiology trainees (RCR, 2017a). Carrying out robust workforce modelling and implementing the training posts required will require central input and support – the training itself will take years and is not a short-term solution. Public Health England also recommend that a coordinated strategy be formulated by key stakeholders to ensure a sufficient workforce is trained to meet future demands of the national Breast Screening Programme (PHE, 2016).

Whilst there is much to be done, there are positive signs:
• radiology is an extremely popular medical specialty, with every training post being oversubscribed by five to six applicants, of whom four to five are of appointable standard (Strickland, 2017).
• A new academy to train a new generation of radiologists has been established in Wales.
Radiography training

The 2016 HEE Workforce Plan states that some further additional investment in diagnostic radiography is justified (HEE, 2016).

As with clinical radiologists, CRUK has recommended that HEE conduct strategic planning around workforce at the national level and that this be based on accurate modelling. HEE and NHSE should work together to increase the number of places on radiographer training programmes, increase the number of places in radiologist specialist training and implement run-through programmes for sonographers. They also recommend that Local Education and Training Boards should project demand for workforce using the expected growth in demand for imaging activity (2020 Delivery, 2015).

Attracting students to radiography may be challenging: radiography is one of the allied health professions for which existing study courses, leading to professional registration, are no longer eligible for an NHS bursary – as of August 2017. Research also highlights low awareness of allied health professionals as an initial significant barrier to considering these careers (Define Research & Insight, 2017). Comparing smaller and specialist AHPs have particular advantages and disadvantages to the more well-known careers in larger AHPs and medicine and nursing. Communications need to cover the four ‘key pillars’ of information including definition of individual AHPs, particular aspects of identity fit, and particular emotional and rational benefits wanted (Define Research & Insight, 2017).

Awareness of, and clinical placement exposure to, advanced practice radiography roles may also be an important factor in attracting student and early career radiographers (McVey, 2017).
2A External Support - Outsourcing

Outsourcing reporting is costly and can increase risks, but has provided a useful short-term backup. Using external providers may further increase workforce pressures as staff may leave NHS providers to join them.

Outsourcing
The advent of digital imaging and storage using Picture Archiving and Communications Systems (PACS) has allowed the separation of image acquisition from reporting. Some of the benefits of PACS have been realised by the NHS – images are instantly available for diagnosis and clinical management and can be transmitted to specialist centres when appropriate (RCR, 2014). However, the full potential for improved efficiency and quality is far from being realised (RCR, 2014).

According to the 2016 NHS Benchmarking report, the median position for participants who outsource reporting is that 3% of all reports are outsourced (NHS Benchmarking, 2016a). In 2015/16, participants outsourced an average of 1.96% of total examinations, a figure which has remained stable over the last 12 months. Most participants used outsourcing to cover out-of-hours and urgent imaging requests. These were most likely to outsource plain film x-ray reporting and MR examinations to an independent sector provider (NHS Benchmarking, 2016a).

There are attractions to the outsourcing model, particularly in areas where it is difficult to recruit and retain radiologists (RCR, response to Dalton). For example, James Paget NHS Trust uses external providers to support its service, and South Warwickshire have used outsourced radiology reporting to an external provider in order to improve MRI referral turnaround times (NHS Benchmarking, 2016b).

However, there are some disadvantages, including:

- **Cost**: in 2015, 75% of departments reported outsourcing some of their reporting work to commercial companies and 92% made overtime payments to radiologists – spending on these activities increased to £88.2m in 2014/15 (RCR, 2016a).

- **Risk of fragmentation**: the outsourcing model may lead to fragmentation of the clinical pathway. As a result, clinicians may seek second opinions locally, resulting in duplication (RCR, 2014).

- **Increased duplication**: Radiologists working outside the main service, which may be without access to all relevant previous imaging and clinical information, may be driven to work in a more 'defensive' fashion resulting in a greater frequency of repeat or additional tests (RCR, 2014).

- **Other**: other potential drawbacks include the loss of training opportunities and the risk of failing to plan effectively for the medium to long-term as short-term solutions are available (RCR, 2014). Outsourcing also funds the local private sector, who might then in turn recruit NHS radiology staff to meet demand.
Collaborative Regional Radiology Networks

Radiology networks are receiving increasing attention, with several RCR publications stating the value they can provide by helping to make the best use of existing resources (Silvestrin, 2016). About a third of NHS Trusts and health boards employ fewer than 10 radiologists and smaller services are challenged in responding rapidly to variation in demand and capacity (RCR, 2014). As imaging has increased in its complexity, it is not feasible in most hospitals to deliver the range of specialist support in a timely fashion across all clinical presentations. This is most evident in relation to ‘out of hours’ services where often only a single radiologist is available for consultation (RCR, 2014).

The RCR proposes that, in the future, most radiologists should work in a distributed network fulfilling a dual role as generalists to their local healthcare community and as an expert resource to a wider network in their specialist areas of practice (RCR, 2014). A grouping of 150-200 radiologists would have the capacity to provide continuous 24 hour cover across the range of required specialties (RCR, 2014). A new model of service along these lines would optimise capacity, offer advantages to patients in terms of equitable access to expertise and provide the best environment for radiologist training (RCR, 2014).

Some networks are already in place in the UK, including
- The Royal Brompton (interventional radiology collaboration to cover out of hours interventional cases between three local hospitals)
- Salisbury NHS Trust (network solution for interventional radiology services with neighbouring Trust), and
- Torbay and South Devon NHS Trust (Peninsula out of hours CT reporting - currently involves three Trusts, soon to be four)
- EMRAD’s seven acute Trusts provide radiology services for 6.5 million people in the Midlands (~10% of the country) (NHS Benchmarking, 2016b).

Scotland is developing a National Radiology Model which will enable radiology staff to work across Scotland, maximizing utilisation and flexibility to work across traditional Health Board boundaries. Networking radiology services will enable reporting from any site to be completed from anywhere (NHS Scotland, 2016).

However, there are potential challenges facing the implementation of regional radiology networks including:
- IT - the robustness and quality of NHS IT systems;
- Size of the gap - existing radiological workload challenges – even with networked connectivity it may not be able to offer a substantial solution to reporting backlogs (RCR, 2017a);
- Organisational - though Trusts could consider collaborating through a suitable legal vehicle such as a joint venture; and
- Cultural - i.e. avoiding a defensive culture and developing a true network (RCR, 2014)

Collaborative regional radiology networks can mitigate some of the impact of increasing specialisation and are a natural solution for health regions to explore.
Managing demand for radiological exams and ensuring appropriate requests will help to mitigate the impact of growing demand and workforce shortages.

Demand management
A practical approach to minimising demand growth is to explore demand management solutions, of which a number of options are available. It is posited that there is a tendency to over-refer patients for diagnostic imaging. As well as incurring unnecessary cost and increasing waiting times, these duplicate, unnecessary or incorrect tests and expose patients to more radiation than is required. However, the situation is compounded by programmes for sharing patient records which, generally, do not include diagnostics information, meaning that there is limited visibility of previous exams available when making new referrals across the community provision.

Examples from the NHS Benchmarking Network (NHS Benchmarking, 2016a) of how demand can be managed include:

• the use of vetting forms, consensus and MDT discussion
• triage and review
• physiotherapy and joint injection pathways prior to treating in radiology
• implementation of a radiology clinic to advise referring clinicians as to appropriateness of requests
• regional ultrasound guidelines produced for GPs
• improving referral guidelines and pathways for specific conditions
• Airedale have introduced Right Care principles into everyday working
• At Northampton General, all inpatient requests are discussed with the radiologist to ensure the correct examination and protocols are followed

In addition to these examples, demand management is also being addressed through:

• The introduction of tight referral guidelines in Sweden, so that no unnecessary exams are performed and the ones that are performed are the most appropriate for each case. This is one of the initiatives which should allow Sweden to reach a balance of demand and capacity by 2025 (Silvestrin, 2016).

• Getting It Right First Time, a programme designed to improve clinical quality and efficiency within the NHS by reducing unwarranted variations. New clinical leads have been recruited to cover more than 30 clinical specialties, including Imaging & Radiology (NHS Improvement, 2017b).
3A Transformation – Demand Management

Managing demand for radiological exams and ensuring appropriate requests will help to mitigate the impact of growing demand and workforce shortages.

Demand management continued
• Clinical Decision Support: Clinical Decision Support is software that integrates clinical patient data to support clinicians to make appropriate decisions for patient care. CDS in radiology relies on appropriateness criteria which are evidence based guidelines, reviewed annually and which aim to assist clinician decision-making to ensure that radiology diagnostics and interventions are used most effectively and improve the quality of care patients receive. CDS for radiology is not currently in popular use across the UK but is being implemented in Europe and is routinely used in radiology in the United States.
• iRefer: a radiological investigation guidelines tool from RCR, which is available in both online and booklet format. The guidelines are also being piloted in a CDS system. iRefer helps referring healthcare professionals to determine the most appropriate imaging investigation(s) or intervention for patients based on the best available evidence (RCR, 2017b).

It is recognised that demand management must be clinically led. Clinicians must recognise their role in this- engaging with the Trust to decide the best model and ensuring patient expectations are appropriately managed.
There is particular concern about the use of imaging where there isn’t clear evidence of benefit to the patient.

The CRUK horizon scanning report has several reservations about demand management, but also identifies two areas of opportunity (2020 Delivery, 2015):

- Firstly, the use of imaging where there is no clear evidence of benefit to the patient, e.g. using MRI scans for diagnosing musculoskeletal pain.
- Secondly, the frequency of surveillance scanning for cancer survivors, where there is substantial variation in practice. However, there is no consensus as to whether, on average, people living with and beyond cancer are over-examined or under-examined (2020 Delivery, 2015). They recommend therefore that NHS England, supported by the Royal College of Radiologists, should develop clear, nationally evidence-based protocols for follow-up and surveillance scanning for some cancers. These should be evidence-based, be developed for at least breast, prostate, colorectal (because there is a higher level of survivor prevalence) and some rarer cancer types, and should specify the modality, extent of scan and scanning frequency for high prevalence cancers. These protocols should be risk-stratified so that individual patients receive an appropriate level of imaging follow-up which may include zero imaging in some very low risk patients (2020 Delivery, 2015).
Advanced roles

The Nuffield Trust state there is an urgent need to reshape the NHS workforce to equip it to meet the changing demand from the population it serves and deliver the vision set out in the Five Year Forward View (Imison, Castle-Clarke & Watson, 2016). There are opportunities to develop the current workforce at all grades: from redeploying support staff, extending the skills of registered professionals and training advanced practitioners (Imison, Castle-Clarke & Watson). Extending roles can enrich the work of professional staff and make their jobs more rewarding (Imison, Castle-Clarke & Watson).

Within radiology, there are unrealised opportunities to make better use of available technology and skills to deliver novel service models (NHS Scotland). Radiographers can play a greater role within the imaging team through acquiring advanced skills (for which there should be an incremental increased pay incentive) including vetting imaging study requests, post-processing complex imaging studies and paediatric image acquisition. The RCR is keen to promote and encourage excellence in radiography and such radiological team working is in the clear interests of patients (RCR, 2017a). The growth in reporting by extended practice radiographers will be an important response to the continuous growth in demand experienced by imaging departments across the NHS (NHS Benchmarking, 2016a).

Currently, we know that:

• Consultant radiologists are reporting over half of all examinations (54%), with sonographers and radiographers reporting 21.1% of examinations. The proportion of examinations reported by radiology registrars was 11.1% in 2015/16 (NHS Benchmarking, 2016a).

• Optimal use of the full-range of skill-mix is highly variable across Trusts: in mammography, the use of assistant practitioners (e.g. Band 4) is relatively well established, as is the use of advanced practitioner radiographers, who undertake reporting as well as image acquisition. In some Trusts, an equivalent development of skill-mix is underway in several modalities, with advanced practitioner radiographers reporting plain film x-rays within a clinical governance framework. However, many Trusts keep to traditional radiographer and radiologist roles, with little use of either assistant or advanced practice (2020 Delivery, 2015).

• There is considerable variation in the delivery of radionuclide imaging/nuclear medicine. In some Trusts this is an integral part of the imaging service, while in others it is a separate facility (2020 Delivery, 2015).

• There is variation in the use of skill-mix in plain film reporting, which could release radiographers from tasks that could be done by healthcare assistants (2020 Delivery, 2015).

• Radiographer reporting of plain film radiographs is an established role in the UK. Despite this, previous research has demonstrated widespread inconsistencies in implementation, scope and utilisation (Snaith, Hardy & Lewis, 2015). The British Institute of Radiology (BIR), Society and College of Radiographers and InHealth Radiographer Reporting have issued a joint document on why radiographer reporting is a vital part of service delivery as a key proven innovation which will help reduce unacceptable waiting lists (BIR, 2017).

21% of all reporting is currently performed by radiographers and sonographers.
CRUK recommends the radiographer advanced practitioner role be developed within an overall governance framework for improving reporting productivity - this should set the expectation that the majority of plain film reporting should become radiographer-delivered over time (2020 Delivery, 2015).

**Current initiatives**
Work is being done by the College of Radiographers to develop definitive definitions of advanced practice, both clinically and educationally, in the UK and across the world (TopTalk, 2016). In 2016, new legislation was passed enabling independent prescribing by therapeutic radiographers, although it did not support proposals for independent prescribing by diagnostic radiographers. However, NHS England is working with relevant professional bodies to further consider these proposals (NHS England, 2017).

**Examples from around the UK**
Seven Trusts in Yorkshire have announced the UK’s first reporting radiographer academy will accept trainees from September (Working Together Partnership Vanguard).

**Homerton Hospital** has extended the contribution of radiology department assistants (healthcare assistants) allowing radiographers to concentrate on patient care. This is increasing the efficiency of service delivery and creating capacity for additional reporting sessions. An assistant practitioner is used in Outpatients and for GP x-rays, providing a significant contribution to capacity, performing approximately 20% of Outpatient x-ray imaging (CoR, 2016a).

**The Countess of Chester Hospital** has developed assistant and advanced practitioner roles in its radiography team. Their responsibilities include reporting plain film x-ray, chest x-ray and nuclear medicine examinations and providing a PICC line service for the Trust. These roles have increased capacity for reporting and capacity for PICC lines. They have allowed the progression of radiographers into other advanced roles with a cost effective backfill at band 4. This has enabled career progression for qualified radiographers and band 3 support workers. When first introduced, the assistant practitioner role was originally met with negativity but now staff have seen the advantages of these roles, they welcome them. Radiologists can concentrate on reporting the more complex cross-sectional imaging and complex IR procedures. This has been ongoing for the last seven years and continues to grow as the scope of practice grows and is funded from the existing budget (Williams, 2015).

**In the US**, radiologist assistants (RAs) are registered radiological technologists who have undertaken a higher level of education and training so that they can extend the ability of the radiologist to provide patient care. RAs support the diagnostic imaging team by taking a leading role in patient management, performing selected exams under the supervision of the radiologist, and evaluating image quality (Askew, 2015).
### 3B Transformation – Advanced Practice

This table summarises developments in practice by modality (1/3)

<table>
<thead>
<tr>
<th>Modality</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **Plain Film** | • Emergency and GP plain film reporting Radiographer (Isle of Wight)  
• Assistant practitioners extended role and working evenings to support out of hours plain film service (Milton Keynes)  
• Radiographer plain film image interpretation (South Tyneside)  
• Reporting radiographers (axial, appendicular) (Royal Devon & Exeter)  
• Radiographer plain film reporting to include chest and abdomen examinations (South End University)  
• Radiographers have led a development in Plain Image reporting (Aintree)  
• Radiographer reporting appendicular and axial A&E and GP referrals (East Cheshire NHS Trust) |
| **IVs/Lines** | • IV cannulation by radiographers and assistants (Heart of England)  
• We have trained radiographers to be able to do IV port access to help with modality efficiency and patient experience (Royal Marsden)  
• Radiographer lead PICC line service (Royal Brompton)  
• Radiographer contrast Administration – 0.5 WTE reporting radiographer in place (Imperial College) |
| **CT** | • Radiographer led CT Colonoscopy sessions (Imperial College)  
• Radiographer reporting for CT colonography (Leeds Teaching Hospital)  
• Plans for CT radiographers to report lung nodules in place (Leeds Teaching Hospital)  
• Radiographer led training days for Cardiac CT and Chest Radiography (Royal Brompton)  
• Radiographer protocolling and justification of CT/MR referrals (Imperial College)  
• Radiographer led CT colonography including first reports (Southend University)  
• Appointment of two advanced practice cardiac cross sectional radiographers (University Hospitals of Leicester)  
• A Trainee CT Head Reporter (Burton) |
| **Fluoroscopy** | • Radiographer led video fluoroscopy service (training in progress) (Southend University)  
• Radiographer lead upper GI fluoroscopy lists (South Tyneside)  
• All upper GI fluoroscopic examinations (Royal Devon & Exeter)  
• Radiographer vetting in Fluoroscopy (Leeds Teaching Hospital)  
• Radiographers have led a development in Fluoroscopy (Aintree) |

The following three slides provide further examples of advanced roles from a range of UK trusts provided through the NHS Benchmarking Network (NHS Benchmarking, 2016b).
## 3B Transformation – Advanced Practice

This table summarises developments in practice by modality (2/3)

<table>
<thead>
<tr>
<th>Modality</th>
<th>Examples</th>
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</thead>
</table>
| MRI      | • MRI reporting radiographer (Isle of Wight)  
           • Radiographer vetting in MRI (Leeds Teaching Hospital)  
           • There is also advanced practitioners reporting in MRI spine and knee (Burton) |
| Breast   | • APs’ in Breast – extended duties to include additional views and symptomatic mammography on completion of breast foundation degree (Milton Keynes)  
           • Aps to provide mammography support including mammography (Milton Keynes)  
           • We have role extension for staff especially in breast imaging (Royal Marsden)  
           • Skill mix: Breast assistant and advanced practitioners, including reporting, interventions (University Hospitals of Leicester)  
           • Radiographers have led a development in Breast Imaging (Core biopsy and FNA) (Aintree) |
| A&E      | • Radiographer reporting appendicular & axial A&E and Orthopaedic clinics (Milton Keynes)  
           • Radiographer A&E hot reporting 9 am – 5 pm Mon – Friday (Milton Keynes) |
| HSG      | • Radiographer led HSG service including reporting (North Lincolnshire)  
           • Nurse provided HSG service (Milton Keynes)  
           • Nurse lead HSG sessions (South Tyneside)  
           • Radiographer performed HSGs (Royal Devon & Exeter) |
| Ultrasound | • Reporting efficiencies with advanced practice in ultrasound (Heart of England)  
            • Interventional sonographer training junior doctors (Leeds Teaching Hospital)  
            • Sonographer led TRUS service. Sonographer led FNA neck (Leeds Teaching Hospital)  
            • Radiographer vetting in US (Leeds Teaching Hospital)  
            • Ultra sonographers provide scans for SAU on Saturdays (Milton Keynes)  
            • Successful rolling sonographer training program. Seven day sonographer led ultrasound service, implementation due Sept 2016 (Salisbury)  
            • Trainee midwife sonographer commenced (Ipswich)  
            • There has been a development of sonographer led HSK and H&N imaging (ABN)  
            • Radiographers have led a development in Ultrasound (Aintree) |
### Modality

<table>
<thead>
<tr>
<th>Other/general</th>
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<tbody>
<tr>
<td>• Radiographer extended roles (James Paget)</td>
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<tr>
<td>• Radiographer lead Cystography lists (South Tyneside)</td>
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<tr>
<td>• Radiographer performed facet joint injection lists (North Bristol)</td>
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<tr>
<td>• Radiographers performing video swallows (Milton Keynes)</td>
</tr>
<tr>
<td>• Specialist roles for Radiographers, e.g. UGI/research/education (Royal Liverpool)</td>
</tr>
<tr>
<td>• Proctograms, Sialograms, Radiographer performed lithotripsy (Royal Devon &amp; Exeter)</td>
</tr>
<tr>
<td>• Radiographer/Nurse led Pre Assessment for interventional cases to reduce waiting time and improve patient experience (Ipswich)</td>
</tr>
<tr>
<td>• Radiographer led vetting under scheme of work in certain exams (Southend University)</td>
</tr>
<tr>
<td>• GP reporting sessions every Mon-Fri day (Torbay and South Devon)</td>
</tr>
<tr>
<td>• Radiographer reporting at weekend in addition to Mon-Fri (Torbay and South Devon)</td>
</tr>
<tr>
<td>• Nurse led nuclear medicine cardiac stress team (University Hospitals of Leicester)</td>
</tr>
<tr>
<td>• Image-guided Vascular Access Service led by Radiology nurses (University Hospitals of Leicester)</td>
</tr>
<tr>
<td>• Skill mix: Nurses &amp; radiographers performing Hysterosalpingograms (University Hospitals of Leicester)</td>
</tr>
<tr>
<td>• Role extension for clinical support workers and radiographers (Walsall Healthcare)</td>
</tr>
<tr>
<td>• There has been an ongoing development of radiographers reporting (ABN)</td>
</tr>
<tr>
<td>• There has been further development of the reporting radiographer role, as well as improved performance management through the use of capacity and demand analysis (Aneurin Bevan)</td>
</tr>
<tr>
<td>• There has been an increase in the scope of the reporting radiographers to include GP work; whilst the department has also trained assistant practitioners (Blackpool)</td>
</tr>
<tr>
<td>• There has been an introduction of extended roles in Interventional radiology, GI radiographers, radiographer led MCUGs, Urethrograms, HSGs, reporting radiographers and PIA clinics (Central Manchester Foundation Trust)</td>
</tr>
<tr>
<td>• Assistant practitioners undertaking a wide range of examinations (East Cheshire NHS Trust)</td>
</tr>
<tr>
<td>• There is a radiographer reporting team led by a consultant radiographer with 5.1 WTE reporting radiographers working 8am-8pm Monday to Friday and 8am-4pm Sunday- reporting in chest, abdomen and Paediatrics (Burton)</td>
</tr>
<tr>
<td>• The department has qualified stress leaders since 2006 in nuclear medicine, and is developing programmes to introduce more radiographer responsibility for the care of the patients during procedures in cardiac, CT and MR (Blackpool)</td>
</tr>
</tbody>
</table>
Consideration needs to be given to:

- **Radiologists’ concerns**: a survey of the views of radiologists in Scotland showed a lack of support for radiographer reporting of cross-sectional imaging studies, with 85% of consultants and 98% of trainees against it. Given the issues of retention of both consultants and trainees, and the importance of sustainable team building and provision of radiology registrar training, the RCR suggests their views should be recognised (RCR, 2017a).

- **Cost**: developing advanced practice roles can be expensive and, if done at scale, will require a strong supporting governance structure (Imison, Castle-Clarke & Watson, 2016).

- **Complexity**: the RCR believes that the current and anticipated increase in demand is for more complex and time-consuming imaging examinations for which the expertise of a radiologist is required. Imaging reports must be diagnostic and actionable to be of any value, and there is concern that this requires an understanding of the patient process and medical conditions derived from specialist medical training (RCR, 2017a).

- **Risks**: reshaping the NHS workforce carries risks. There is evidence that without careful role and service redesign, new and extended roles can increase demand, supplement rather than substitute for other staff, cost rather than save, threaten the quality of care, and fragment care (Imison, Castle-Clarke & Watson, 2016).
3C Transformation – Other Service Improvement Options

There are a number of other improvements that may increase capacity, including optimising the use of non-clinical time and exploring auto-reporting.

Organisational redesign can improve the alignment of demand and capacity.

- The mean percentage of consultant radiologist PAs used on MDT meetings was 12%. This is equivalent to 1.2 PAs, or 4.8 hours during the working week. Generally, consultant radiologists in teaching hospitals spent more time in MDT meetings compared to medium and small sized organisations (NHS Benchmarking, 2016a). Collaborative team working can enable more effective use of the skills within the team. The collaborative approach taken by the radiology department of an acute London hospital has highlighted the value of the team working approach advocated by the RCR and the College of Radiographers (CoR, 2016a).

- Overall radiographic staff of Band 7 or above spend an average of 50% of time on non-clinical duties (CoR, 2016b). This could be reduced to release time for clinical work.

- Over the past 12 months, the proportion of examinations that are auto reported has risen by 1% to 10% (NHS Benchmarking, 2016a). This could be extended further.

- Another possibility may be to take advantage of potential changes to working hours due to the ending of the European Working Time Directive (EWTD). Most of the UK healthcare system has been affected by EU legislation and policies, including the European Working Time Directive (EWTD). Concerns were raised over the resultant reduction in trainee clinical experience and exposure to learning opportunities. Brexit may be an opportunity to introduce a change in working policies more suited to the NHS, assuming a return of pre-EWTD working conditions (Piorkowska, Goh & Booth, 2017).

- Learning from the private sector, work stations could be installed in the home of radiologists. Radiologists who are keen to undertake extra-contractual work could work remotely and link to local services through a hub model.

Improvement examples from other UK Radiology departments

<table>
<thead>
<tr>
<th>UK examples</th>
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<tbody>
<tr>
<td>Imaging coordinators (admin) supporting acute workflow and reporting (Mid Yorkshire Hospitals)</td>
</tr>
<tr>
<td>Radiologist home workstations increasing flexibility (Mid Yorkshire Hospitals)</td>
</tr>
<tr>
<td>Business case for changing the department to a shift pattern for radiographers rather than on call system (Yeovil District Hospital)</td>
</tr>
<tr>
<td>70% of all reports completed with voice recognition (East Cheshire NHS Trust)</td>
</tr>
<tr>
<td>Redesign of the Radiology establishment – noting a shortfall in the band 6 cohort, the Trust upgraded a Band 5 position to a Band 6 (Walsall Healthcare)</td>
</tr>
</tbody>
</table>

Source: NHS Benchmarking, 2016b
Strengthening the efficiency and effectiveness of imaging pathways can enable better use of radiologist and radiographer time, including through the streamlining of MDT processes.

Reducing variation in the imaging process pathway can also increase efficiencies and allow better use of the workforce, including:

- Electronic requesting makes it easy to spot duplicate imaging requests and address these at justification (2020 Delivery, 2015).
- Preparing patients for scanning – if performed outside the scanning room, more time can be available for scanning. The most efficient departments use radiographer helpers (Bands 2 and 3) to prepare the patients, taking responsibility for activities such as pre-procedure checks and cannula insertion. This allows radiographers more time to conduct examinations and increase patient throughput (2020 Delivery, 2015).

Where consultants report large volumes of scans, in addition to full time work, there is a risk of reduced productivity or quality in-hours. Few Trusts have robust ways of monitoring this. CRUK suggests Trusts need to employ robust processes to give them confidence they have fully utilised potential productivity of contracted Radiology reporting time before seeking overtime or outsourcing (2020 Delivery, 2015).

MDT meetings and preparation have a significant impact. As these meetings grow in number and duration, the impact on radiologist capacity grows too. On average, these meetings represent 10% of the weekly activity of a radiologist. The CRUK report acknowledges the need to streamline MDT processes. Standardised reporting formats could assist other clinicians to interpret reports by radiologists who are not present (2020 Delivery, 2015).

Funding models could also be reviewed. CRUK research suggest that Trusts which fund imaging departments on an activity basis – rather than block contracts – have less difficulty in keeping up with demand as the funding enables steps to be taken to meet it (2020 Delivery, 2015). They recommend that Trusts move to a budget system for improving services that reflects changes in activity and funds it accordingly, based on the tariff, in particular for Outpatient and GP direct access scans (2020 Delivery, 2015).

Artificial intelligence (AI) is developing at pace and fast becoming a critical component of the imaging pathway. At the 2017 Health Information and Management Systems Society (HIMSS) annual conference, several vendors showed the first concrete examples of how AI works in imaging. AI will bring the potential to interpret clinical data more accurately and more rapidly than medical specialists. However, AI will not replace physicians any time soon. An important, unresolved challenge for medical AI is that it provides no explanatory power. It cannot search for causes of what is observed. It recognises and accurately classifies a skin lesion, but it falls short in explaining the cause, prevention and elimination options. Several machine learning tools, such as probabilistic graphical models, have been developed, but they are far from the practical efficacy that deep learning has achieved in diagnosis support. AI could become the tireless, irreplaceable and cost-effective complement of physicians, giving the doctor more time to focus on the complexities of their individual patient.
3. Conclusion
Conclusion

Radiology workforce shortfalls in the UK are a growing problem. Health regions may choose to work collaboratively on actions to address the short, medium and longer term challenges.

There are significant radiology workforce shortage issues across the UK that need to be addressed.

- c10% of UK radiology posts and c8% of radiographer posts are vacant.
- 34% of radiology consultants are aged 50 or over and will be retired within 10-15 years.
- Estimates suggest demand for CT and MRI will increase by 5-9% annually.

Solutions are emerging that can minimise the impact of current and future shortages. HR solutions are fundamental in both the short and longer-term.

- **Recruitment**: undertake a vigorous coordinated programme across a health region to maximise international recruitment and fill vacancies in the short term.
- **Retention**: develop, potentially in collaboration with NHS Improvement, a holistic radiology staff retention programme across a health region.
- **Workforce planning**: work with HEE to carry out robust definitive workforce modelling, with assumptions agreed by key/expert stakeholders, to ensure the future generation of radiology workforce will be in place within ten years. Create training posts accordingly. Ensure sufficient generalist posts.
- **Training**: explore options to strengthen both radiologist and radiographer training in order to reduce attrition, facilitate multi-professional education and training, support a networked model of service delivery, and support advanced roles for non-radiologist staff.

External support via costly overtime and outsourcing models should be transitioned, as viable, to a collaborative radiology network.

- **Regional radiology network**: develop a business case to form a collaborative regional radiology network across a health system.

A whole range of both proven good practice and innovative approaches to the radiology pathway are available to test and/or ensure uptake, as appropriate. This should include:

- **Demand management**: pilot the use of Clinical Decision Support. Advocate for national evidence-based protocols for cancer follow-up and surveillance.
- **Advanced practice and service improvement**: convene a representative regional panel to review practices from across the UK and recommend the best approach for selection, testing and implementation across a region. Trusts should employ robust processes to ensure they fully utilise the potential productivity of their contracted time, including MDT processes.

While no one approach alone will resolve the radiology workforce challenges, implementing targeted measures and nurturing the workforce based on a concerted programme can mitigate the impact to cost and quality and help improve patient care overall.


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