HORIZON SCANNING

An evaluation of imaging capacity across the NHS in England

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Executive Summary

Around half of us will be diagnosed with cancer in our lifetimes.[1] There were around 280,000 new cancer diagnoses in England in 2013[2] and this is set to increase considerably as we live longer. Cancer survival is at its highest ever level, but the NHS in England is under considerable pressure. The '62-day wait' target - which states that 85% of cancer patients should receive treatment within 62 days of being urgently referred for suspected cancer by their GP – has now been breached for six consecutive quarters. This is indicative of pressures across the pathway – from seeing a specialist, to receiving a test, to getting results, and ultimately commencing treatment.

This rising demand for diagnostic tests, and subsequent pressure on services, means action is now needed. Cancer Research UK commissioned this research to understand the pressures facing imaging services in England and to identify solutions for addressing these issues. Addressing future demand and 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 full 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[a].

Research Aims

The aims of this work were to model current and future demand for medical imaging, ascertain the barriers to meeting rising demand and determine how these can be overcome. We hope the findings of this work will influence national policy on imaging services, but also provide useful recommendations for actions that can be taken by commissioners and service providers to ensure imaging services are better equipped to deal with future demand. The intention is that this work will lead to better experience and outcomes, not just for people with (suspected) cancer, but for everyone who uses these services.

The findings of this report were shared with the Independent Cancer Taskforce, to inform the recently published *Achieving World-Class Cancer Outcomes: a Strategy for England 2015-2020*. While this report shows a considerable gap between current capacity and demand for imaging services, if the Government and NHS bodies act to implement the recommendations of *Achieving World-Class Cancer Outcomes*, significant progress will be made towards delivering world class diagnostic services.

Findings

A number of challenges facing medical imaging services were identified through an evidence review, modelling and interviews:

- Imaging activity has been growing at nearly 6% per annum over the last ten years.
- It is likely that, in future, demand for MRI and CT will grow at 9% per annum or more[b].
- There is currently a lack of capacity to respond to this increasing demand.
- Workforce shortfalls are a crucial limiting factor to meeting rising demand, as workforce growth has not kept pace with increased

[a] Ten-year cancer survival by stage at diagnosis for the eight cancers (combined). Data for patients diagnosed in 1996-2000 in the Former Anglia Cancer Network area

[b] According NHS England figures, in 2013-14 there were 5.2m CT exams and 2.7m MRI exams. If current growth continues, in 2023-24 there would be 12.4m CT exams and 6.9m MRI exams

activity. New projections suggest that there will be increasing shortfalls going forward.
- Equipment is also an issue as very few trusts have a planned, financially-supported approach to replacing or adding equipment.
- Some funding models can inhibit meeting future demand: funding on an activity basis was more helpful than a block contract to keep up with increasing demand.

Recommendations

Meeting rising demand

Imaging departments are struggling to keep up with increased demand, and this is only set to worsen as demand for imaging continues to grow. This has resulted in increasing numbers of patients waiting more than six weeks for their imaging examinations, evidence of substantial reporting backlogs and some Trusts making risk-based decisions not to report particular types of imaging examinations (for example, certain outpatient and sometimes inpatient plain X-ray studies).

Growth in MRI and CT use is clinically appropriate and inevitable, but local practice in the NHS has been to try to manage demand and hold activity flat. This has been counter-productive as activity growth has happened anyway and it has meant that Trusts have not been able to plan for activity growth in the most productive way.

Our research suggested that Trusts which fund their imaging departments on an activity basis – rather than on block contracts - have less difficulty in keeping up with demand as the funding enables steps to be taken to meet it.

1. **The Government should increase investment in diagnostic services as set out in *Achieving World-Class Cancer Outcomes*, to ensure the NHS can meet rising demand and contribute to our cancer outcomes equalling the best in the world. Investment in diagnostics also has the potential to avert treatments costs later in the patient pathway. For imaging specifically, investment will be needed to train new members of the workforce, replace ageing equipment and buy additional new scanners.**

2. **Commissioners should work with provider organisations to develop clear, funded plans that will deliver the capacity for the predicted increase in demand.**

3. **Trusts should move to a budget system for imaging services that reflects changes in activity and funds it accordingly, based on the tariff, in particular for outpatient and GP direct access scans.**

Workforce

Over the last ten years there has been significant workforce growth of both diagnostic radiographers and radiologists. However, over the last five years, workforce capacity has not kept pace with the rate of growth in activity. This gap is evidenced by high vacancy rates across diagnostic radiographers, sonographers and radiologists, high amounts of overtime working, high expenditure on outsourced reporting and high prices for agency staff and locums.

In addition, the Royal College of Radiologists (RCR) reports that the UK has a low number of radiologists compared to our European counterparts. The UK has 48 radiologists per million population while Germany has 92, Spain has 112 and France has 130.[3]

The projections for the supply and demand of diagnostic radiographers and consultant radiologists produced for this report differ from those previously produced by Health Education England

and indicate a likelihood that – based on current rates of training and attrition from training – shortfalls in the number of imaging staff will increase. The RCR workforce census indicates an even bigger shortfall than identified in this report.

4. **Health Education England should conduct strategic planning around workforce at the national level, and be based on accurate modelling[c]. Health Education England and NHS England 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[d]. Local Education and Training Boards should project demand for workforce using the expected growth in demand for imaging activity.**

5. **Health Education England[e] should implement a short-term international recruitment effort for sonographers, radiographers and radiologists as the only measure that can credibly reduce vacancy rates in the time before increased training takes effect[f].**

6. **Health Education England and the Society and College of Radiographers should work together to focus on reducing attrition rates from radiography degree courses.**

Effectiveness and Productivity

All Trusts visited for this project had moved towards extended-day and weekend scanning for MRI and in many cases CT. For MRI, the most common scenario is 8am-8pm scanning on weekdays, plus eight-hour days at weekends. This suggests there is little room for increasing the hours of operation. Trusts that have not achieved such extensive scanning hours identify staff shortage as the main constraint. Many Trusts have reached their MRI equipment capacity and are using independent sector scanners to make up the shortfall. Visits identified variation in the use of skill-mix in plain film reporting and releasing radiographers from tasks that could be done by healthcare assistants.

There is evidence that the level of surveillance scanning, i.e. scanning of patients following treatment, varies across the country. However it is not clear what the appropriate level of surveillance is, so there is a possibility that surveillance could be reduced, freeing up capacity.

7. **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.**

8. **NHS England should undertake an assessment of the national spend on overtime and locums versus investing in full time NHS staff, as well as the recent initiative to clamp down on the cost of paying agency staff, and the impact of this**

[c] As stated in *Achieving World-Class Cancer Outcomes* (recommendations 83 and 84).
[d] Figures for radiographers do not allow for accurate quantification of the number of places required. In order to reduce the gap between supply and demand, radiologist training places should increase at the same rate as demand growth, and in addition there should be 50 additional places per year for 3 years, beginning in 2016/17. Note that this is also factors in the 30 additional places for the preceding 3 years.
[e] As per recommendation 85 in *Achieving World-Class Cancer Outcomes*.
[f] Using the current vacancy rate as a proxy for the gap between supply and demand, figures show the current national shortfall in radiologists to be 290 WTE.

on overall value for money.

9. **NHS imaging providers, with support from NHS England and the Royal College of Radiologists, should develop 'imaging networks' to provide patients with appropriate support.**

10. **NHS England, supported by the Royal College of Radiologists, and as part of the Living With and Beyond Cancer programme, should develop clear, nationally evidence-based protocols for follow-up and surveillance scanning for appropriate cancers. NHS England should support its implementation in practice[g].**

Equipment

Imaging equipment within CT and MRI is also a significant problem, albeit to a lesser extent than workforce. Prices for CT and MRI equipment have reduced over time, but Trusts continue to struggle with old equipment and progressing business cases for new equipment. Very few Trusts have a planned, financially supported approach to the replacement of existing equipment, or to expanding their number of scanners. As a result, many departments are working with equipment that is much older than the recommended seven years, for extended hours.

The UK has a very low number of CT and MRI scanners as compared with other OECD countries, with around 9 CT scanners and 7 MRI scanners per million population. Germany has 19 CT and 11 MRI, Spain has 17 CT and 15 MRI and France has 14 CT and 9 MRI per million population.[4]

11. **NHS England should implement a long-term plan for replacing ageing machinery on a rolling basis, including earmarking national funding for new MRI and CT equipment and procure this at the national level. This should also include producing regular projections for England's future equipment needs based on accurate modelling of rising demand.**

A Patient-centred service

Our field research revealed strong support for a proactive approach to patients having access to the reports of their imaging studies. This is in line with the government's aim of shared decision making in health ('No decision about me, without me') and is supported by similar work of Cancer Research UK and Public Health England which demonstrates that patients want access to all the records of their care. One example of an existing project that achieves this is the 'Patient Portal'[h], an initiative developed by the National Cancer Registration Service in partnership with brainstrust and Cancer Research UK, which gives patients with cancer or a brain tumour access to their pathology and imaging reports as well as a record of their treatment.

People enter diagnostic services via different routes and for different reasons. The majority of NHS Trust imaging departments have to balance their resources to support three overlapping but relatively distinct patient pathways:

- Emergency and inpatient care
- Cancer care
- Planned and community care

Where departments try to deliver such services, there are trade-offs of resources, which predominantly disadvantage the planned and community care pathway. New approaches to and 'streaming' of these pathways may be needed, including delivery in the community through

[g] As per recommendations 67 and 68 of the Taskforce report which requires stratified follow-up pathways for some cancers and further research.

[h] https://portal.myregistry.org.uk/

innovative models, including multi-disciplinary diagnostic centres.

12. Services should be supported to deliver a strategy to ensure patients are at the heart of their care and can access the reports of their imaging tests should they wish to do so, as per recommendation 57 of the Taskforce report.

13. **Acute providers should develop integrated systems that link the requesting acquisition and reporting of imaging tests to the patient pathway with clear information to the patient.**

14. Acute providers should develop plans to approach delivery of diagnostics in new and innovative ways to meet the needs of people who may be on different patient pathways.

1. Introduction

Around half of us will be diagnosed with cancer in our lifetimes.[1] There were around 280,000 new cancer diagnoses in England in 2013[2] and this is set to increase considerably as we live longer. Cancer survival is at its highest ever level, but the NHS in England is under considerable pressure. The '62-day wait' target - which states that 85% of cancer patients should receive treatment within 62 days of being urgently referred for suspected cancer by their GP – has now been breached for six consecutive quarters. This is indicative of pressures across the pathway – from seeing a specialist, to receiving a test, to getting results, and ultimately commencing treatment. Action is now needed to ensure services are equipped to cope with rising demand.

Medical imaging is a crucial part of the diagnostic pathway and involves creating images of the inside of the body in order to support diagnosis, ongoing surveillance and treatment of a range of conditions, including cancer. Demand for such tests - particularly for Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) - has been growing over the last decade. The increase in demand has been driven by many factors, including demographic factors (growing population and ageing population); clinical guidelines which lead to switching from a simple modality (e.g., plain film X-Ray, Ultrasound) to a cross-sectional modality; clinical guidelines which lead to new imaging or imaging at a lower threshold; and surveillance scanning due to increased patient survival in imaging-intensive conditions such as cancer and stroke. Imaging activity has been growing rapidly for several decades and in England has increased by nearly 6% per annum over the last ten years[i].

It is clear that over-examination, and the subsequent potential for over-diagnosis, is a concern that must be acknowledged when considering appropriate levels of tests. However increasing levels of investigative tests were not found to be inappropriate in an international context where scans per population are lower in the UK than elsewhere (see figure 5). Additionally, as England's cancer survival lags behind other comparable countries, the contribution of early diagnosis to improve this may require additional tests being undertaken.

Imaging workforce growth has been significant in the NHS over the last ten years, across both diagnostic radiographers and radiologists. However, over the last five years workforce growth has not kept pace with the rate of growth in activity, even if an adjustment is made for productivity growth. This gap is evidenced by high vacancy rates (across diagnostic radiographers, sonographers and radiologists), high amounts of overtime working, high expenditure on outsourced reporting (much of which is for bulk reporting of routine imaging examinations) and high prices for agency staff/ locums.

As a result of activity growth outstripping workforce growth, imaging departments are struggling to keep up with demand. Symptoms of this include increasing numbers of patients waiting more than six weeks for their imaging examinations, increasing median waiting times, evidence of substantial reporting backlogs, and some Trusts making risk-based decisions not to report particular types of imaging examinations (e.g., certain outpatient and sometimes inpatient plain X-ray studies).

Imaging equipment within CT and MRI is also a problem, albeit to a lesser extent than workforce. Prices for CT and MRI equipment have reduced over time, but Trusts continue to struggle with old equipment and have difficulty progressing business cases for new equipment.

[i] This figure (5.7%) represents growth rates across all modalities, weighted by complexity

This report aims to ascertain the barriers to meeting rising demand for imaging services and offers solutions for how best these can be overcome. It complements the University of Birmingham report for Cancer Research UK, *'Scoping the Future: an evaluation of endoscopy capacity across the NHS in England'* which undertook a similar assessment of endoscopy services. Taken together, these reports describe a picture of England's diagnostic services facing considerable strain and requiring significant action if patient outcomes are to improve and not deteriorate.

2. Scope and methodology

This project, completed between April and June 2015, focused on imaging services in the NHS in England, and in particular on their impact on cancer services (as an input to the Independent Cancer Taskforce's *Achieving World-Class Cancer Outcomes*). This project specifically focuses on diagnostic imaging, though the capacity and demand issues highlighted will have implications for surveillance imaging, and imaging used to support treatment delivery, for example planning for radiotherapy.

We have evaluated the gap between demand for and supply of imaging services currently; the impact of that gap on cancer services and on other NHS services; the likely evolution of services, and implications of that evolution. We then looked at what solutions, both national and local, are most appropriate for ensuring that imaging departments are in a position to provide the required service, not only for cancer patients but for all patients.

The methodology that we used during this project included:

- Analysis of historic data and publications from sources including, but not limited to: NHS England; Organisation of Economic Cooperation and Development (OECD); Health Education England (HEE); Royal College of Radiologists (RCR); Society and College of Radiographers(SCoR); National Institute of Health and Care Excellence (NICE); National Cancer Intelligence Network (NCIN);
- Field research interviews[j] and local analysis with more than 20 NHS Trusts/Foundation Trusts covering a range of geographies and Trust-types
- Interviews with representatives of independent sector companies involved in image acquisition and image reporting
- Expert interviews including with individuals from the Department of Health (DH), NHS England, Health Education England, Royal College of Radiologists and Society and College of Radiographers
- Development of Excel-based forward-looking projection models of imaging demand, demand for imaging workforce, and supply of imaging workforce
- Testing of interim findings with relevant stakeholders.

[j] Job titles of individuals interviewed, and organisations represented, are shown in Appendix 2 to this report (available on request)

3. Findings and recommendations

3.1 Meeting Rising Demand

Recommendations

1. The Government should increase investment in diagnostic services as set out in the *Achieving World-Class Cancer Outcomes,* to ensure the NHS can meet rising demand and ensure our cancer outcomes equal the best in the world. Investment in diagnostics has the potential to avert treatments costs later in the patient pathway. For imaging specifically, investment will be needed to train new members of the workforce, replace ageing equipment and buy additional new scanners.
2. Commissioners should work with provider organisations to develop clear, funded plans on a rolling basis, which will deliver the capacity for the predicted increase in demand.
3. Trusts should move to a budget system for imaging services that reflects changes in activity and funds it accordingly, based on the tariff, in particular for outpatient and GP direct access scans.

> *"The department is currently very stressed – our demand is much higher than capacity… We don't have the flexibility, in either workforce or equipment, to deal with the rise in demand."* - Clinical Director

3.1.1 Current Situation

Activity growth and demand growth

Demand for imaging services has been growing steadily for many decades. Over the last five years, activity growth across all modalities has averaged 3.6% per annum,[k] but with that growth concentrated in the more complex modalities (MRI and CT). On a complexity-weighted basis[l] (complexity-weighted to reflect demand for radiologists), activity growth has averaged 5.8% per annum over the last 5 years as shown in Figure 1, below.

[k] Over the last ten years, imaging activity growth totalled across all modalities has averaged 3.4% per annum, and on a complexity-weighted basis this has averaged 5.7% per annum.

[l] This figure has been calculated by taking an approximate estimate for the average amount of time required to report on an exam for each modality, and using this figure to gauge the contribution of each modality to the national demand. While this has been calculated for time required to report, modalities which take more time to report, e.g., CT and MRI, also take longer to acquire a scan.

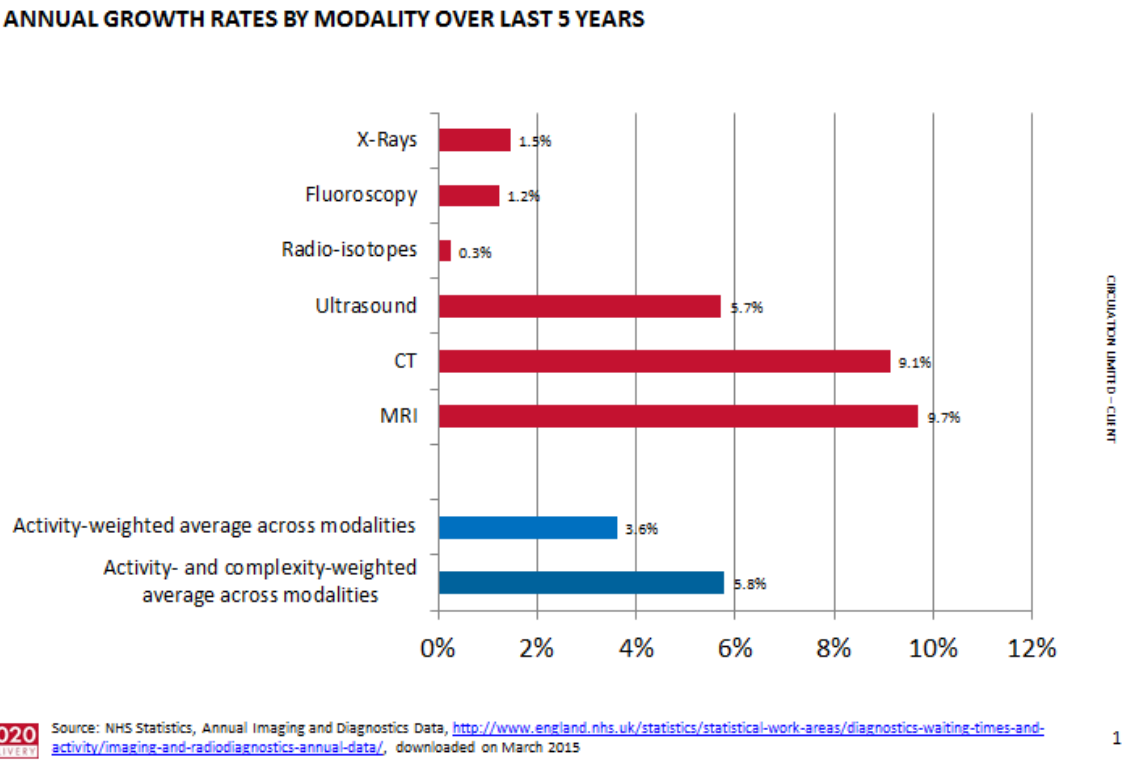


Figure 1: Imaging activity growth rates by modality: all modalities have seen growth

This demand growth is driven by many factors including demographics (growing and ageing population); new clinical guidelines which specify imaging, particularly MRI/ CT and Positron Emission Tomography-Computed Tomography (PET-CT), as part of the pathway; awareness campaigns; progressive changes in doctor/patient behaviours; and increased survival rates in particular conditions.

Figure 2 shows examples of the growth rates associated with selected factors:

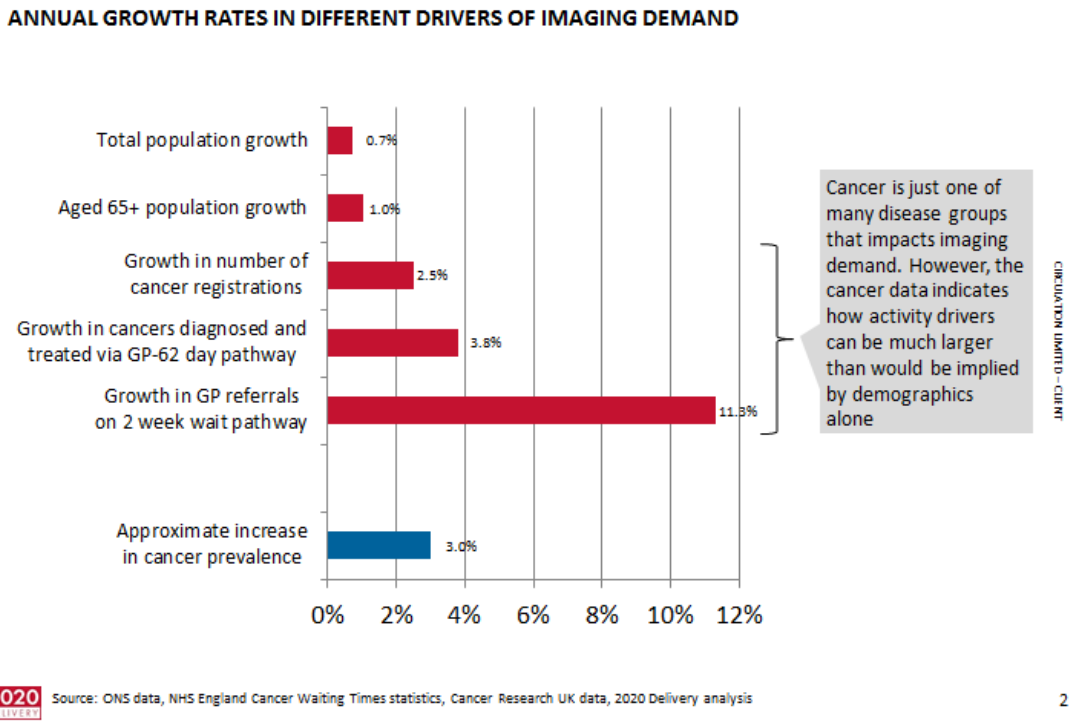


Figure 2: Illustration of growth rates in a range of factors that drive imaging forward

Figure 3 (below) shows the approximate contributions made by each of seven factors (see page16) to the CT growth of an average of 9.1% per annum over the last five years. Figure 4 shows the same for the MRI growth of an average of 9.7% over the last five years.

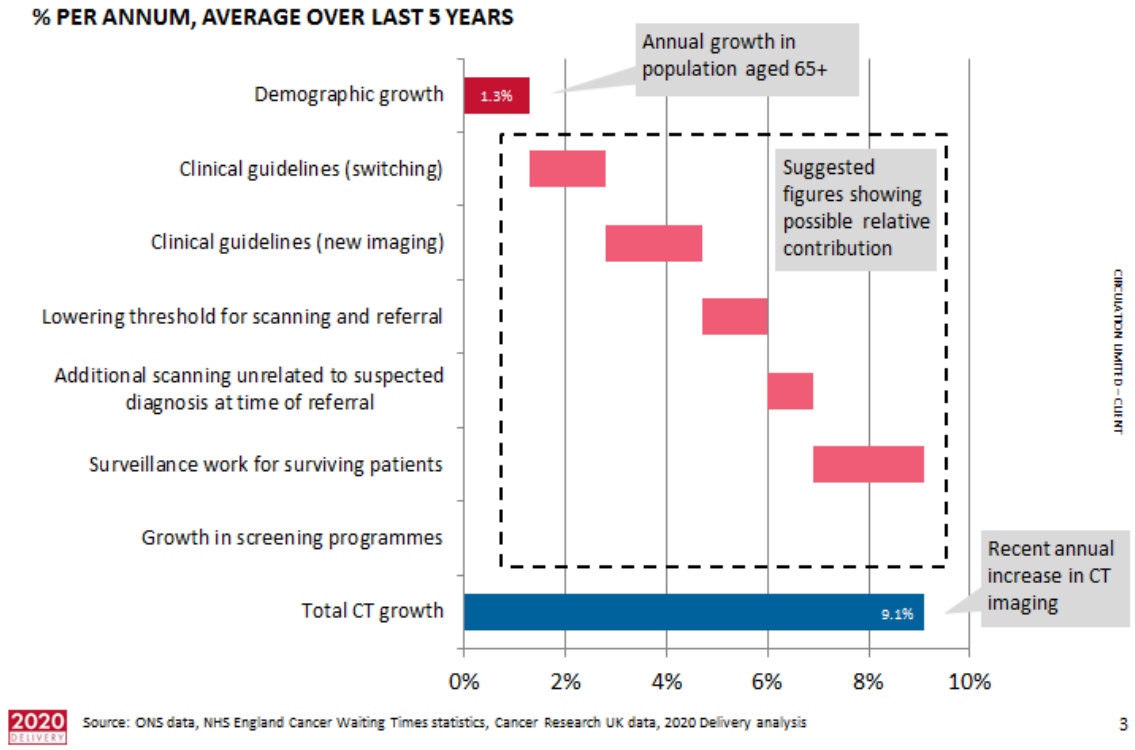


Figure 3: Illustration of contribution of factors that have driven demand for CT scanning

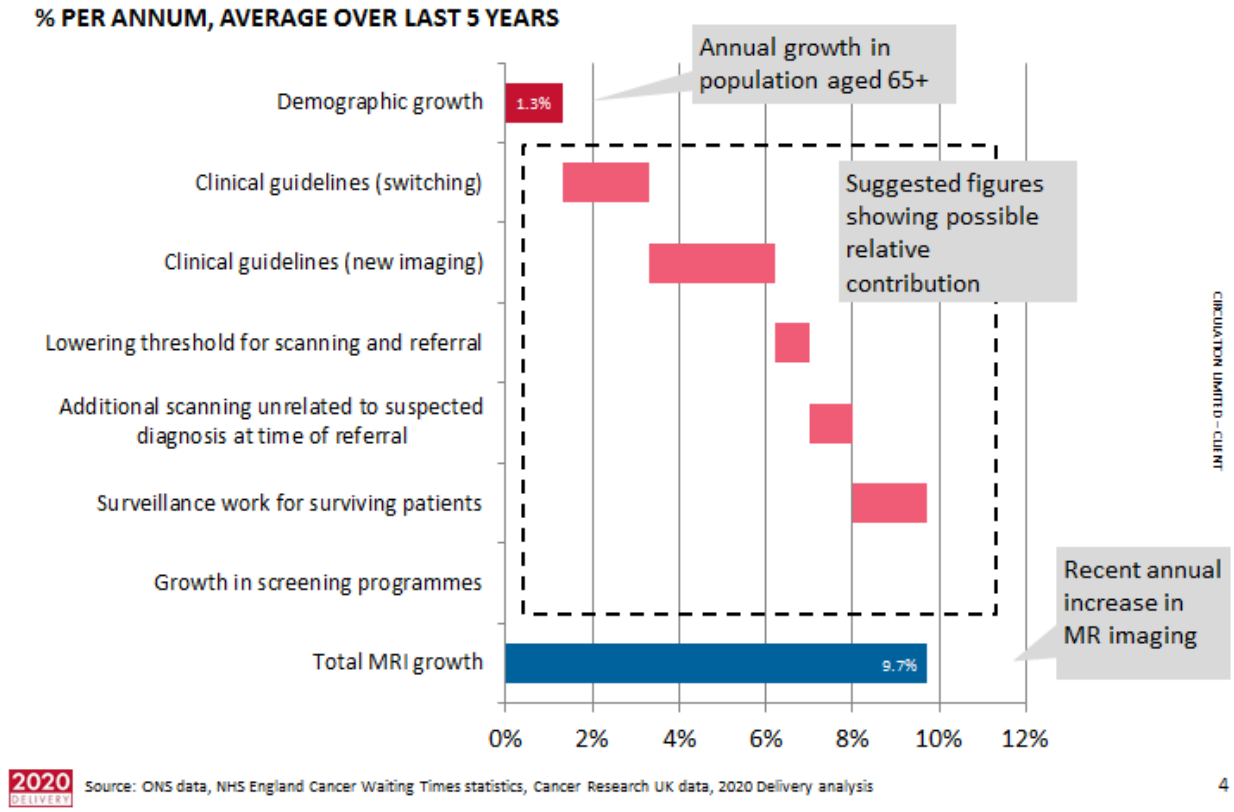


Figure 4: Illustration of contribution of factors that have driven demand for MRI scanning

"MR scanning is at crisis point – there is no extra capacity anywhere in the area, whether that is other Trusts, private hospitals or independent providers." – Radiology General Manager

Despite this, 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, as shown in Figure 5.

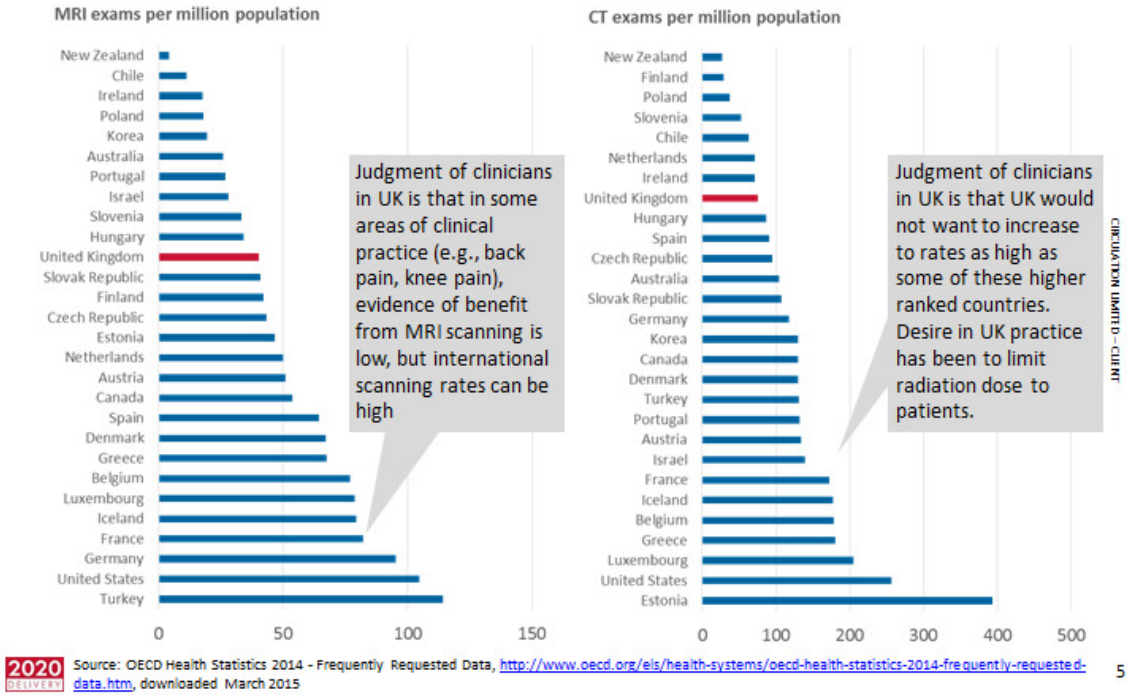


Figure 5: UK performs a low number of MRI and CT scans per million population compared to OECD peers

Imaging departments have invested considerable effort in trying to reduce the growth in imaging (e.g., through vetting/justification of imaging requests against agreed national evidence-based guidelines). Growth has continued in spite of these efforts because the underlying drivers of the large majority of the growth have been real, and the growth therefore clinically appropriate.[m]

[m] Our research indicated only two areas of concern about appropriateness: the first was the use of imaging where there is not clear evidence of benefit to the patient, e.g., using MRI scans for diagnosing musculoskeletal pain; and the second related to 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: further work on a 'Living With and Beyond Cancer' programme of work will be undertaken, as per recommendations in chapter 7 of *Achieving World-Class Cancer Outcomes*

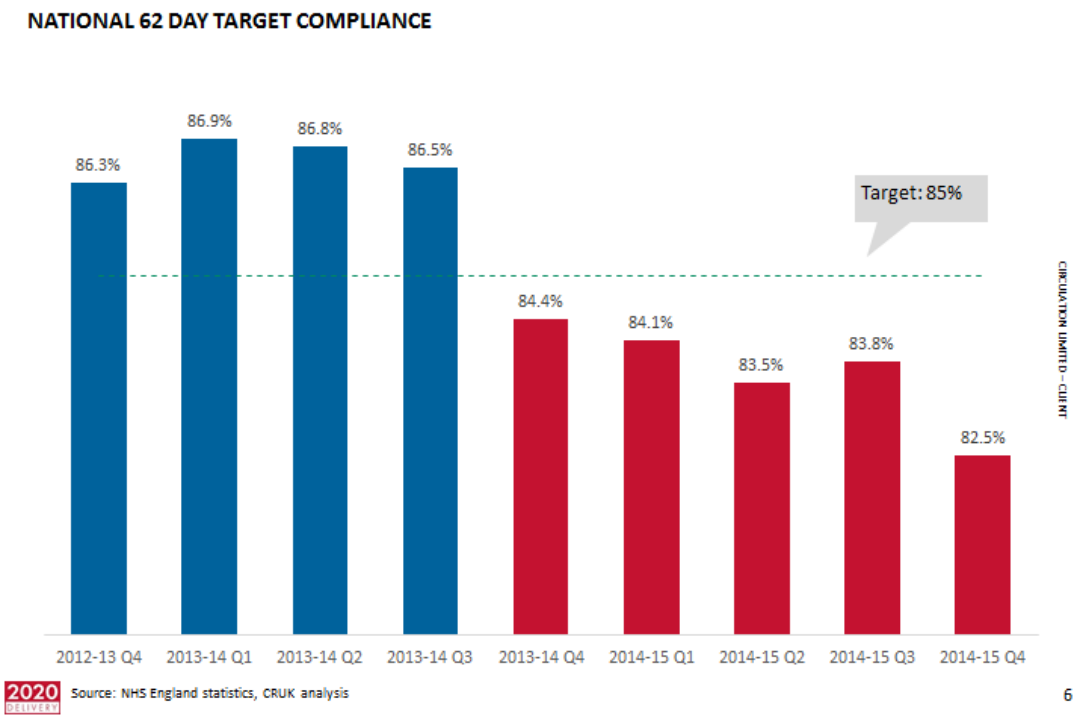


Figure 6: National compliance with 62 day urgent referral to treatment has been below target each quarter for 2014-15

Nationally, Trusts are struggling to meet the 62 day target of urgent referral to treatment for cancer patients. While the imaging department is only one part of this process, improving patient flow through diagnostic imaging would give Trusts a better opportunity to meet these targets.

Many Trusts fund their imaging departments on a 'block' basis, which provides no funding for activity growth, despite the fact that the Trust receives activity-based reimbursement via Payment by Results (PbR) and the unbundled tariff.[n] This makes it very difficult for departments to plan and fund either equipment growth or workforce growth for the (inevitable) increase in MRI and CT activity which comes each year. Our research showed that Trusts which fund their imaging departments on an activity basis (even if just for outpatients and GP direct access activity as per the 'Payment by Results' tariff mechanism) have less difficulty in keeping up with demand as funding allows service development.

3.1.2 Future projection for imaging services

In spite of historic growth, England and the other countries of the UK continue to have low rates of MRI and CT scanning relative to OECD peers. The clinical evidence is that demand for MRI and CT will continue to grow fast in the UK, likely at rates of 9% per annum or more for MRI and CT respectively. This is because the same factors that have driven growth will continue to apply at speed:

- Population growth and the ageing of the population will continue

[n] Trusts are reimbursed on an activity basis for outpatient imaging examinations and GP Direct Access imaging examinations. Within A&E and for inpatients, the picture is more complicated, with reimbursement a function of overall patient condition and treatment, rather than specifically linked to the imaging examination.

- 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) and to drive either new imaging or imaging at lower thresholds (e.g., for dementia)
- Survival rates, and prevalent patient populations, will continue to rise for imaging-intensive conditions such as cancer and stroke

Although evidence appears to suggest that growth in MRI and CT is clinically appropriate and inevitable, local practice in the NHS has been to try to manage demand and hold activity flat. This has been counter-productive, as it has meant that Trusts have not been able to plan for activity growth in the most productive way. As part of this project, we have produced projections of supply and demand, both for diagnostic radiographers and for consultant radiologists. Our projections differ from those previously produced by Health Education England, and indicate a high likelihood that – based on current rates of training and of attrition from training – shortfalls in the numbers of imaging staff (both diagnostic radiographers and consultant radiologists) will increase. This makes investment essential to maintain levels of activity, keep pace with rising demand, and prevent the service falling even further behind.

Future demand growth

There is substantial evidence to suggest that demand for imaging will continue to grow at the rapid rates seen in previous years, and *some scenarios predict even faster growth after 2020*. This is because of the following seven factors:

1. Demographic growth (growing population, ageing population) will continue, and is continuing to drive gradual increases in demand for imaging. As a result of the population ageing, prevalence of dementia will increase, and proactive management of this will lead to increased imaging, particularly MRI and newer molecular imaging options. NICE guidelines on treatment of dementia patients are currently under review, and it is likely that they will be revised to recommend further increases in imaging.
2. Clinical guidelines continue to cause imaging activity to be switched from modalities such as fluoroscopy and ultrasound to CT and MRI. Examples include:
    a. CT colonography (e.g. from barium enema)
    b. Prostate imaging with MRI (e.g., from ultrasound-based prostate imaging)
    c. MR-guided biopsies for prostate
    d. Cardiac imaging, previously echocardiography and nuclear medicine
    e. Trauma patients. While previously patients would have received CT head, US abdomen and chest X-ray, recommended practice is now to use CT for each of these body areas. The threshold at which CT is being used for trauma patients is also reducing.

    As CT technology improves, radiation dose per imaging examination decreases. As a result it becomes clinically appropriate to provide a CT scan in a wider range of circumstances, which increases demand.
3. Clinical guidelines are driving new imaging in situations where previously no or little imaging was performed. Examples include:
    a. The use of MRI, Magnetic Resonance Angiogram (MRA) and Computed Tomography Angiogram (CTA) in the management of stroke. Over the past 5

years, the number of stroke and Transient Ischaemic Attack (TIA) patients receiving an MRI scan utilising diffusion weighted imaging has increased markedly, and this is likely to increase further.

b. There has also been growth in carotid and vertebral vascular imaging across all modalities.

c. Growth in cardiac imaging is set to rise significantly, particularly as dose rates in CT reduce. NICE is currently reviewing its guidance on chest pain. Our discussion with the British Society of Cardiac Imaging suggests there will be a move to 24/7 cardiac CT service in emergency departments, so that this can be used as a filter for all patients presenting with chest pain. This will lead to a massive increase in this technique.

d. As discussed above, tMRI is increasingly used in the diagnosis of dementia. The NICE guidance on dementia is under renewal and is likely to recommend a further increase in MR imaging in this condition, which, coupled with increasing prevalence of dementia, will lead to further growth in MRI.

4. Lowering of thresholds at which scanning is performed:

    a. NICE has recently published an updated version of guideline 27 ('Suspected cancer: recognition and referral (NG12)). Currently, when GPs refer patients on the 2 Week Wait pathway, around 10% of the patients they refer are diagnosed with cancer, as shown in Figure 7. The new NICE guidelines on referral for suspected cancer lower the referral threshold so that anyone with symptoms with a 3% or greater chance of being diagnosed with cancer is referred. The implications of this new guideline could be a large increase in the number of patients coming via the 2 Week Wait route, and a large increase in associated imaging demand. There is also likely to be an increase in negative tests, more equivocal results and the potential for more diagnoses of other diseases or conditions.

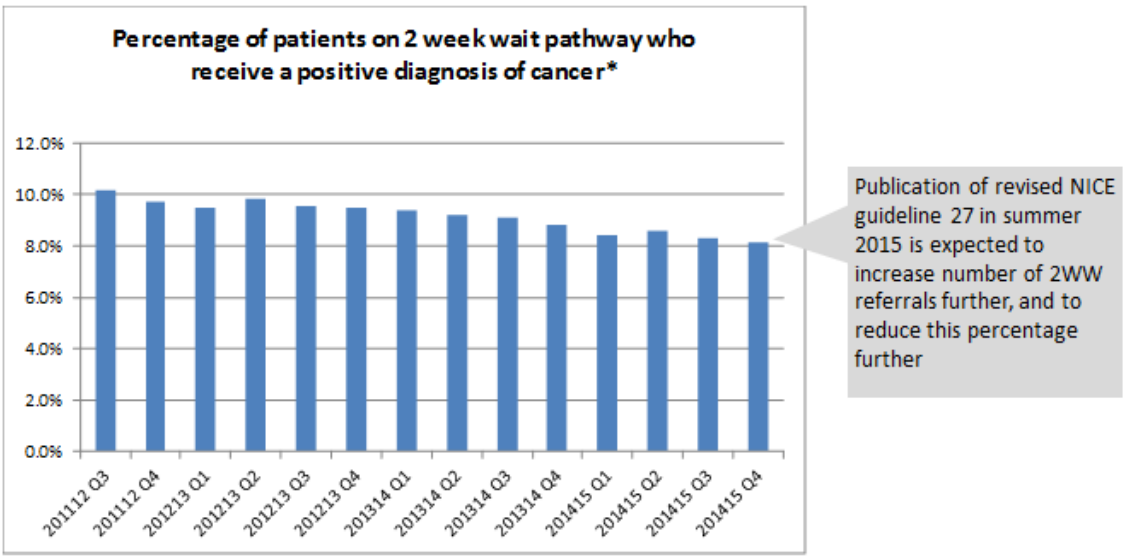


Figure 7: The % of 2 week wait patients who have a positive diagnosis of cancer is reducing

b. Public awareness campaigns (e.g., 'Be Clear on Cancer') have an effect on both patient and clinician behaviour, and collectively lead to a lowering of referral thresholds and an increase in imaging demand.

c. The DH publication 'Direct access to diagnostic tests for cancer' (2012) set out best practice clinical pathways for non-obstetric ultrasound (for suspected ovarian cancer), chest X-ray (for suspected lung cancer) and brain MRI (for suspected brain cancer). Outside of imaging, flexible sigmoidoscopy was also included as a direct access test for colorectal cancer. These direct access pathways can lead to increased imaging activity without necessarily increasing 2 Week Wait referrals. Although not fully implemented at the time, this has been restated in *Achieving World-Class Cancer Outcomes* and therefore should increase activity on this pathway.

5. Increasing the number of imaging examinations for suspected cancer is likely to lead to increased rates of detection of abnormalities other than cancer, which itself would lead to further demand for imaging (e.g., an investigation does not find lung cancer in a patient, but finds lung nodules that require surveillance or some level of further investigation).

6. As survival continues to increase for patients with certain cancers as well as other diseases, e.g., stroke and ischaemic heart disease, there will be growing populations of patients who for disease-monitoring purposes, are heavy users of imaging services. 'Surveillance imaging' for patients who have survived cancer is a particular growth area as research has suggested that the number of cancer survivors is likely to increase by 1 million people per decade.[5]

7. In the longer term, there are three potential changes to recommendations relating to screening which could have significant impacts on imaging demand post-2020, and smaller (but still significant) impacts pre-2020 as new pathways/protocols are piloted. These three potential changes, subject to assessment and recommendations by the National Screening Committee are:

    a. A potential ovarian cancer screening programme, depending on the final results of the 'UK Collaborative Trial of Ovarian Cancer Screening' (UKCTOCS), showing the impact of ovarian cancer screening on the mortality rate, which is likely to be published in around the end of 2015. This could lead to an ultrasound-based screening programme for women aged 50-74 (with piloting of this programme between now and 2020, and full roll-out after 2020)[o].

    b. A potential lung cancer screening programme, based on the results of three international trials currently looking at the impact of CT-based lung cancer screening on lung cancer mortality. These trials are expected to report late 2015 – early 2016, and could recommend targeted screening of current and former smokers aged 55 – 74. This could lead to a substantial CT-based screening programme (with piloting of this programme between now and 2020, and full roll-out after 2020).

    c. A potential extension to the existing breast cancer screening programme. Currently, women aged 50 – 70 are entitled to be screened once every three years. Two existing trials are running to evaluate the potential benefits of extending the screening programme to women aged 47 – 73.

Based on the seven factors above, figure 8 shows a possible projection for how demand may increase for CT scanning over the next five years; figure 9 shows a possible projection for how demand may increase for MRI scanning over the same period.

[o] The frontline test for an ovarian screening and extended breast screening programme would not be CT or MRI, but follow up testing may have an impact.

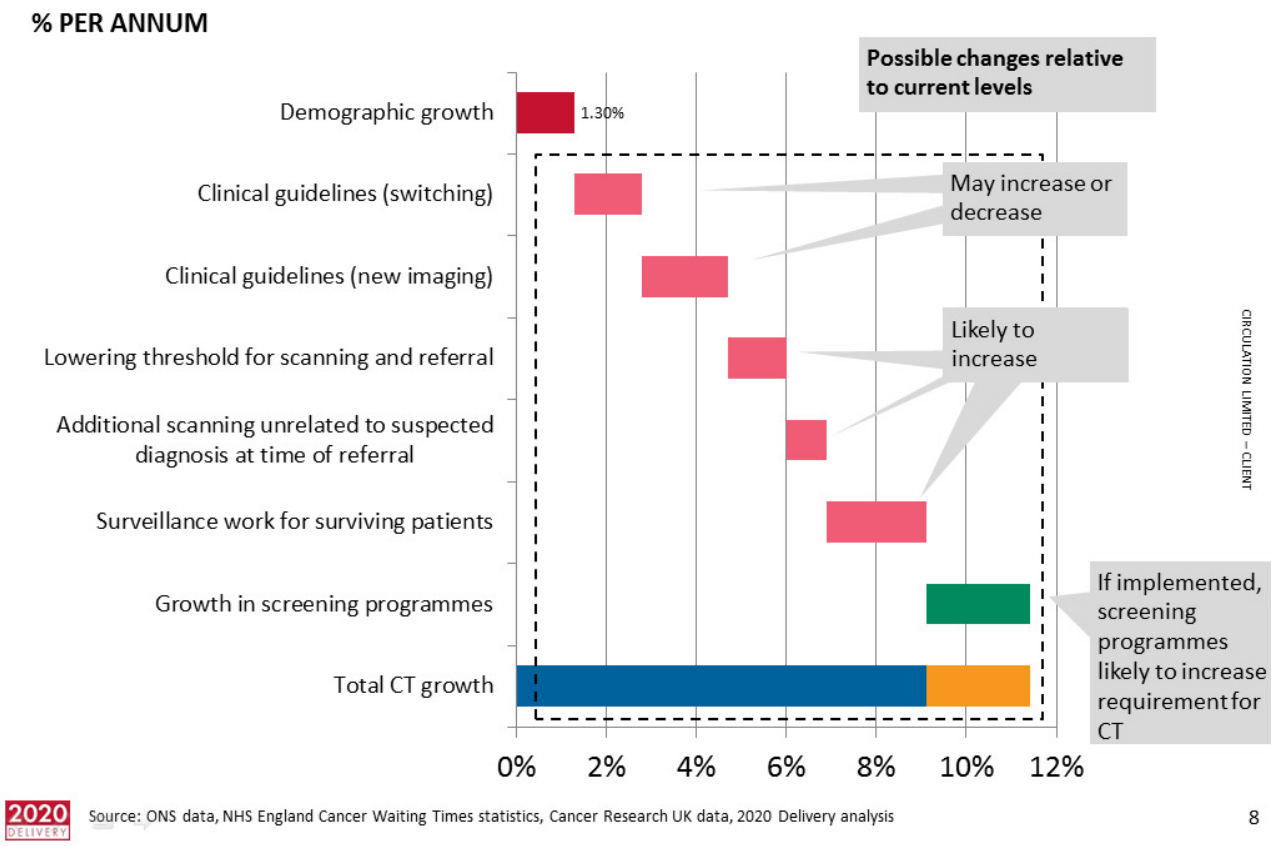


Figure 8: Suggested contribution of factors to cause growth of demand for CT imaging

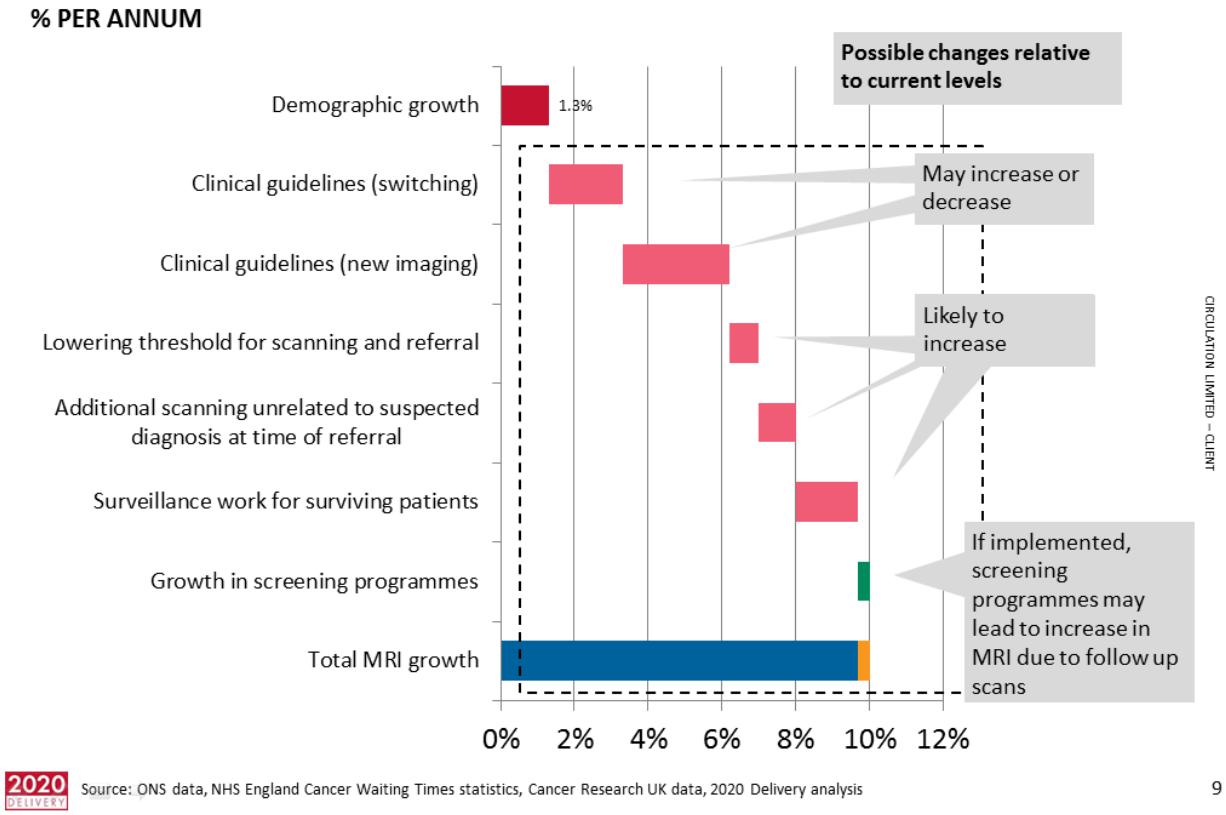


Figure 9: Suggested contribution of factors to cause growth of demand for MR imaging

Figures 8 and 9 show how demand for CT and MRI might increase. However, in the absence of action to address workforce and equipment shortages, increased demand is more likely to lead to increased waiting times than increased activity, as has already been seen over the last two years.

Recommendation 1: The Government should increase investment in diagnostic services as set out in *Achieving World-Class Cancer Outcomes*, to ensure the NHS can meet rising demand and contribute to our cancer outcomes equalling the best in the world. When cancer is diagnosed at an early stage, treatment options and chances of a full recovery are greater. Investment in diagnostics also has the potential to avert treatments costs later in the patient pathway. For imaging specifically, investment will be needed to train new members of the workforce, replace ageing equipment and buy additional new scanners.

MRI and CT demand will continue to grow, and that this growth will be at rates comparable to previous growth (i.e., circa 9% per annum for MRI and CT respectively, with faster growth if CT-based screening for lung cancer is introduced). Trusts should plan for this level of growth in these modalities (i.e., making clear that it is futile to try to manage demand down to zero growth). In the past, this has been done for radiotherapy (from the National Radiotherapy Advisory Group report) in a way that allowed multi-year planning of both workforce and equipment. This is equally important now for MRI and CT. This work would also involve input from many other sources, including but not limited to NHS England, Public Health England and the Department of Health.

As part of supporting departments to justify increased resourcing in a Trust, a central document should be produced which shows how activity has increased nationally, and how this has affected demand for staff. Some of the appendices of this report could be used to form the basis of this document, which would support Imaging General Managers and Imaging Clinical Directors in producing a business case or applying for funding. This could be taken forward by Cancer Research UK.

Recommendation 2: Commissioners should work with provider organisations to develop clear, funded plans that will deliver the capacity for the predicted increase in demand.

These plans should be developed on a rolling basis and include detail of capital equipment replacement and expansion.

Recommendation 3: Trusts should move to a budget system for imaging services that reflects changes in activity and funds it accordingly, based on the tariff, in particular for outpatient and GP direct access scans.

This should help to address the difficulties in keeping pace with rising demand found in departments funded on block contracts.

3.2 Workforce

Recommendations

4. **Health Education England should conduct strategic planning around workforce at the national level, and be based on accurate modelling[a]. Health Education England and NHS England 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[a]. Local Education and Training Boards should project demand for workforce using the expected growth in demand for imaging activity.**
5. **Health Education England[a] should implement a short-term international recruitment effort for sonographers, radiographers and radiologists as the only measure that can credibly reduce vacancy rates in the time before increased training takes effect[a].**
6. **Health Education England and the Society and College of Radiographers should work together to focus on reducing attrition rates from radiography degree courses.**

Over the last five years, the number of diagnostic radiographers has grown at 2.3% per annum and the number of consultant radiologists has grown at 3.4% per annum.[p] These growth rates have not been sufficient to keep up with demand growth, and this difference between demand growth and workforce growth has been too great for the NHS to bridge through productivity improvements. [q]

Demand growth has had the following impacts:

- Imaging waiting times are increasing: this is visible in data showing median request-to-scan times for MRI and CT, and in data showing number of patients waiting more than six weeks for their scan
- There are substantial backlogs of imaging examinations that are not reported within 30 days, as shown by the Royal College of Radiologists' publications on backlogs
- There are substantial vacancy rates in the key disciplines (7.8% for diagnostic radiographers; 18% for sonographers; 12% for consultant radiologists[r]). Each of these workforce groups is on the Migration Advisory Committee's 'shortage occupations' list.

[p] Data from NHS iView, downloaded April 2015.
[q] It should be noted that the 2014 RCR workforce census (https://www.rcr.ac.uk/sites/default/files/publication/bfcr153_census.pdf) suggests only a 1.7% increase in consultant radiologist numbers in total over the last two years with the workforce shrinking in some parts of the country. This indicates that workforce shortages may be more pressing than this report suggests. Both figures show demand outstripping capacity – the question is to what degree. More work should be done to understand the differences in the figures in order to plan appropriately.
[r] Data from RCR 2014 Workforce census (The figure is a UK-wide vacancy rate. The equivalent 2013 survey showed a lower vacancy rate of 8%.)

- The existing workforce is working substantial amounts of overtime:[s] this was reported by almost every Trust we interviewed, and applies to radiographers, sonographers and radiologists
- Because of the 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 it is economically rational for sonographers to leave the NHS and work for an agency.
- High overtime rates and prices for agency staff/locums mean that Trust imaging departments are facing cost inflation, which reduces the money they have available to pay for activity increases. Trusts are employing strategies such as paying 'recruitment and retention premia' to sonographers, or re-banding Band 7s to Band 8A, in an effort to avoid losing sonographers to agency employers.
- Some Trusts are making unbudgeted increased use of independent providers, for both imaging capacity and outsourced reporting, in order to meet demand.

> *"We currently outsource all the reporting that we can, and we would outsource more if the independent providers had the capacity"* – Radiology General Manager

Our field research indicated that 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.

We observed considerable variability in the delivery of radionuclide imaging/nuclear medicine. In some Trusts this was an integrated part of the imaging service, while in others it was a separate facility.

Staffing also differed, with the commonest model being a radiologist-provided service with smaller numbers of departments run by nuclear medicine physicians. It would seem appropriate at this time, particularly with the growth in PET-CT and other 'molecular imaging', to have a single common career pathway for radiology and Nuclear Medicine that acknowledges different routes of entry.

3.2.1 Demand and supply projections for imaging workforce

Health Education England has previously published projections of demand and supply for diagnostic radiographers, as shown in Figure 10. Our research points towards different projections of supply and demand for diagnostic radiographers, and this variation is explored below.

[s] HEE/ CfWI surveys are asking about quantities of overtime being worked; prices paid to agency; and about use of 'recruitment and retention premia' and up-banding

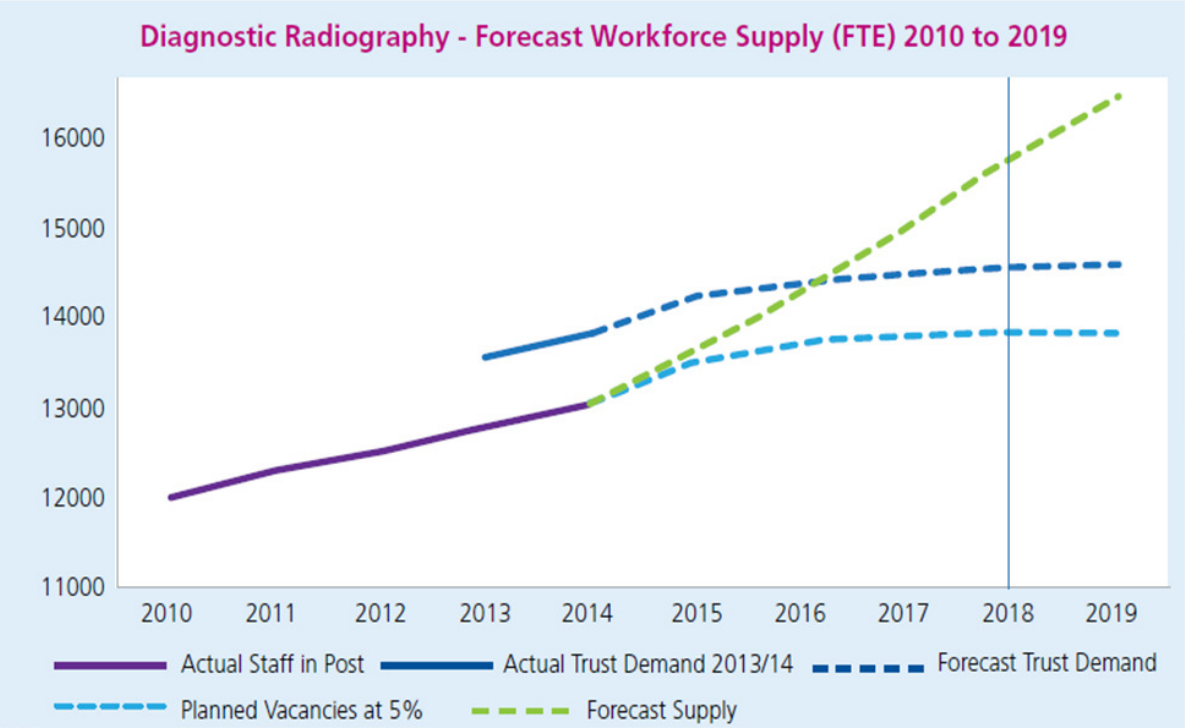


Figure 10: Health Education England's projection shows expected future supply for diagnostic radiographers outstripping demand

As part of this project, we have also made projections for future supply of diagnostic radiographers, based on assumptions of: number of diagnostic radiographers beginning degree courses; attrition rate from degree courses in diagnostic radiography; annual proportion of radiographers leaving the profession. The output of that projection is shown in figure 11, alongside the Health Education England projection.

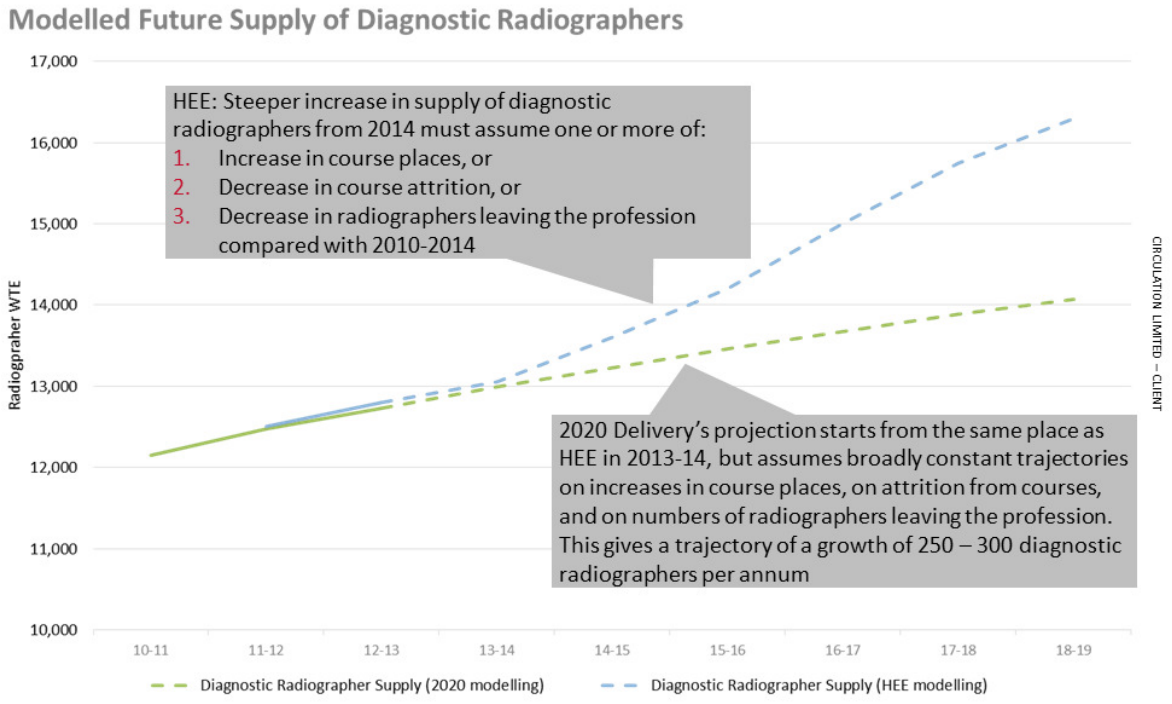
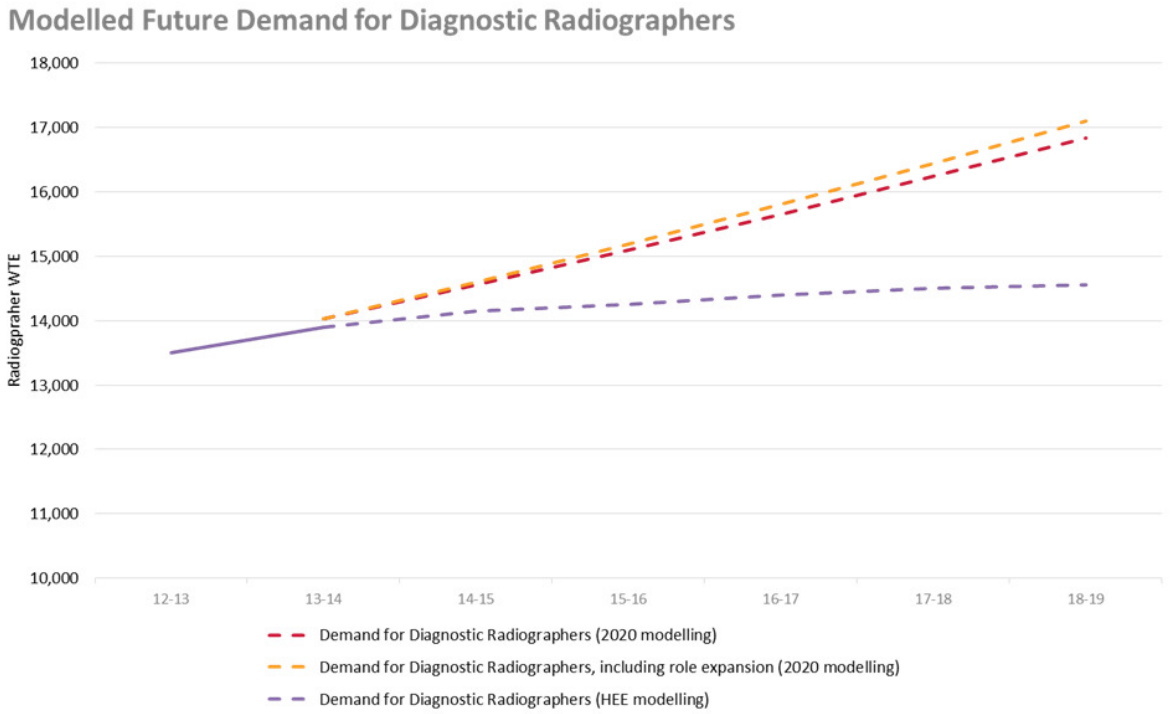


Figure 11: 2020 Delivery's modelling shows a more gradual increase in diagnostic radiographer supply than does the HEE scenario

We have made projections for future demand for diagnostic radiographers, based on assumptions of: growth in demand for imaging (complexity-weighted); increase in productivity of diagnostic radiographers; and change in role of diagnostic radiographers, in particular if they take on more of the load of reporting plain film X-rays. The output of that projection is shown in figure 12, alongside the Health Education England projection.



Source: Health Education England, Workforce Plan for England: Proposed Education and Training Commissions for 2015/16; 2020 Delivery analysis

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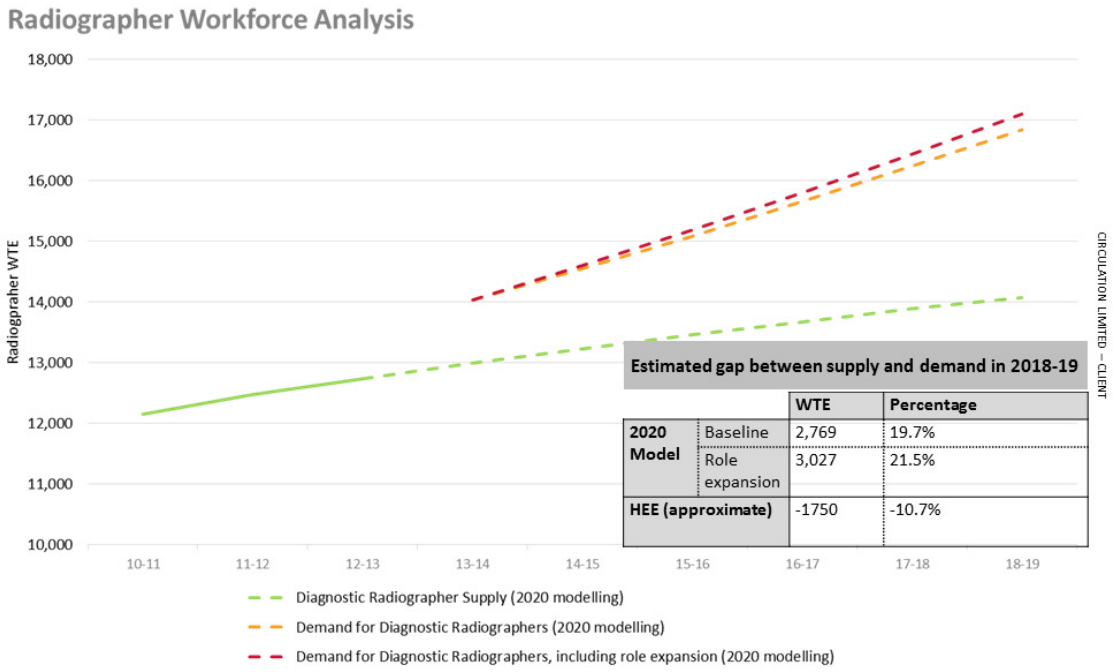
Figure 12: 2020 Delivery's modelling shows an ongoing increase in demand for diagnostic radiographers

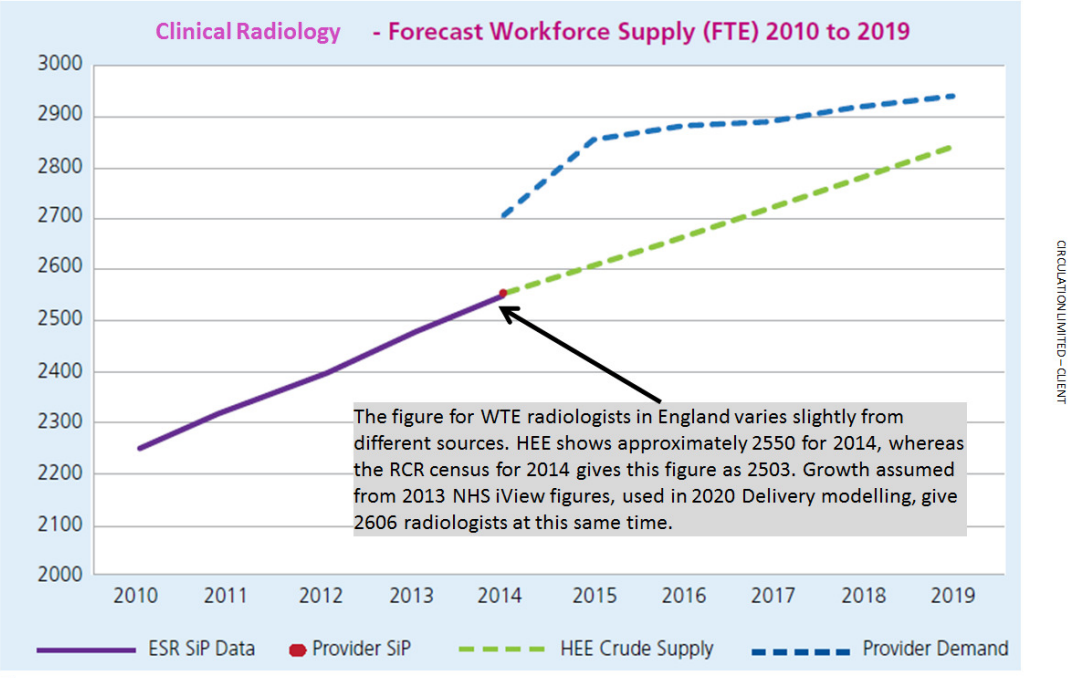
As a result, under current scenarios for the supply of diagnostic radiographers (as in figure 11) and the demand for them (as in figure 12), 2020 Delivery's projection shows an increasing gap between demand and supply, as shown in figure13:



Source: Health Education England, Workforce Plan for England: Proposed Education and Training Commissions for 2015/16; 2020 Delivery analysis

Figure 13: 2020 Delivery's model shows a base scenario of the gap between supply and demand for diagnostic radiographers widening

Health Education England has previously published projections of demand and supply for clinical radiologists, as shown in figure 14, below.



Source: Health Education England, Workforce Plan for England: Proposed Education and Training Commissions for 2015/16

14

Figure 14: Health Education England's projection shows a shrinking gap between supply and demand for consultant radiologists, by 2019

We have also made projections for future supply of clinical radiologists, based on assumptions of: number of radiologists beginning specialist training; attrition rate between training and becoming a consultant radiologist; number of retirements per annum; number of consultants leaving the profession each year for reasons other than retirement. The output of that projection is shown in figure 15, alongside the Health Education England projection.

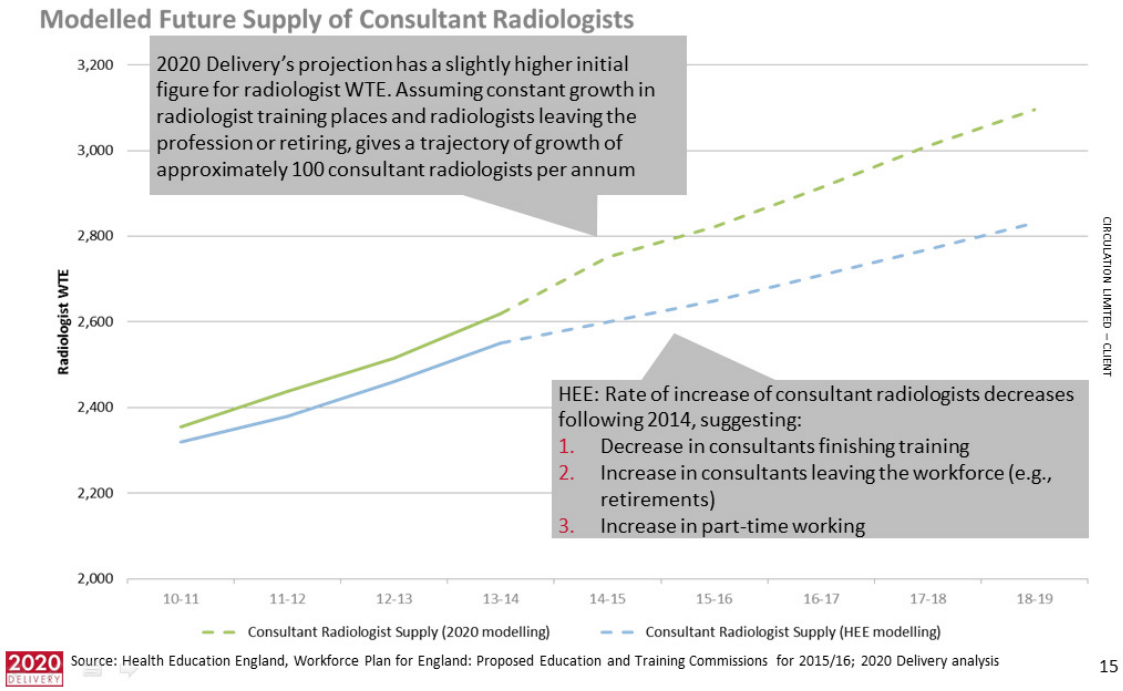
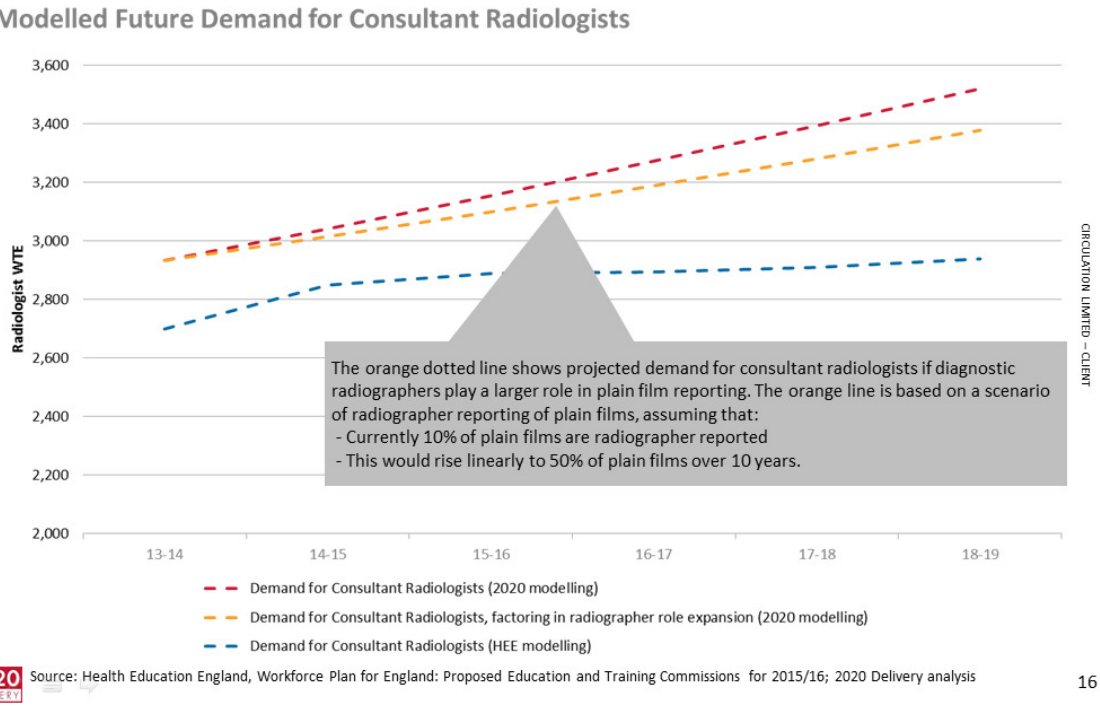


Figure 15: 2020 Delivery's modelling shows consultant radiologist numbers to increase at a slightly higher rate than HEE modelling

We have made projections for future demand for clinical radiologists, based on assumptions of: the current gap between supply and demand;[t] growth in demand for imaging (complexity-weighted); increase in productivity of clinical radiologists; impact from changes in the role of diagnostic radiographers, in particular if diagnostic radiographers take on more of the load of reporting plain film X-rays. The output of that projection is shown in figure 16, alongside the Health Education England projection.

[t] We have used the current vacancy rate for consultant radiologists (12%) as a proxy for the gap between demand and supply. This is acknowledged as being an oversimplification, and probably an underestimate. The real gap between demand and supply is a function of vacancy rate, amount of overtime being worked, and use of outsourcing for routine reporting.



Source: Health Education England, Workforce Plan for England: Proposed Education and Training Commissions for 2015/16; 2020 Delivery analysis

16

Figure 16: In 2020 Delivery's model, demand for consultant radiologists continues to rise. This levels off in the HEE scenario

As a result, under current scenarios for the supply of clinical radiologists (as in figure15) and the demand for them (as in figure 16), 2020 Delivery's projection shows a continuing gap between demand and supply, as shown in figure 17:

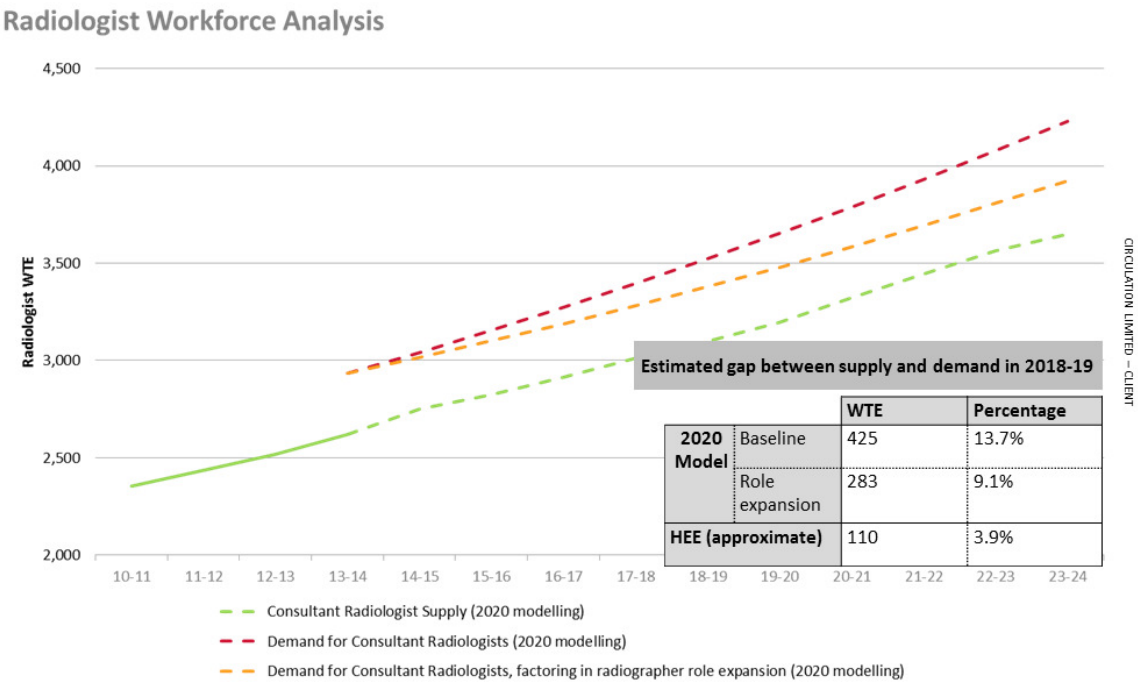


Figure 17: as a base scenario 2020 Delivery's model shows the gap between supply and demand for consultant radiologists widening

Recommendation 4: Health Education England should conduct strategic planning around workforce at the national level, and be based on accurate modelling[u]. Health Education England and NHS England 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[v]. Local Education and Training Boards should project demand for workforce using the expected growth in demand for imaging activity.

These plans should specifically aim to increase and fill the number of places on radiographer training programmes. As shown in section 4 of this document and in Appendix 3, there is a material difference between our projections for supply and demand for diagnostic radiographers, compared to those produced by HEE/CfWI. Our projections also differ from the RCR census. The reasons behind these differences are not clear, as we do not have detail of the assumptions used by different bodies. HEE should lead an initiative, in conjunction with NHS England, RCR and SCoR, to reconcile the various different models, and produce an updated model based on agreed assumptions. This model should then drive the number of radiographer training places, bearing in mind that any increase in course numbers will take three years to play through the system.

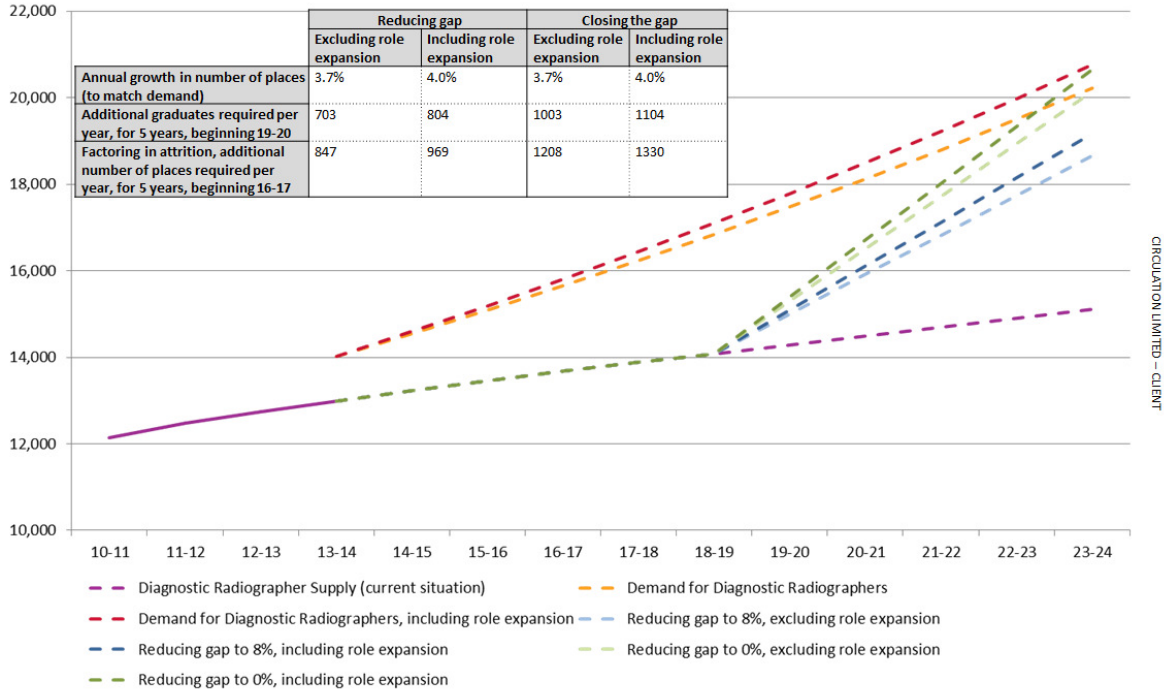
Some possible scenarios addressing supply and demand are shown in Figure18. These numbers are highly speculative, and further modelling is required following amendment of

[u] As stated in *Achieving World-Class Cancer Outcomes* (recommendations 83 and 84).

[v] Figures for radiographers do not allow for accurate quantification of the number of places required. In order to reduce the gap between supply and demand, radiologist training places should increase at the same rate as demand growth, and in addition there should be 50 additional places per year for 3 years, beginning in 2016/17. Note that this is also factors in the 30 additional places for the preceding 3 years.

the figures for diagnostic radiographers. An approximate estimate for the number of diagnostic radiographers required by 2023-24, excluding role expansion assumptions, is to increase the number of places on radiographer degree courses in line with growth of demand, as well as an additional 847 places per year (accounting for attrition), for five years, beginning in 2016-17.

This report does not consider the medical physics workforce; however this is another section of the workforce which plays an important role in delivering imaging services. We have heard anecdotally that there are shortages in this part of the workforce as well, and this should be considered alongside other specialties as a barrier to meeting demand for imaging which should also be addressed.



2020 DELIVERY Source: 2020 Delivery analysis

Figure 18: Matching growth in radiographer training places with demand would reduce impact of increase demand on workforce

Local Education and Training Boards should project demand for diagnostic radiographers and radiologists using the expected growth in demand for imaging activity, rather than financial data. This would increase the accuracy of the workforce projections, and allow for more robust workforce planning.

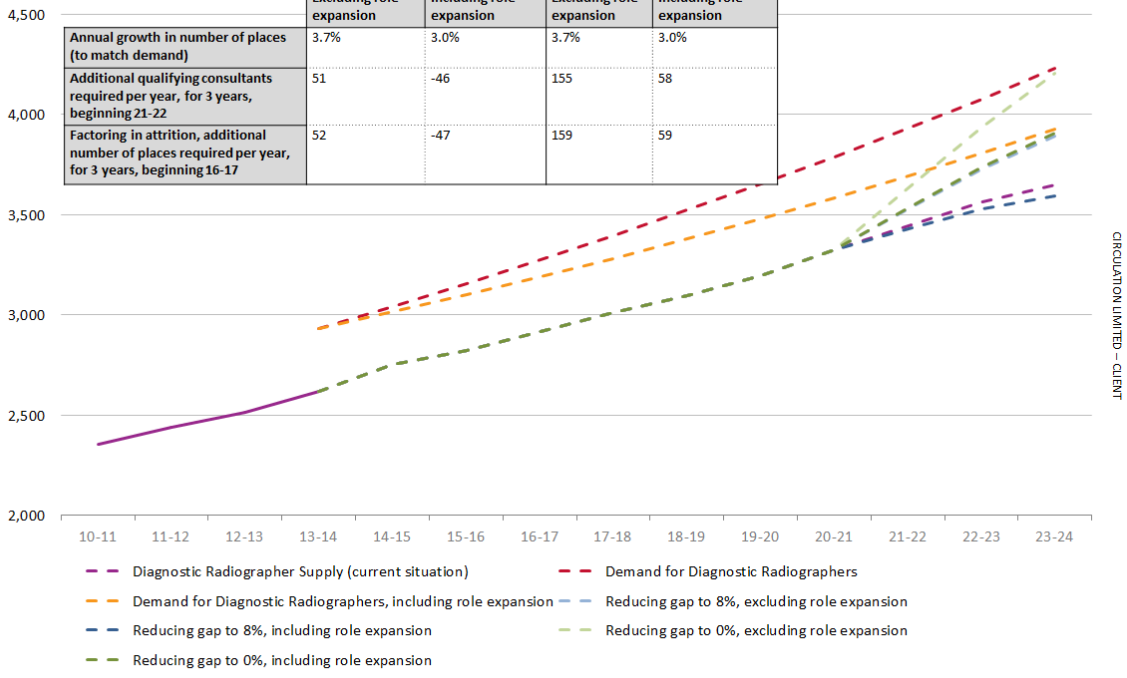
HEE has developed and should now implement run-through programmes for sonographers (i.e., without having to go through radiography first). In order for this to be effective, these courses would need approval from the Health and Care Professions Council. Part of this work would require government backing for protection of title for sonographers. This is recommended in the Taskforce's report.

The number of places on radiologist specialist training should be increased. As with diagnostic radiographers, there is a difference between our projections of supply and demand for consultant radiologists and those produced by HEE/ CfWI. The reasons behind these differences are not clear, as we do not have detail of the assumptions used by HEE/

CfWI. HEE should lead an initiative, in conjunction with NHS England and RCR, to reconcile the two sets of models, and produce an updated model based on agreed assumptions. This model should then drive the number of specialist training places for radiologists (in particular numbers starting training after 2017/18, which is when the current agreement of an extra 30 radiologist trainees per annum expires). Any further increases in radiologist specialist training places will take five years to work through the system.

Figure19 shows some possible scenarios to address the gap between supply and demand for consultant radiologists. As with the modelling for an increase in radiographer places, the numbers are speculative at this stage. In order to reduce the gap between supply and demand to 8% by 2023-24, the number of radiologist training places should grow with demand, as well as approximately 50 additional places for 3 years, beginning 2016-17. Note that this number is in addition to the extra 30 radiologist training places that were funded for three years, beginning 2014-15.

	Reducing gap		Closing the gap	
	Excluding role expansion	Including role expansion	Excluding role expansion	Including role expansion
Annual growth in number of places (to match demand)	3.7%	3.0%	3.7%	3.0%
Additional qualifying consultants required per year, for 3 years, beginning 21-22	51	-46	155	58
Factoring in attrition, additional number of places required per year, for 3 years, beginning 16-17	52	-47	159	59



2020 DELIVERY Source: 2020 Delivery analysis

Figure 19: To reduce the supply and demand gap, radiologist training numbers should scale with demand, and additional places be added

In addition, NHS England should engage with radiographers and radiologists currently approaching retirement, in order to reduce the impact of this on the NHS. This proactive engagement of staff aged 55 and over should discuss what new options could be put in place to make staying on in work a more desirable option.

Recommendation 5: Health Education England[w] should implement a short-term international recruitment effort for sonographers, radiographers and radiologists as the only measure that can credibly reduce vacancy rates in the

[w] As per recommendation 85 in *Achieving World-Class Cancer Outcomes*.

time before increased training takes effect[x].

There should be an international recruitment effort (e.g., from Europe, Australia, New Zealand) for sonographers, radiographers and radiologists, on the basis that this is the only mechanism that can credibly reduce vacancy rates in the short-term before any increased training takes effect. The fact that these roles are on the Migration Advisory Committee's 'shortage occupations' list (which applies to workers outside the EU) should support the case for immigrating sonographers, radiographers and radiologists obtaining visas.

Recommendation 6: Health Education England and the Society and College of Radiographers should work together to focus on reducing attrition rates from radiography degree courses.

In the past, the Society and College of Radiographers has focused on attrition rates from radiography degree courses,[6] and has been successful in reducing attrition from >30% prior to 2010, to 17% in recent years. They should now review attrition rates across Higher Education Institutions, and consider what further changes might reduce attrition further. Every additional 1% saved in attrition saves 1% in the number of radiography course places required.

[x] Using the current vacancy rate as a proxy for the gap between supply and demand, figures show the current national shortfall in radiologists to be 290 WTE.

3.3 Efficiency and Productivity

Recommendations

7. **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, including development of a career framework from Band 2 to Band 9 and the required underpinning education and training. This work should focus on skill-mix and the opportunity to use Assistant and Advanced Practitioners to make imaging services more efficient and effective.**
8. **NHS England should undertake an assessment of the national spend on overtime and locums versus investing in full time NHS staff, (as well as the recent initiative to clamp down on the cost of paying agency staff), and the impact of this on overall value for money.**
9. **NHS imaging providers, with support from NHS England and the Royal College of Radiologists, should develop 'imaging networks' to provide patients with appropriate support.**
10. **NHS England, supported by the Royal College of Radiologists, and as part of its cancer survivorship programme, should develop clear, nationally evidence-based protocols for follow-up and surveillance scanning for appropriate cancers.**

The independent sector has developed in recent years as a provider of imaging services to the NHS. Their contribution takes a number of forms:

- Direct contracts with primary care through the AQP process, particularly for non-obstetric ultrasound, plain film radiography, MRI (particularly for Musculoskeletal pathway) and occasionally for CT
- PET-CT: The new contract with Alliance Medical will deliver the major component of PET-CT imaging in England
- Mobile and fixed MR and CT services. These can be directly commissioned by the Clinical Commissioning Group (CCG), or the mobile fleet in particular provide a service to Trusts to increase capacity on a reactive short-term basis, or for more prolonged contracts
- Reporting Services for urgent out-of-hours imaging, and to provide extra capacity to deal with locally-unmet demand for routine reporting.

Our field research indicated that the companies that provide imaging services have experienced a significant increase in activity as a result of demand from Trusts. However, due to the competition for a limited pool of staff across sectors, independent providers – which can themselves 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, e.g. to cover local breakdown.

> *"We are at a crisis with sonographers – we try to train our own, but as soon as they qualify, they leave to go to the independent sector."* – Radiology General Manager

The amount of reporting being outsourced is now large – estimated at £47m for England in 2013-14,[7] which is equivalent to approximately 400 radiologists[y] against a registered workforce of 2503 Whole Time Equivalents (WTEs).[7] Much of this outsourced reporting activity is provided by NHS radiologists working additional hours for the reporting companies. Constraints on the availability of radiologists mean that outsourced reporting services have limited ability to respond at short notice to Trust demand for additional reporting. On a longer-term basis, it seems likely that this sector will continue to grow.

3.3.1 Imaging pathway process variation

There are a number of potential constraints/bottlenecks in the imaging pathway which, if addressed, can lead to improved productivity and/or reduced waiting times. In our field research, we identified variation in addressing these issues, as follows.

Pathway process 1: Referral to justification

The majority of departments interviewed had already introduced some form of electronic requesting. In those where a paper system was still in place, there were inherent delays in this part of the pathway. All departments that were using a paper system had or were developing plans to introduce Order-Communications solutions.

An additional advantage of electronic requesting is that it makes it easy to spot duplicate imaging requests (e.g., if an inpatient has had chest X-Rays several days in succession) and address these at justification.

A second bottleneck in this area was the process of justification. Most departments that relied on radiologists to do the bulk of this work reported delays in the cancer and planned care pathways due to radiologist availability. Delegating this function to trained radiographers (within a clinical governance framework) is now a common practice and, where introduced, reduced delays as well as improving productivity.

Pathway process 2: Justification to imaging

There were some issues identified in the booking systems for imaging, mostly based on availability of administrative staff or carve-out practices. Carve-out practices, if not well-managed, disadvantaged patients in the planned care pathway and some more specific pathways – notably cardiac MRI and CT.

There was variation in the systems in place to prepare patients prior to scanning. If this necessary activity can be performed outside the scanning room, then more time is available for scanning. The most efficient departments used radiographer helpers (Bands 2&3) to prepare the patients, taking responsibility for such activities as pre-procedure checks and cannula insertion. This gave the radiographers more time to conduct examinations and thus increased patient throughput.

Pathway process 3: Imaging to report reaching referrer

The use of voice recognition systems within reporting was common practice throughout the departments we interviewed, with only isolated cases of non-adoption.

Electronic communication of reports was commonplace – while some departments relied on the production of paper-based reports, these were a minority. Primary care reports were more likely to be paper-based than hospital referrals.

[y] Estimate based on an indicative cost to trusts of £120k per radiologist per annum, factoring in on-costs

Across and within Trusts there appeared to be a difference in radiologist reporting productivity. Concerns were raised that, particularly where consultants were doing large amounts of reporting in addition to full time work, there was a risk of reduced productivity or quality in-hours. However, few Trusts had robust ways of monitoring this. Trusts need to employ robust processes to give them confidence they have fully utilised the potential productivity of their contracted radiology reporting time before seeking overtime or outsourcing solutions.

Pathway process 4: Integration of imaging into the cancer pathway

Many departments expressed concerns about the lack of communication between IT systems that resulted in potential delays in the patient journey. In many cases imaging departments did not know the timing of the next intervention for the patient, e.g., the date of an outpatient appointment, and so could not tailor the timing of the imaging appointment to fit with this. Ideally the booking of an appointment would trigger the next stage in the pathway (and vice versa) but often delays occurred due to clinicians waiting until receipt of the report before taking the next step.

3.3.2 Overall quality of imaging service and impact on cancer patients

In spite of the challenges referred to above, most Trust imaging departments believe that they continue to provide a good imaging service for (identified and suspected) cancer patients. All Trust imaging departments prioritise the inpatient/emergency patient pathway and the cancer pathway above all other pathways. Where imaging services struggle, the data indicate that the effect is principally on planned care and community-based patients (some waiting longer than six weeks for image acquisition, with often significant further delays for a report). In some Trusts there is also an impact on inpatients (some waiting two days for their imaging examination where the ideal would be less than 24 hours).

Many Trusts are struggling to keep on top of reporting demand, to the extent that they have taken risk-based decisions not to report on every examination. Typically, plain-film X-Rays associated with fracture clinic follow-ups are the first type of imaging that departments agree not to report. In some Trusts, these risk-based decisions go further, and particular types of plain-film X-Rays for A&E, in-patients and outpatients may not be reported. These decisions pose a larger risk to patients (i.e., risk of a significant missed diagnosis),[z] and these practices are indicative of the extent of the struggle that some imaging departments are facing to keep up with demand.

NCIN's 'Routes to diagnosis' publication indicates that, in 2007, 24% of cancers were diagnosed following a routine (i.e., non-urgent, non-cancer) GP referral, and a further 14% were diagnosed following a routine (non-urgent, non-cancer) outpatient attendance.[8] In the light of that, the fact that imaging services are struggling to keep up on routine (i.e., 18 weeks referral to treatment) pathways will inevitably have an impact on speed of cancer diagnosis.

Multi-disciplinary team (MDT) meetings and preparation are also having a significant impact on imaging departments. These meetings are an important part of diagnosis and treatment planning for all cancer tumour sites, but do not have any formal payment mechanism (payment is associated with outpatient attendances, imaging exams, and treatment delivery). The meetings require attendance from radiologists and advanced and consultant radiographers where these staff contribute to reporting (as well as, e.g., oncologists, surgeons and cellular pathologists) so, as these meetings grow in number and duration, their impact on radiologist capacity within each imaging department grows too. On average,

[z] Note evidence from Northern Ireland where this practice, without sufficient clinical control and risk management, led to a substantial number of important missed diagnoses.

these meetings represent 10% of the weekly activity of a radiologist (equivalent nationally to 250WTEs of the total 2503).[7] The Taskforce report also acknowledges the need to streamline MDT processes (recommendation 38).

Our field research also demonstrated that there is substantial variation in approaches to surveillance scanning of patients who have survived cancer. Surveillance scanning of the high-volume tumour sites (e.g., breast, prostate, colorectal) places a substantial load on imaging departments. While approaches to surveillance scanning varied, we did not find clinical consensus about where patients might be over-examined or under-examined – we merely found agreement that evidence-based standardisation would be a good idea.

It is important to note that it is not possible to isolate the cancer part of the service from the rest. As one interviewee put it:

> *"Cancer work doesn't just sit in isolation. We could certainly do cancer very well, but this would impact on other areas."* – Clinical Director

3.3.3 *Financial efficiency*

Over the long term (i.e., decades), the financial efficiency of imaging has increased. This has been driven by factors including: reduction in capital costs of equipment (e.g., for CT and MRI); innovations such as digital (rather than film-based) X-Ray; introductions of RIS-PACs systems and voice recognition software for reporting; development of skill-mix within the imaging workforce; and process redesign.

At the same time, the total cost of imaging has also increased. This along with other factors is affecting financial efficiency. This is because activity has grown significantly faster than the rate of productivity improvement referred to above, leading to increased overtime, more expensive locum staff being used and upbanding and recruitment and retention premia being applied to attract staff.

In addition, there is evidence that in recent years financial efficiency may have begun to decrease. It has been difficult to gather definitive quantitative data in this area, but nonetheless the following points have been raised:

- There has been cost inflation for agency staff/locums, in particular for sonographers
- Trusts have begun to pay 'recruitment and retention premia', or to increase bandings, in particular for radiographers
- Consultant radiologists are working substantial amounts of overtime, either on a sessional basis or a piece-rate basis for their Trust, or for an outsourced provider. There are concerns about the impact of fatigue on the likelihood of making an error[9], as well as whether radiologists can continue to report as productively in-hours when they are working so many additional hours
- Unpublished findings from the recent RCR survey show that outsourcing costs are estimated to be around £47m for England in 2013-14.

Note that *Appendix 1* to this report details our desk research findings that support this assessment of the current state, and *Appendix 2* to this report summarises our field research findings. These appendices are available upon request.

Recommendation 7: 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.

This will build on the work that has already been done by the Royal College of Radiologists and the Society and College of Radiographers, and would include development of a career framework from Band 2 – Band 9, and the required underpinning education and training. It will also include development of a career framework for Sonography from Band 4 – Band 9. Developing and publicising the career framework for radiographers and sonographers may increase demand for, and reduce attrition from, the profession.

There is also a need for adequate post-graduate radiographic education, at the master's level for those in Bands 7-8 and at the doctoral level for those in Band 8 working as advanced and consultant radiographers.

New guidance should include, specifically:

- Development of a career framework from Band 2 to Band 9 and the required underpinning education and training. This work should focus on skill-mix and the opportunity to use Assistant and Advanced Practitioners to make imaging services more efficient and effective.
- Duties to be performed by Assistant Practitioner (Band 4) and Radiographer Helper (Bands 2-3) rather than trained radiographers in all imaging modalities
- The role of Radiographer Advanced Practitioner within an overall governance framework in improving reporting productivity. This should be quantified where possible (e.g., % of mammography reporting, % of plain film reporting [and type] by Radiographer Advanced Practitioners). This should set the expectation *that the majority of plain film reporting* should become radiographer-delivered over time.

Recommendation 8: NHS England should undertake an assessment of the national spend on overtime and locums versus investing in full time NHS staff, (as well as the recent initiative to clamp down on the cost of paying agency staff), and the impact of this on overall value for money.

This could be achieved by developing the workforce censuses that are performed by the Royal College of Radiologists and the Society and College of Radiographers, or via HEE/CfWI surveys that are currently planned. In addition to continuing to collect vacancy rates, these should ask about:

i. Prices paid for agency/locum radiographers/sonographers, by grade
ii. Approximate quantum of radiographer overtime being worked
iii. Approximate quantum of radiologist overtime being worked.

In addition, local imaging departments within Trusts should be able to demonstrate effectiveness in cases of high levels of overtime, and be able to evidence that overtime/outsourcing is utilised on top of productive use of in-hours reporting – i.e., implementing a minimum reporting standard in-hours to qualify for any overtime reporting.

Recommendation 9: NHS imaging providers, with support from NHS England and RCR, should develop 'imaging networks'[aa] to provide patients with appropriate support

These would allow patients access to the expertise of a radiologist with relevant skills and sub-specialisation where appropriate.[bb] Networks across multiple Trusts would allow the out-of-hours service to be provided in a more cost-effective way.

[aa] As previously recommended in Royal College of Radiologists publications.
[bb] Detail from the Royal College of Radiologists given here: https://www.rcr.ac.uk/rcr-sets-out-its-vision-new-model-radiology-service-delivery

This would be facilitated:

1. By standard protocols for image acquisition, such that scans would be performed in a way that was acceptable to all local Trusts
2. Structured reporting, such that reports could be interpreted at all local Trusts, and also by another radiologist at MDT meetings.

In addition, services could benefit from improving the efficiency of MDTs and MDT preparation processes. Each MDT should have two designated consultant radiologists, with at least one consultant radiologist present at each meeting and with each consultant radiologist attending two-thirds of the meetings. A further change would be to develop standardised reporting formats so that it is easier for other clinicians to interpret reports by radiologists who are not present.

Recommendation 10: 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[cc].

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.

Efficiency dependent on addressing workforce shortages

It is important to note that many of these recommendations can only be undertaken if the recommendation relating to training more radiographers is implemented. In the absence of that, demand for radiographers on image acquisition will make it impossible for radiographers to make time to take on advanced practice roles that involve reporting.

[cc] As per recommendations 67 and 68 of *Achieving World-Class Cancer Outcomes.*

3.4 Equipment

Recommendation 11

- **NHS England should implement a long-term plan for replacing ageing machinery on a rolling basis, including earmarking national funding for new MRI and CT equipment and procurement of this at the national level. This should also include producing regular projections for England's future equipment needs based on accurate modelling of rising demand.**

Equipment renewal and expansion (especially for MRI and CT) continues to be challenging, as has been highlighted in the past (e.g., by the NAO in 2011). Very few Trusts have a planned, financially-supported approach to the replacement of existing equipment, or to expanding the numbers of MRI/ CT scanners. As a result, we found many examples of departments working with old equipment for extended hours.

NHS Supply Chain figures suggest that around £215 million is needed to replace ageing CT and MRI scanners. This figure does not take into account the need for new equipment to meet increasing demand, which could cost up to £50 million per year. [dd] In addition, OECD data suggests that the UK has a very low number of CT and MRI scanners as compared with other OECD countries, with around 9 CT scanners and 7 MRI scanners per million population. Germany has 19 CT and 11 MRI, Spain has 17 CT and 15 MRI and France has 14 CT and 9 MRI per million population.[4]

All Trusts we visited had moved towards extended-day and weekend scanning for MRI and in many cases CT. This is more evident in MRI where the most common scenario is 8am – 8pm scanning on weekdays plus 8-hour days at weekends. Those Trusts that have not achieved such extensive scanning hours identify staff shortage as the main constraint.

While some Trusts may be able to make some additional small gains by improving processes to increase throughput, many Trusts have reached their MR equipment capacity and are using independent sector scanners to make up the shortfall.

In many cases, Trusts are using equipment that is much older than the recommended seven years. This can cause further delays in the pathway due to reduced throughput from a longer acquisition time, machine downtime and the requirement for follow-up imaging which would not be required with a higher resolution first image. In addition, modern CT scanners provide a lower radiation dose, making them safer for patients.

Further growth in activity needs to be addressed with the acquisition of new scanners. The bureaucracy involved in completing business cases and protracted negotiations for each new scanner causes frustration and, importantly, delays in securing new equipment. However, prices for MRI and CT scanners have fallen since 2011, and while equipment continues to be an area of challenge, cost issues here appear to be becoming slightly less acute than was the case in previous years.

[dd] This is based on figures provided by NHS Supply Chain which show that in England there are 483 CT systems and 380 MRI systems installed, which provide diagnostic tests for all symptoms, not just those related to cancer. Given approximate average costs of £480,000 for a CT system and £800,000 for an MRI system, increasing current systems by 9% per year would cost £48m in the first year. This figure is a highly speculative estimate as it assumes requirement for equipment would exactly scale with activity demand. It is recommended that NHS England undertake an exercise to ascertain the precise level of investment needed.

It was notable that PET-CT, Ultrasound and Plain X-ray did not feature in our field research as areas where availability of equipment was a major problem.

This would ensure that procurement of this equipment is not a protracted process which competes with other funding needs in a Trust. The amount of funding set aside should be sufficient to accommodate 9% per annum growth in MRI and CT respectively, and allow replacement of old equipment. Guaranteed funding for scanning equipment would bypass individual priorities to ensure that the imaging workforce is supported by efficient and up-to-date equipment.

3.5 A Patient-Centred service

Recommendations:

12. **Services should be supported to deliver a strategy to ensure patients are at the heart of their care and can access the reports of their imaging tests should they wish to do so.**
13. **Acute providers should develop integrated systems that link the requesting acquisition and reporting of imaging tests to the patient pathway with clear information to the patient.**
14. **Acute providers should develop plans to approach delivery of diagnostics in new and innovative ways to meet the needs of people who may be on different patient pathways.**

Our field research revealed strong support for a pro-active approach to patients having access to the reports of their imaging studies. This is in line with the government's aim of shared decision making in health ('No decision about me, without me') and is supported by similar work of Cancer Research UK and Public Health England which demonstrates that some patients want access to all the records of their care.

Recommendation 12: Services should be supported to deliver a strategy to ensure patients are at the heart of their care and can access the reports of their imaging tests should they wish to do so

This would need careful planning, including discussions on appropriate wording of reports,[ee] integrating such an approach with other clinical input in the pathway and, most importantly, providing readily available access to support from the imaging department. Radiologists as doctors are ideally placed to give such support, and this would improve the profile of the profession with the public. It would, however, be a further demand on the time of the imaging workforce. This is also a recommendation in *Achieving World-Class Cancer Outcomes*.

Recommendation 13: Acute providers should develop integrated systems that link the requesting acquisition and reporting of imaging tests to the patient pathway with clear information to the patient.

This would mean that the patient would be aware of the exact timing of all events. The imaging department would know the date and nature of the next required intervention and users of the service would have clear information on progression through the imaging part of the pathway. This would result in significant reduction in wasted effort in chasing appointments, results and rebooking of appointments. More importantly, it would reduce anxiety and concern on the part of the patient.

Recommendation 14: Acute providers should develop plans to approach delivery of diagnostics in new and innovative ways to meet the needs of people who may be on different patient pathways.

The majority of NHS Trust imaging departments have to balance their resources to support three overlapping but relatively distinct patient pathways:

[ee] For example, wording such as "cancer cannot be ruled out" can be clear to a referring clinician, but easily misinterpreted by a patient

- Emergency and inpatient care
- Cancer care
- Planned and community care

Where departments try to deliver such services, there are trade-offs of resources, which predominantly disadvantage the planned and community care pathway.

Commissioners should work with providers to develop 'out of hospital diagnostic centres', or multi-disciplinary diagnostic centres, that are able to offer separate services for planned and community care. Such centres need to be integrated into the local health care Trusts so that there is free passage of data. These centres will be piloted as part of the Accelerate, Coordinate and Evaluate (ACE) programme[ff].

[ff] http://www.cancerresearchuk.org/health-professional/early-diagnosis-activities/ace-programme

4. Conclusions

> *"Imaging is not just a supporting service – it should be seen as a specialty in its own right and acknowledge the role in the pathway"* – Clinical Director

This report illustrates the urgent need for imaging services to be adequately funded and staffed if the NHS is to keep up with rising demand.

If the recommendations listed above are not followed, the gap between supply of imaging services and demand for imaging will continue to grow. The implication of this growing gap would be:

- Continued increases in imaging waiting times (median request-to-scan times for CT and MRI continuing to increase; numbers of patients waiting more than six weeks for their imaging examinations continuing to increase)
- Continued difficulty in avoiding reporting backlogs, addressable only through overtime and outsourcing of large volumes of bulk/routine reporting, or through increasing the number of types of imaging examination that are not reported at all (e.g., plain films for fracture clinic follow-ups), with resulting increased clinical risk
- Taking the increases in imaging examination waiting times and reporting backlogs together, the gap between supply and demand would have a significantly negative impact on the early diagnosis agenda for cancer, and also negative impacts on other patient pathways, including the emergency pathway within hospitals
- Continued increases in vacancy rates across radiographers, sonographers and radiologists
- Continued cost inflation on agency staff/overtime, which would itself be counter-productive, reducing the ability of imaging departments to pay for activity growth. While it has not been within the scope of this report to calculate the magnitude of this cost, it is likely to be significant
- Extreme difficulty in implementing new screening programmes in the short to medium term, if any of the ovarian cancer screening, lung cancer screening or extension of breast cancer screening is agreed following publication of trials data

We strongly urge the Government, NHS England and other arm's length bodies involved in delivering diagnostic services, RCR, SCoR and local imaging services to act upon the recommendations in this report to ensure cancer patients – and indeed all patients who use imaging services – receive the best care.

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