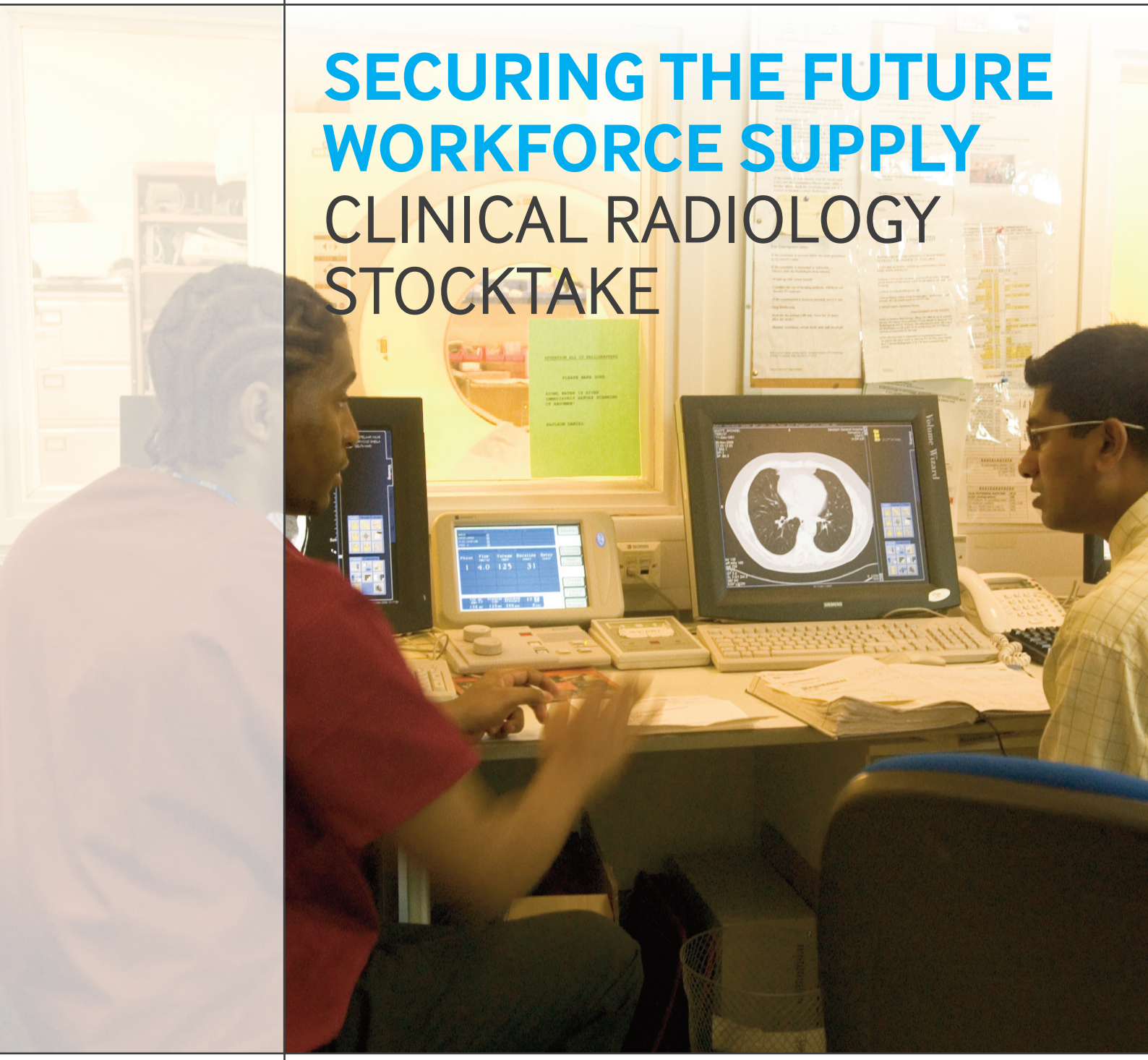
CENTRE FOR WORKFORCE INTELLIGENCE

SECURING THE FUTURE WORKFORCE SUPPLY

CLINICAL RADIOLOGY STOCKTAKE



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Context and purpose

In March 2012, the Royal College of Radiologists (RCR) presented a case (RCR, 2012a) to the Medical Programme Board (MPB)[1] for growing the clinical radiology workforce. The RCR stated that because of increased demand on clinical radiology services, the profession would need to increase training numbers by 60 trainees per year for the next five years. The MPB recommended that the case should be reviewed by the Joint Working Group on Specialty Training Numbers (JWG).

The Centre for Workforce Intelligence (CfWI) was commissioned by the Department of Health to undertake this review. This report covers the CfWI's stocktake of the clinical radiology workforce (excluding clinical oncology) in England, and provides an assessment of the RCR's case for growing the specialty, to inform the JWG recommendations to the emerging local education and training boards (LETBs) on clinical radiology trainee numbers for 2013.

The CfWI engaged with multiple stakeholders, including the Department of Health (DH), Health Education England (HEE), the RCR and the Society and College of Radiographers (SCoR) to inform this report. Due regard has been taken of the professions' opinions, which have influenced rather than driven the report, and the report includes perspectives and analysis that can be identified from available data.

Key findings

- There have been year-on-year increases in all imaging modalities and the CfWI expects this trend to continue.
- Complex imaging, which is more consultant intensive, is increasing as a percentage of total imaging and the CfWI expects this trend to continue.
- There is an increasing imbalance between supply and demand and the consultant workforce may not be able to cope with the additional imaging demands expected in the future.
- Current training numbers are not adequate to meet future demand as the service is presently configured.
- An expansion of clinical radiology trainee numbers is required until the next CfWI review.
- There is evidence to support expansion of the interventional and paediatric radiology workforces.
- Growth of the non-medical workforce, particularly radiographers, is required to support any workforce expansion in clinical radiology.

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 of the

[1] Now know as the Medical Board, a professional board of Health Education England (HEE): http://www.hee.nhs.uk/about/advisory-boards/medical-board/

various imaging professions to enhance patient safety, optimise skill mix and enable more effective workforce planning.

There is 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.

The RCR is continuing to develop a dual training programme with nuclear medicine after experiencing legislative issues when seeking to maintain the dual accreditation of clinical radiology trainees doing a sixth year of higher nuclear medicine training.

Recommendations / next steps

The CfWI is aware that the available resources for both service delivery and education are not conducive to workforce growth, and that expansion in this specialty would mean reductions elsewhere.

The CfWI has examined and described the available evidence throughout this report, and taken into consideration the need for further analysis based on a whole-team approach when making its recommendations.

The resulting recommendations are what the CfWI considers the minimum requirements to maintain a clinical radiology service, until definitive whole-team information has been quantified and agreed between the imaging professions.

- The CfWI recommends an increase of 30 clinical radiology Specialty Training 1 (ST1) posts above the planned ST1 posts for 2013, and that ST1 posts are maintained at baseline plus 30 for subsequent years so that the total number of clinical radiology National Training Numbers (NTNs) increases by 30 per year until the next review. These should include posts within interventional, paediatric and breast radiology.
- The RCR to further analyse the regional variation of consultant-to-population ratios, as the data suggests a possible imbalance.
- Professional bodies involved in clinical imaging to further analyse the impact of service changes and activities on future demand, to refine the RCR's activity guidelines to enable more accurate forecasting.
- The RCR to work with other professional bodies to further support and develop skill mix to expand the workforce where possible and appropriate.
- Commissioners to work with education providers and the profession to reduce the current training attrition rate.
- The CfWI and the RCR to analyse interventional, paediatric and breast radiology service provision to quantify future training number requirements and to engage with commissioners to consider dedicated training numbers for these subspecialties.
- Commissioners to consider the development and implementation of the three-tier model of service delivery for paediatric imaging.
- The SCoR to continue to support and enable radiographers in taking on more image reporting responsibilities where appropriate.

- The CfWI to conduct an in-depth review of radiography in 2013-14 to quantify future workforce requirements; the review to include training in subspecialty areas, skill mix and the case for formal career plans for paediatric and interventional radiographers.
- The CfWI recommends a further clinical radiology review once interventional and paediatric radiology, the RCR's activity guidelines and the radiographic workforce have been further analysed and quantitatively defined.

As part of the whole-team approach, the CfWI will be conducting a review of radiography in 2013-14 to complement this clinical radiology review, to quantify future radiography workforce requirements, and to look at radiography subspecialty training areas, particularly ultrasound and the case for formal career plans for paediatric and interventional radiographers.

SHA / LETB workforce planners are currently working on information collected from employers about their future intentions and risk identification in both service delivery and workforce terms. This will add a national overview of plans for future service delivery once complete, and will contribute to the whole-team approach. The CfWI hopes that this work will be available in time to complement the pending radiography workforce review.

CONSIDERATIONS FOR FUTURE REQUIREMENTS

Outline of the RCR's case

The RCR's case states that the increased workload undertaken by clinical radiologists has resulted from tests becoming more labour intensive and complex, as well as the introduction of picture archiving and communications systems (PACS), resulting in the increased numbers of images available for a consultant to review. Furthermore, the role of the clinical radiologist has expanded, with their mandatory input required at multidisciplinary team (MDT) meetings, which accounts for around one-tenth of a consultant's clinical input. Specifically:

- There has been a 26 per cent increase in radiology examinations across England between 2004/5 and 2010/11, from around 30 million in 2004 to almost 39 million in 2011.
- The number of interventional radiology examinations has risen by over 50 per cent since 2007.
- There is no evidence that this demand has begun to plateau, and the RCR expects year-on-year increases for the foreseeable future.
- The biggest percentage rise has been across the tests that are the most radiologist intensive, such as computed tomography (CT) examinations (86 per cent) and magnetic resonance imaging (MRIs) (125 per cent).
- Images per examination have increased. For example, in CT the radiologist was looking at 50 to 75 per cent more images per study in 2010 than three years earlier, and performed more post-processing image manipulation.
- The increased value of imaging in emergency departments, combined with the imperative to avoid delays in in-patient management, has led to a significant increase in out-of-hours radiologist input.
- The impact of the MDT meeting means that in most departments 10 per cent of the radiologist's clinical time is committed to this activity. The RCR census (RCR, 2012b) for 2010 showed that the frequency of MDT meetings increased for clinical radiologists by 30 per cent between 2007 and 2010.
- The RCR and SCoR have been working together to define how radiographers can extend their roles to ease the reporting burden using technology, skill mix and service improvement techniques (RCR & SCoR 2012). This has resulted in radiographers making sustained and positive contributions, especially to ultrasound, plain film reporting and breast imaging, but may not have the same impact on major expansion areas such as CT, MRI and new technologies.
- In the first quarter of 2011, 25 per cent of planned Advisory Appointments Committee (AAC) appointments for clinical radiology consultant posts failed to result in an appointment. The RCR maintains that this was due to a lack of suitable applicants. Many trusts will not explore business cases for further expansion if they cannot fill existing posts.

- A bulge in expected retirements already exists due to 132 clinical radiologists aged over 62 who currently contribute to the workforce, with another anticipated between 2019 and 2022, with around 80 clinical radiologists expecting to retire each year.
- The RCR states that their most recent census contains evidence showing that clinical radiologists are at greater risk of burnout than consultants working in other specialties, and a high percentage of consultant clinical radiologists opting for early retirement. The RCR maintains this is related to workload and inadequacies in current staffing and facilities.

Data from the RCR's 2010 workforce census

The RCR's internal census (RCR, 2012b) for 2010 achieved a 100 per cent response. It built on equivalent data for previous years and reports the following highlights:

- There was a headcount (HC) of 2,323 clinical radiologists employed in substantive posts in England in 2010, equating to 2,194 full time equivalents (FTE). This translated into 4.5 FTE clinical radiologists per 100,000 population in England at the time. Full-time clinical radiologists were contracted to work an average of 10.3 programmed activities (PAs). The distribution varied from region to region.
- Over 84 per cent of departments reported workload not met by radiology staff within contracted hours. More than 60 per cent of departments reported paying overtime, and 43 per cent were leaving imaging studies unreported or auto-reported, due to lack of resource.
- There were 200 unfilled consultant radiologist posts (over 8 per cent of the England clinical radiology workforce) with significant variations by region.
- The census reported low morale in many imaging departments leading to instances of prolonged absenteeism of consultant clinical radiologists through stress-related illness. The RCR attributed this to a shortfall in the radiological workforce.

RCR conclusions

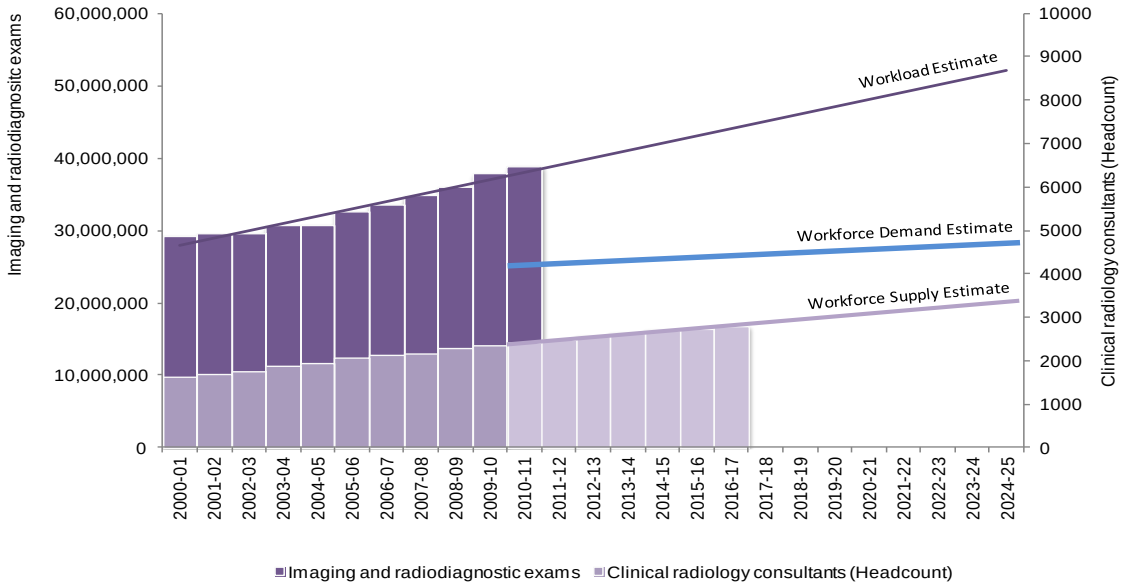
The RCR states that the clinical radiology workforce has been able to cope with demand in previous years due to the historically lower use of imaging per head of population compared to other European countries, but states that this gap is narrowing as the demand for imaging in England increases.

It adds that whilst the National Institute for Clinical Excellence (NICE, 2012) approved referral guidelines may have had some effect on controlling demand, another control has been the relative lack of access to radiology tests in primary care. The RCR expects that direct access to imaging will result in increased workload.

The RCR expects that the high numbers of expected retirements in the next few years alongside static training numbers will create a gap between supply and demand in clinical radiology. It fears that if this gap is not closed, the provision of adequate radiological services in the UK may fail before 2025.

The RCR believes that a ratio of eight clinical radiologists to 100,000 population would bring England into line with comparable European countries, and believes spare capacity exists in the UK training scheme to accommodate 60 extra trainees per year. It also understands the current financial constraints of the NHS and concedes that an increase of 30 trainees per year is realistic and the minimum to sustain a quality imaging service.

Figure 1: RCR predicted gap between workforce supply and demand – clinical radiology



Source: Investing in the clinical radiology workforce - the quality & efficiency case (RCR, 2012a)

The RCR applied the following considerations and assumptions when producing this graph:

- a minimum 8 clinical radiologists are required per 100,000 population to reach comparable European levels
- participation rates for each age band remain constant for the specialty until 2025, with an overall participation rate of 0.95 in the RCR census for 2010
- a specialty training period of five years (ST1-ST5) for clinical radiology
- average delays in training of approximately one year to model the effect of out-of-programme experiences (OOPE) and maternity leave
- all trainees gaining a Certificate of Completion of Training (CCT) in clinical radiology begin working as a clinical radiology consultant within the same year
- training attrition of 3 per cent per intake year (based on 2000-05 data)
- young leavers from the consultant workforce estimated at between 15 to 20 per year, balanced by non-UK entrants to consultant workforce (estimate from census data)
- average retirement modelled at 62, with those aged over 62 and still in the workforce expected to retire over the next four years.

Viewpoint of the Society and College of Radiographers

Skill mix

The SCoR acknowledges that radiographers cannot do the job of radiologists, but also that radiologists do not do the job of radiographers, so advocates mutual respect and collaborative working. It actively promotes a greater use of collaborative skill mix between radiologists and radiographers and is working with the RCR to define the most cost-effective skill mix balance, and has jointly published with the RCR the *Team Working in Clinical Imaging* report (RCR & SCoR, 2012).

Radiographers are registered with the Health and Care Professions Council (HCPC) and are autonomous healthcare professionals, so individually and directly liable for their actions. They provide collegiate and complimentary roles to radiologists and are not substitutes or replacements. Skill mix is about using existing and appropriate talents and potential from across the whole workforce to maximum effect. The radiography profession's Scope of Practice (SCoR, 2009a) entitles radiographers to practise in accordance with their training and development and in accordance with their employer's entitlements and authorisations.

The SCoR believes that assistant practitioner (AP) posts are also a key consideration since, regardless of skill mix changes between radiographers and radiologists for the purposes of image reporting, the images still have to be taken. APs can undertake a significant proportion of routine image acquisition and the AP scope of practice (SCoR, 2012a) has developed to a stage which the SCoR believes is as far as it can confidently progress, with APs now performing virtually all skeletal imaging, assisting CT and MR, and undertaking some contrast examinations where there is a protocol for the projections to be acquired.

The SCoR supports the RCR's case for radiologist expansion but maintains that as around 95 per cent of images are acquired by the radiography workforce, growth is needed in both professions (SCoR, 2012b).

Demand for imaging

The SCoR expects the overall demand for imaging will continue to increase for the foreseeable future, not only due to the ageing population, increased cancer incidence and growing population, but also because existing and new imaging technology will be introduced into additional and more diverse healthcare settings; and initiatives such as early diagnostics and any qualified provider being major drivers (SCoR, 2012b).

Interventional radiology

The SCoR fully supports the expansion of interventional radiology (IR) as advancement of practice, and believes there is great scope for IR. With the many types of intervention available, it is the society's view that surgery is still being performed when radiological interventional procedures would be more appropriate in terms of patient interest and more

efficient in terms of surgeon workload and hospital turnaround. The SCoR believes that referral guidelines for their medical colleagues could be improved (SCoR, 2012b).

Teleradiology

The SCoR acknowledges there is a shift towards remote diagnostics/teleradiology but does not view this as a long-term solution to the increased demand for imaging services, mainly because it is a high-end and expensive resource (SCoR, 2012b). It does not necessarily allow for an immediate diagnostic report which will influence patient management, which is the ideal situation, especially when considering that imaging should be available 24/7.

Furthermore, the society points out that if the providers are not based in the UK, there may be additional issues with data protection, Care Quality Commission registration, training and registration/certification, and continuing professional development (CPD).

Productivity and efficiency

The SCoR recognises that 24/7 imaging would improve the service and make better use of expensive and underutilised machinery (SCoR, 2012b). It stresses that this applies to the whole imaging workforce as there is no point in out-of-hours image acquisition if the images cannot be reported on until the next in-hours shift. The society maintains that this is one area where the skill mix interface between radiography and radiology can be utilised to best effect, and recommends that wherever radiographers can provide an indicative report that can be actioned by another member of the medical team they should be able to do so, easing system holdups and increasing efficiency.

The SCoR acknowledges definite challenges in providing a 24/7 service, particularly where working hours have been funded by on-call payments, and in specialist units such as paediatrics, where APs tend not to work and where skill mix opportunities are more restricted.

Training and funding issues facing the radiographer workforce

There is an identified shortage of sonographers in the UK. The society maintains that this is a direct result of a lack of investment in post-registration education and training. There is some debate in the profession about whether sonography should be studied as a single degree, but no satisfactory resolution has been reached so far.

The society also feels that because of different training, skill sets and responsibilities, sonographers or those who practise ultrasound from overseas may not be suitable to work in the UK due to registration and regulation restrictions. The SCoR has established a voluntary register of sonographers for those who have trained overseas but are not able to register as radiographers.

APs also face a shortage of investment, as they are funded by their employers and not subject to the same funding as student radiographers. Work is underway to cut costs, but it

is proving difficult and about half the training courses established since 2004 are now not recruiting.

The SCoR feels there is definitely room and scope for improvement, and would like to see more opportunities for training, as long as investment allows.

Policy drivers affecting demand

Table 1 summarises the drivers affecting the clinical radiology workforce, relevant policy references, and related papers.

Table 1: Policy drivers and relevant policies and papers affecting the workforce – clinical radiology

Drivers and relevant policies and papers
Adequate, flexible and responsive workforce A flexible and responsive workforce is needed to drive up quality and improve productivity, with nationally transferable skills and competencies to ensure that all skills are utilised effectively and efficiently across all services. Sufficient numbers of clinical radiologists and non-medical support staff, especially radiographers, will need to be provided to meet service requirements and targets, and to allow higher-level training to enable the delivery of more complex and advanced diagnostics. Equity and Excellence, Liberating the NHS: (DH, 2010) The RCR response to: Equity and excellence: Liberating the NHS (RCR, 2010) The Operating Framework for the NHS in England (DH, 2011a) The RCR's response to NHS Future Forum Further Work on Education and Training (RCR, 2011) The RCR's response to NHS Future Forum Further Work on Integrated Services (RCR, 2011b)
Cancer strategy The Government is committed to improving cancer survival rates. The DH strategy provides possible future models for service delivery which will impact on the radiological workforce. Improving outcomes: a strategy for cancer (DH, 2011b)
Interventional radiology There is a requirement to expand this workforce, including the provision of IR services and facilities in major trauma centres. The need to improve the delivery and equity of IR is recognised by the Department of Health. Interventional Radiology: Improving Quality and Outcomes for Patients (DH, 2009) Interventional Radiology: Guidance for Service Delivery (DH, 2010b) Emergency and Urgent Care Services - Major Trauma Services (NHS, 2010)
Teleradiology Increasingly, teleradiologists based outside the UK are being engaged to report the images of UK patients. Doctors based outside the UK are not required to be on the specialist register of the GMC or to have a licence to practise, even though they are practising on patients based in the UK. The regulation of teleradiology (RCR, 2012c)
Quality, Innovation, Productivity and Prevention (QIPP) In imaging, QIPP savings have come over recent years from picture archiving and communications systems (PACS), digital dictation and service redesign, resulting in increases in activity with existing staffing. QIPP discussions for radiology have been extensive and at the highest level. The DH acknowledges that additional QIPP savings are not possible to any large degree in radiology in England and that the service has reached its capacity for increased productivity. The NHS quality, innovation, productivity and prevention challenge (DH, 2010c)

Demographics

Based on Hospital Episode Statistics (HES) first outpatient attendance data (HES, 2012), males aged 60 to 79 and females aged 40 to 49 and 60 to 79 are the patients who use radiology services the most.

The Office for National Statistics (ONS) predicts that the overall population in England will increase by over 7.5 per cent by 2021, and that the population aged over 65 in England will increase from 16 per cent of the total population in 2011 to 22 percent in 2031 (ONS, 2012a).This is likely to have a greater effect on demand for clinical radiology than many other specialties. These are important factors to consider when planning the future imaging workforce.

Changes in activity

Table 2 shows the total number of imaging and radiological examinations or tests in England by imaging modality from 1996–97 to 2010–11 based on the Department of Health's 2012 KH12 form data (DH, 2012a). This data shows an overall 19 per cent increase in examinations or tests from around 32.5 million in 2005–06 to 38.8 million in 2010–11 with MRI, CT and ultrasound showing the largest increases: 90 per cent, 61 per cent and 33 per cent respectively. All modalities except for radio-isotopes showed increases in the number of examinations since 2005-06.

Table 2: Total number of imaging and radiodiagnostic examinations/tests by modality, England, 1996–97 to 2010–11

Year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total
1996-97	19,101,029	1,053,407	391,290	4,443,490	505,476	1,231,284	26,725,976
1997-98	19,474,590	1,172,656	473,074	4,790,532	722,096	1,179,979	27,812,927
1998-99	19,876,933	1,254,474	522,138	5,018,434	699,654	1,244,632	28,616,265
1999-00	19,967,296	1,359,852	585,797	5,255,330	727,255	1,256,965	29,152,499
2000-01	19,913,022	1,488,752	632,594	5,382,582	539,141	1,253,847	29,209,938
2001-02	19,806,876	1,625,304	705,706	5,571,979	537,653	1,222,296	29,469,814
2002-03	19,512,924	1,767,791	786,646	5,635,358	551,423	1,295,639	29,549,781
2003-04	20,056,669	1,992,826	857,550	5,937,383	582,742	1,221,102	30,648,272
2004-05	19,818,330	2,141,652	944,935	6,029,104	560,337	1,190,487	30,684,845
2005-06	20,585,678	2,481,571	1,118,487	6,469,396	623,532	1,209,029	32,487,693
2006-07	21,011,234	2,728,119	1,257,972	6,715,486	588,638	1,249,161	33,550,610
2007-08	21,028,109	3,044,516	1,488,059	7,135,551	673,413	1,337,049	34,706,697
2008-09	21,437,735	3,355,161	1,725,793	7,552,156	616,886	1,256,030	35,943,761
2009-10	21,919,881	3,719,089	1,970,323	8,217,414	615,403	1,301,531	37,743,641
2010-11	22,167,960	3,986,831	2,129,973	8,599,380	603,560	1,317,833	38,805,537
overall change 05-06 to 10-11	8%	61%	90%	33%	-3%	9%	19%

Source: Department of Health KH12, 2012 (DH, 2012)

Table 3 shows year-on-year percentage change in the number of imaging and radiological examinations or tests in England by imaging modality, from 1996–97 to 2010–11 based on the Department of Health's 2012 KH12 form data (DH, 2012a).

Table 3: Annual percentage change in the number of imaging and radiodiagnostic examinations/tests by modality, England, 1996–97 to 2010–11

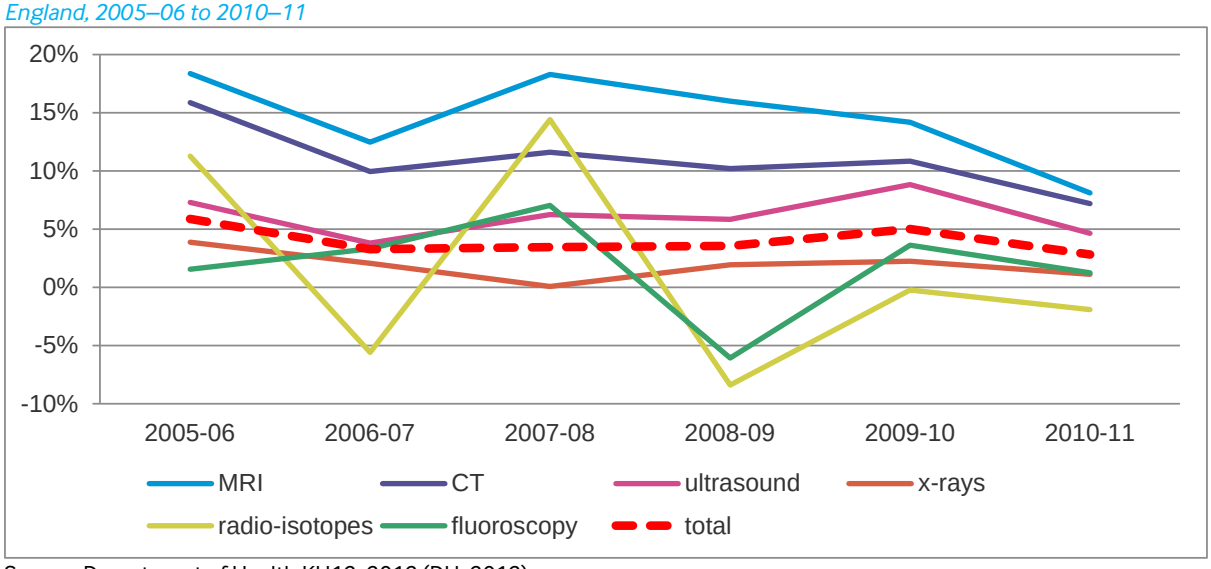
Year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total
1996-97	3.23%	-38.37%	12.50%	10.22%	8.03%	14.23%	2.25%
1997-98	1.96%	11.32%	20.90%	7.81%	42.85%	-4.17%	4.07%
1998-99	2.07%	6.98%	10.37%	4.76%	-3.11%	5.48%	2.89%
1999-00	0.45%	8.40%	12.19%	4.72%	3.94%	0.99%	1.87%
2000-01	-0.27%	9.48%	7.99%	2.42%	-25.87%	-0.25%	0.20%
2001-02	-0.53%	9.17%	11.56%	3.52%	-0.28%	-2.52%	0.89%
2002-03	-1.48%	8.77%	11.47%	1.14%	2.56%	6.00%	0.27%
2003-04	2.79%	12.73%	9.01%	5.36%	5.68%	-5.75%	3.72%
2004-05	-1.19%	7.47%	10.19%	1.54%	-3.84%	-2.51%	0.12%
2005-06	3.87%	15.87%	18.37%	7.30%	11.28%	1.56%	5.88%
2006-07	2.07%	9.94%	12.47%	3.80%	-5.60%	3.32%	3.27%
2007-08	0.08%	11.60%	18.29%	6.26%	14.40%	7.04%	3.45%
2008-09	1.95%	10.20%	15.98%	5.84%	-8.39%	-6.06%	3.56%
2009-10	2.25%	10.85%	14.17%	8.81%	-0.24%	3.62%	5.01%
2010-11	1.13%	7.20%	8.10%	4.65%	-1.92%	1.25%	2.81%

Source: Department of Health KH12, 2012 (DH, 2012)

This data shows that the overall rate of increase across all modalities has been slowing since 2005–06 (see figure 2 below). The red dotted line represents the total overall rate change from 5.88 per cent in 2005–06 to 2.81 per cent in 2010–11.

For the first time since 2005–06, every modality had a reduction in rate of increase between 2009–10 and 2010–11 with MRI, ultrasound and CT showing the largest reductions: 6.1, 4.2 and 3.7 percentage points respectively. If these annual growth rates continue to decrease it may indicate the beginning of a plateau, but this can only be determined when additional data becomes available.

Figure 2: Annual percentage change in the number of imaging and radiodiagnostic examinations/tests by modality, England, 2005–06 to 2010–11



Source: Department of Health KH12, 2012 (DH, 2012)

Table 4 shows the number of imaging and radiological examinations or tests in England per head of population by imaging modality from 1996–97 to 2010–11 based on the Department of Health's 2012 KH12 form data (DH, 2012) and population data from the Office for National Statistics (ONS, 2011).

This data shows an overall 14 per cent increase in examinations or tests per head of population from 0.64 in 2005–06 to 0.73 2010–11 with MRI, CT and ultrasound showing the largest increases. The data also shows overall year-on-year increases for all modalities except for radio-isotope-based investigations.

Table 4: Number of imaging and radiodiagnostic examinations/tests per head of population by modality, England, 1996–97 to 2010–11

Year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total	population
1996-97	0.39	0.02	0.01	0.09	0.01	0.03	0.55	48,664,800
1997-98	0.40	0.02	0.01	0.10	0.01	0.02	0.57	48,820,600
1998-99	0.41	0.03	0.01	0.10	0.01	0.03	0.58	49,032,900
1999-00	0.41	0.03	0.01	0.11	0.01	0.03	0.59	49,233,300
2000-01	0.40	0.03	0.01	0.11	0.01	0.03	0.59	49,449,700
2001-02	0.40	0.03	0.01	0.11	0.01	0.02	0.59	49,649,100
2002-03	0.39	0.04	0.02	0.11	0.01	0.03	0.59	49,863,300
2003-04	0.40	0.04	0.02	0.12	0.01	0.02	0.61	50,109,700
2004-05	0.39	0.04	0.02	0.12	0.01	0.02	0.61	50,466,200
2005-06	0.41	0.05	0.02	0.13	0.01	0.02	0.64	50,763,900
2006-07	0.41	0.05	0.02	0.13	0.01	0.02	0.66	51,106,200
2007-08	0.41	0.06	0.03	0.14	0.01	0.03	0.67	51,464,600
2008-09	0.41	0.06	0.03	0.15	0.01	0.02	0.69	51,809,700
2009-10	0.42	0.07	0.04	0.16	0.01	0.02	0.72	52,234,000
2010-11	0.42	0.08	0.04	0.16	0.01	0.02	0.73	53,012,400
overall change 05-06 to 10-11	3%	54%	82%	27%	-7%	4%	14%	

Source: Department of Health KH12, 2012 (DH, 2012), Office for National Statistics (ONS, 2011)

Table 5 shows the number of imaging and radiological examinations or tests in England per consultant by imaging modality from 1996–97 to 2010–11, based on the Department of Health's 2012 KH12 form data (DH, 2012) and workforce data from the NHS Health and Social Care Information Centre (HSCIC, 2012a)

This data shows a small decrease in the total number of examinations or tests per consultant between 2005–06 and 2010–11. Although the number X-rays, radio-isotope-based investigations and fluoroscopy tests per consultant have been decreasing, the more complex MRI, CT and ultrasound tests have been increasing.

Table 5: Number of imaging and radiodiagnostic examinations/tests per FTE consultant by modality, England, 1996–97 to 2010–11

Year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total	consultants FTE
1996-97	14,007	772	287	3,258	371	903	19,598	1,364
1997-98	14,045	846	341	3,455	521	851	20,058	1,387
1998-99	14,053	887	369	3,548	495	880	20,232	1,414
1999-00	13,673	931	401	3,599	498	861	19,963	1,460
2000-01	13,344	998	424	3,607	361	840	19,574	1,492
2001-02	12,517	1,027	446	3,521	340	772	18,624	1,582
2002-03	11,694	1,059	471	3,377	330	776	17,709	1,669
2003-04	11,486	1,141	491	3,400	334	699	17,552	1,746
2004-05	10,476	1,132	499	3,187	296	629	16,220	1,892
2005-06	10,586	1,276	575	3,327	321	622	16,706	1,945
2006-07	10,613	1,378	635	3,392	297	631	16,946	1,980
2007-08	9,987	1,446	707	3,389	320	635	16,484	2,106
2008-09	9,590	1,501	772	3,378	276	562	16,079	2,235
2009-10	9,642	1,636	867	3,615	271	573	16,603	2,273
2010-11	9,419	1,694	905	3,654	256	560	16,488	2,354
overall change 05-06 to 10-11	-11%	33%	57%	10%	-20%	-10%	-1%	

Source: Department of Health KH12, 2012 (DH, 2012), NHS Health and Social Care Information Centre (HSCIC, 2012a)

Waiting times

Measures of waiting time performance are subject to seasonality. For example, the presence of bank holidays or the number of weekends in a calendar month affects the number of working days. Similarly, adverse weather may result in emergency pressure and impacts upon the health service's ability to preserve elective capacity. These factors can affect waiting times and should be considered when making comparisons across time (DH, 2012b).

The median is the mid-point of the waiting times distribution (i.e. the 50th percentile) and can be interpreted by saying that half of all patients have waited less time and half have waited more. It should be noted that medians are calculated from aggregate data, rather than patient-level data, and therefore are only estimates of the position on average waits (DH, 2012b).

The 2012–13 NHS Operating Framework (DH, 2011a) introduced an expectation that less than one per cent of patients should wait six weeks or longer for a diagnostic test. DH diagnostics waiting times and activity information (DH, 2012b) shows that at the end of June 2012, there were around 460,000 patients still waiting for an MRI, CT, non obstetric-ultrasound, barium enema or DEXA scan, as shown in table 6 below. Of these, over 3,100, or 0.7 per cent, were waiting six weeks or over from referral. The data also shows that the number waiting for 13 weeks or over was 0.02 per cent of the total, and that the average median waiting time was 1.6 weeks.

Table 6: Diagnostic waiting times by test at the end of June 2012, England

Test	total waiting at end of June	number waiting 6+ weeks	% waiting 6+ weeks	number waiting 13+ weeks	% waiting 13+ weeks	median waiting time (weeks)
magnetic resonance imaging (MRI)	126,003	719	0.6%	55	0.04%	1.8
computer tomography (CT)	77,280	283	0.4%	2	0.00%	1.5
non-obstetric ultrasound	234,789	2,050	0.9%	15	0.01%	1.8
barium enema	2,811	9	0.3%	0	0.00%	1.3
DEXA scan	19,010	104	0.5%	2	0.01%	1.7
total	**459,893**	**3,165**	**0.7%**	**74**	**0.02%**	**Avg 1.6**

Source: Department of Health, (DH, 2012b)

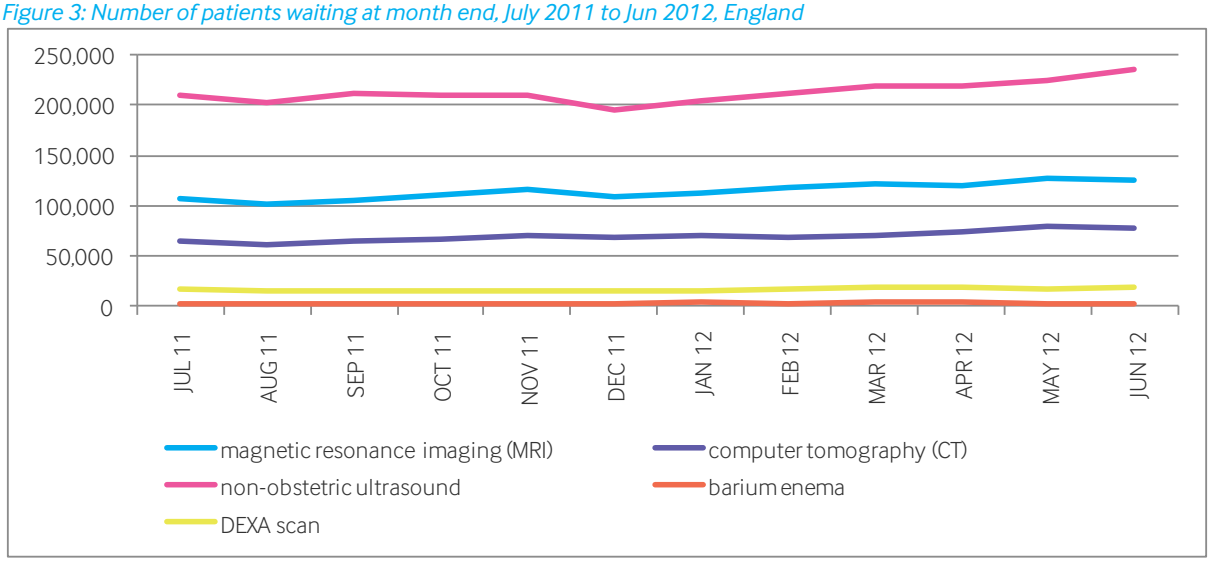
Table 7 shows the number of patients waiting for an MRI, CT, non obstetric-ultrasound, barium enema or DEXA scan at the end of each month between July 2011 and June 2012. Figure 3 displays the same information in graphical format.

Table 7: Number of patients waiting at month end, July 2011 to June 2012, England

Test	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012
magnetic resonance imaging (MRI)	107,329	101,531	106,158	110,152	116,612	108,156	112,713	118,330	121,160	120,605	127,047	126,003
computer tomography (CT)	65,191	61,741	65,213	66,613	71,305	68,469	71,280	69,420	71,143	74,303	78,856	77,280
non-obstetric ultrasound	209,201	202,273	210,947	210,756	210,759	195,801	204,083	212,383	219,966	219,941	224,566	234,789
barium enema	3,178	3,007	3,073	3,025	2,718	2,931	4,020	3,019	3,589	3,716	3,059	2,811
DEXA scan	16,337	16,111	15,284	15,974	15,836	15,767	16,023	17,108	18,155	18,383	17,975	19,010

Source: Department of Health, (DH, 2012b)

Figure 3: Number of patients waiting at month end, July 2011 to Jun 2012, England



Source: Department of Health, (DH, 2012b)

The data shows an overall upward trend in the number of patients waiting for scans between July 2011 and June 2012. DEXA increases were not as pronounced as MRI, CT and non-obstetric ultrasound, while barium enema scans remained more or less static over the year. This trend is in line with the overall year-on-year increases as seen in the changes of activity section above.

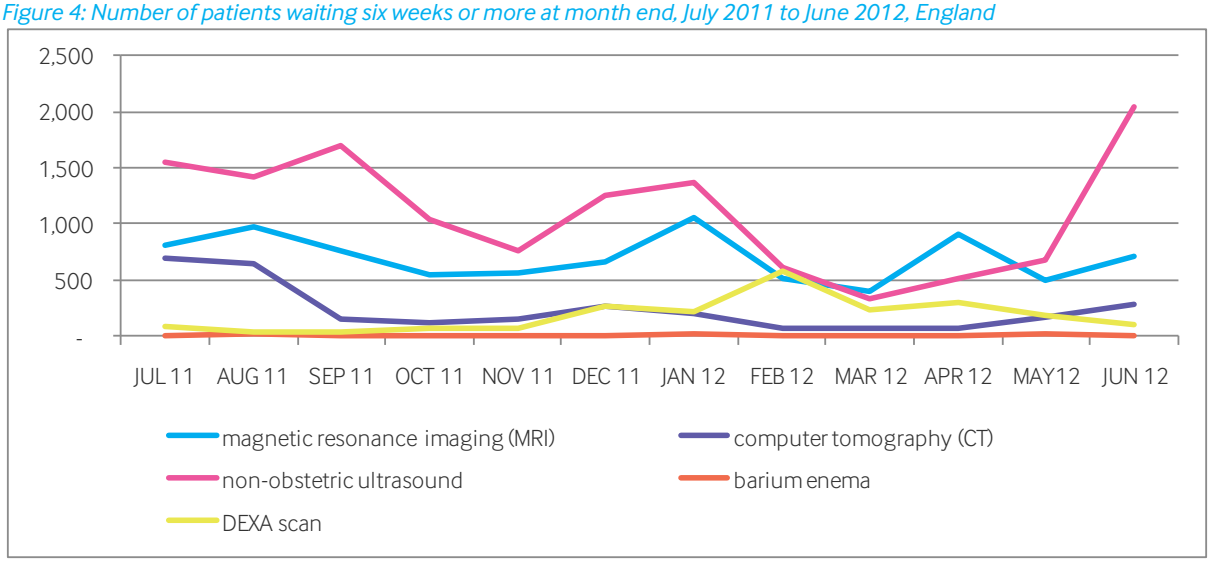
Table 8 shows the number of patients waiting six weeks or more for an MRI, CT, non-obstetric ultrasound, barium enema or DEXA scan at the end of each month between July 2011 and June 2012. Figure 4 displays the same information in graphical format.

Table 8: Number of patients waiting six weeks or more at month end, July 2011 to June 2012, England

Test	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012
magnetic resonance imaging (MRI)	804	978	761	549	557	663	1,060	518	392	910	494	719
computer tomography (CT)	691	648	153	122	148	265	203	67	74	73	165	283
non-obstetric ultrasound	1,543	1,413	1,705	1,048	757	1,246	1,363	614	337	523	672	2,050
barium enema	3	15	7	3	0	2	15	5	1	3	20	9
DEXA scan	80	36	33	64	71	264	224	573	239	296	186	104

Source: Department of Health, (DH, 2012b)

Figure 4: Number of patients waiting six weeks or more at month end, July 2011 to June 2012, England



Source: Department of Health, (DH, 2012b)

Table 8 and Figure 4 show an overall downward trend in the number of MRI, CT and non-obstetric ultrasound patients waiting six weeks or more. Non-obstetric ultrasound does show a sharp rise in June 2012 but this may be a one-off anomaly which can only be determined when additional data becomes available.

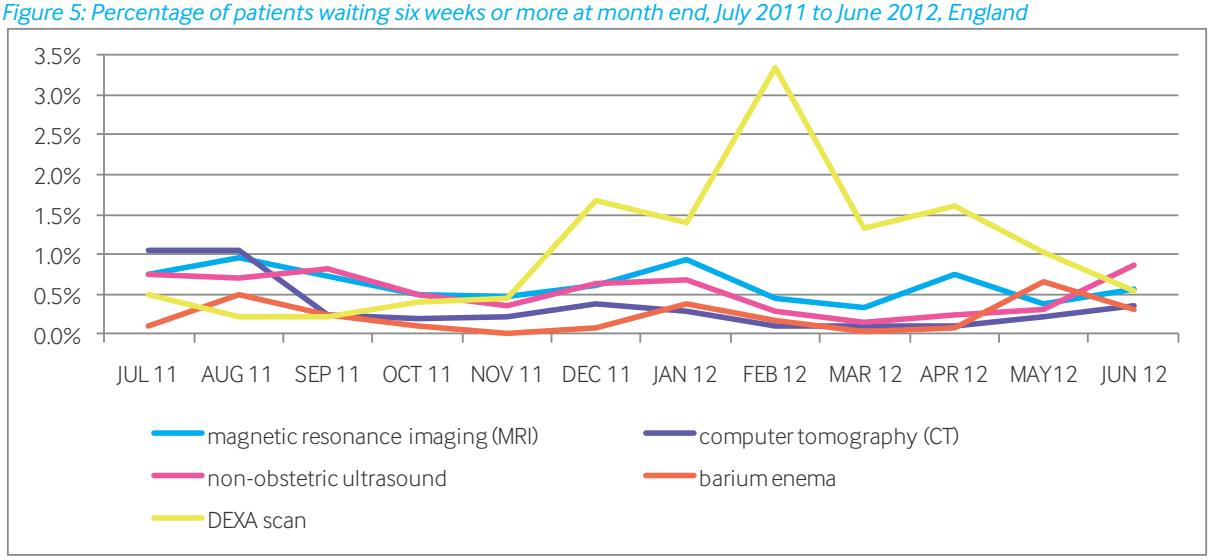
Table 9 shows the percentage of patients waiting six weeks or more for an MRI, CT, non-obstetric ultrasound, barium enema or DEXA scan at the end of each month between July 2011 and June 2012. Figure 5 displays the same information in graphical format.

Table 9: Percentage of patients waiting six weeks or more at month end, July 2011 to June 2012, England

Test	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012
magnetic resonance imaging (MRI)	0.7%	1.0%	0.7%	0.5%	0.5%	0.6%	0.9%	0.4%	0.3%	0.8%	0.4%	0.6%
computer tomography (CT)	1.1%	1.0%	0.2%	0.2%	0.2%	0.4%	0.3%	0.1%	0.1%	0.1%	0.2%	0.4%
non-obstetric ultrasound	0.7%	0.7%	0.8%	0.5%	0.4%	0.6%	0.7%	0.3%	0.2%	0.2%	0.3%	0.9%
barium enema	0.1%	0.5%	0.2%	0.1%	0.0%	0.1%	0.4%	0.2%	0.0%	0.1%	0.7%	0.3%
DEXA scan	0.5%	0.2%	0.2%	0.4%	0.4%	1.7%	1.4%	3.3%	1.3%	1.6%	1.0%	0.5%

Source: Department of Health, (DH, 2012b)

Figure 5: Percentage of patients waiting six weeks or more at month end, July 2011 to June 2012, England



Source: Department of Health, (DH, 2012b)

They show that – with the exception of DEXA scans – the fluctuation in waiting rates throughout the year for each modality was within a single per cent, which is typical when looking back to 2008, and the overall average percentage of patients waiting six weeks or more throughout the year was 0.43 per cent, or 0.55 per cent including DEXA. MRI, CT and non-obstetric ultrasound show the beginnings of an upwards movement but until these break the trend seen over the past year they should be assumed to be part of the normal cyclical variation in this timeline.

The number of patients waiting for a DEXA scan started to increase in November 2011and peaked in February 2012 before returning to previous levels in June 2012. This occurred outside the normal summer holiday period so cannot be attributed to staff holidays, and the SCoR is not aware of any guidance, policy or major equipment replacement programmes that might have contributed to the peak. If an individual is over 50 and falls, sustaining a fracture, they would by default have a DEXA scan, and the SCoR has suggested that this peak may have been due to the cold or icy weather creating a sudden 'emergency' demand which then subsided back to normal osteoporosis screening levels once the weather warmed up (SCoR, 2012b).

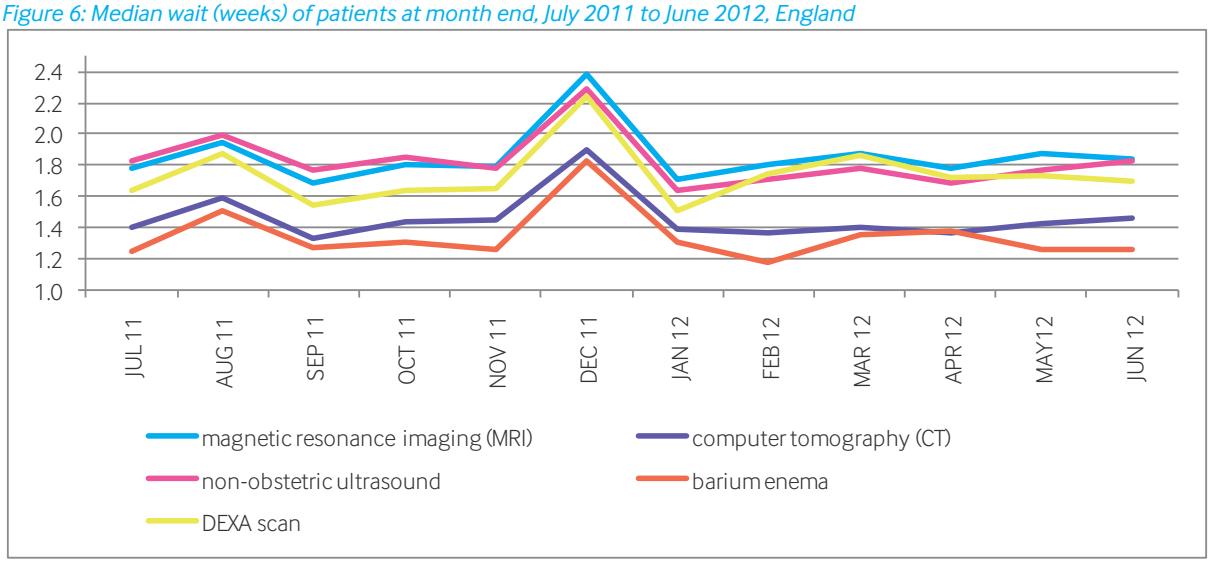
Table 10 shows the median wait of patients expecting an MRI, CT, non obstetric-ultrasound, barium enema or DEXA scan at the end of each month between July 2011 and June 2012. Figure 6 displays the same information in graphical format.

Table 10: Median wait (weeks) of patients at month end, July 2011 to 2010 to June 2012, England

Test	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012
magnetic resonance imaging (MRI)	1.8	1.9	1.7	1.8	1.8	2.4	1.7	1.8	1.9	1.8	1.9	1.8
computer tomography (CT)	1.4	1.6	1.3	1.4	1.5	1.9	1.4	1.4	1.4	1.4	1.4	1.5
non-obstetric ultrasound	1.8	2.0	1.8	1.8	1.8	2.3	1.6	1.7	1.8	1.7	1.8	1.8
barium enema	1.3	1.5	1.3	1.3	1.3	1.8	1.3	1.2	1.4	1.4	1.3	1.3
DEXA scan	1.6	1.9	1.5	1.6	1.6	2.2	1.5	1.7	1.9	1.7	1.7	1.7

Source: Department of Health, (DH, 2012b)

Figure 6: Median wait (weeks) of patients at month end, July 2011 to June 2012, England

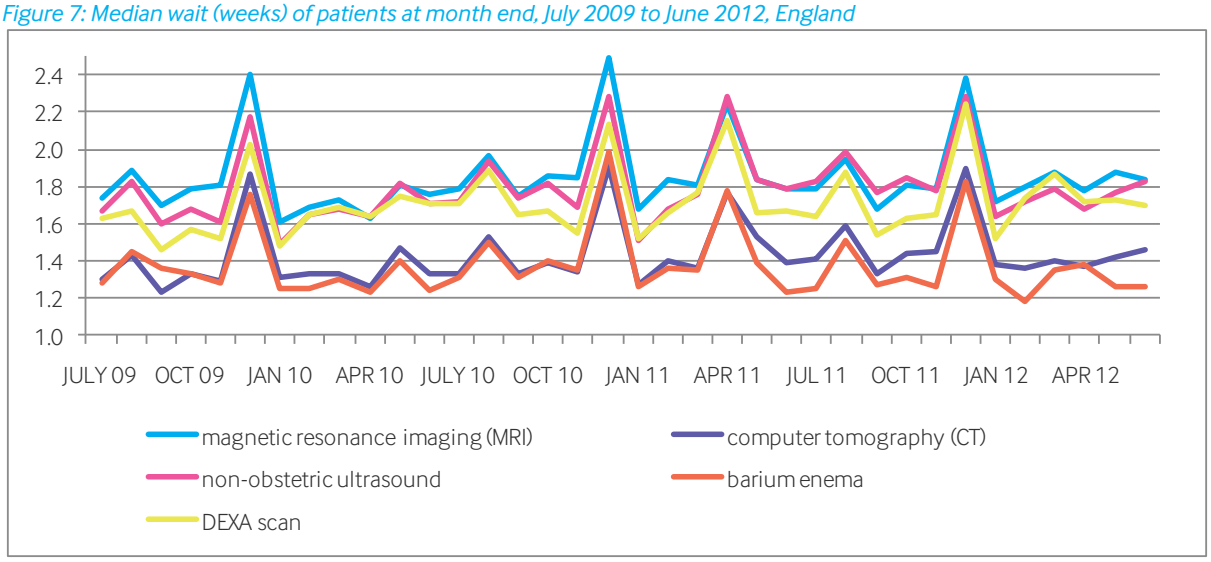


Source: Department of Health, (DH, 2012b)

The data shows no upward or downward trends across all modalities, with the only significant variation over December and less notably over August, which ties in with the winter and summer vacation periods. This is significant as it means the median waiting time over this timeline is static.

Figure 7 shows the median wait of patients expecting an MRI, CT, non-obstetric ultrasound, barium enema or DEXA scan at the end of each month between July 2009 and June 2012. This shows a very slight upward trend across all modalities with peaks in vacation periods. Table 11 displays the same information broken down into yearly averages, with a total average across the three years.

Figure 7: Median wait (weeks) of patients at month end, July 2009 to June 2012, England



Source: Department of Health, (DH, 2012b)

Table 11: Median wait (weeks) of patients at month end, July 2009 to June 2012, England

Test	average median waiting time (weeks)			
	Jul 09 to Jun 10	Jul 10 to Jun 11	Jul 11 to Jun 12	Jul 09 to Jun 12
magnetic resonance imaging (MRI)	1.8	1.9	1.9	1.9
computer tomography (CT)	1.4	1.5	1.5	1.4
non-obstetric ultrasound	1.7	1.8	1.8	1.8
barium enema	1.3	1.4	1.3	1.4
DEXA scan	1.6	1.8	1.7	1.7

Source: Department of Health, (DH, 2012b)

Analysis

The change in activity and waiting times charts and graphs show that for most modalities there have been increases in the number of examinations since 2005–06. However, the overall rate of increase across all modalities has been slowing since 2005–06, and every modality reported a reduction in the rate of increase between 2009–10 and 2010–11.

For the year ending June 2012 there was an overall upward trend in the number of patients waiting for scans. However, the number of patients waiting six weeks or more showed an overall downward trend and the median waiting times across all modalities did not increase. Additionally, the overall average percentage of patients waiting six weeks or more was 0.55 per cent, which is well within target of less than 1 per cent, and the fluctuation between waiting rates throughout the year for each modality was within a single percentage point, which appears to be the typical cyclical variation of this consideration.

Against the measures above, between 2005 and June 2012, the profession absorbed and processed the increasing number of examinations without any negative impact on patient median waiting times or the operating framework six-week-wait percentage targets, and the actual number of patients waiting six weeks or more at month end over the year ending June 2012 shows an overall downwards trend, with the exception of non-obstetric ultrasound, which needs further clarification.

The college states that the clinical radiology workforce was able to cope with demand in previous years due to the historical lower use of imaging per head of population compared to other European countries. However, the UK is the only country in the world with ionising radiation legislation on the statute, limiting the use of radiation for medical purposes to those occasions when it can be clinically justified. This means that patients in other European countries may be sent for imaging when it would be deemed unnecessary in UK. Since imaging service regulation and provision is not the same across Europe as it is in England, the CfWI suggests that comparing imaging per head to other European countries as a single measure does not accurately reflect the requirement in England.

Additionally, the tables above show that the total number of imaging/tests per head of population increased by 14 per cent between 2005–06 and 2010–11, with MRI, CT and ultrasound showing the greatest increases. They also show that during the same period the total overall imaging/tests per consultant actually decreased by 1 per cent. This is because non-complex tests (X-rays, radio-isotopes and fluoroscopy) fell by a slightly larger margin than the increases in complex tests (MRI, CT and ultrasound). The least complex plain films

can be reported at 30 or more per hour, while complex MR tests may take an hour each, so even though the overall tests per consultant fell, the actual radiologist workload will on average have increased.

The CfWI suggests that the clinical radiology workforce coped with the increasing demand in previous years because of the changes in numbers of tests per consultant between modalities, alongside skill mix initiatives that evolved over time to meet service needs, and other service improvement initiatives including altered rotas and increased working hours.

Interventional radiology

Interventional radiology (IR) was granted subspecialty status in 2010. IR, where clinically appropriate, offers less invasive alternatives to open surgery for a range of procedures, resulting in decreased lengths of stay, leading to lower unit costs for providers and commissioners, and improved patient experience.

Poor awareness among commissioners and providers regarding IR roles and lack of additional investment have resulted in very few dedicated IR training posts and no clear career pathway (RCR, 2012d). Other issues, such as limited availability of appropriate equipment and lack of access to outpatient clinics and support staff, have affected the profession negatively. Additionally, the increased use of IR has in the past been difficult to quantify because of coding and funding issues; data is now being collected monthly, which will assist future analysis.

There have been several reports containing evidence of the need for change to IR, from organisations including the National Confidential Enquiry into Patient Outcome and Death (NCEPOD), the National Institute for Health and Clinical Excellence (NICE), the National Imaging Board and Healthcare Commission. These have been reflected in a number of reports and documents from the DH and NHS such as:

- *Interventional Radiology: Improving Quality and Outcomes for Patients* (DH, 2009)
- *Interventional Radiology: Guidance for Service Delivery* (DH, 2010b)
- *Emergency and Urgent Care Services - Major Trauma Services* (NHS, 2010)
- *High Quality Care for All: NHS Next Stage Review* (DH, 2008).

The profession and the DH therefore agree that there is a need to improve the delivery and equity of access to IR through the expansion of this workforce as an advance in radiological practice, including the provision of IR services and facilities in major trauma centres. Overall skill mix would not work as this is a specialised field, so it will be necessary to train more IR specialists. Many in the profession believe a national recruitment process for dedicated IR NTNs would be the best way forward because of deanery variations in practice and the current geographical variations in consultant provision, and that support for change should come from the DH Medical Directorate, all royal colleges, LETBs, deaneries, workforce planners and clinical communities (RCR, 2012d).

Table 12 shows that there is a current estimated shortfall of around 222 FTE interventional radiologists to deliver a 1:5 on-call rota target for every acute trust. This is a crude estimate and does not take into account four trusts that did not submit data by the time of this review. It also ignores any networking arrangements between trusts, which will reduce the numbers required. It does show, however, a definite shortfall that requires a detailed further analysis of IR to more accurately quantify future requirements. Ideally, future increases in these posts should come from converting posts from other oversubscribed specialties.

Table 12: Interventional radiologists by trust, England, between May 2011 and March 2012

SHA	total trusts	trusts with data	interventional radiologists	IR needed for 1:5 ratio
North East	8	7	17	18
North West	24	22	75	35
Yorkshire and Humberside	15	15	53	22
East Midlands	8	8	43	-3
West Midlands	15	15	52	23
East of England	18	18	46	44
London	24	23	93	22
South East Coast	12	12	46	14
South Central	10	10	33	17
South West	17	17	55	30
	151	**147**	**513**	**222**

Source: National Clinical Director for Imaging, Department of Health (DH, 2012c)

Paediatric radiology

Paediatric radiology (PR) is one of the smallest radiological subspecialties. The RCR's 2011 census shows a fall in the number of dedicated paediatric consultant radiology posts from thirteen in 2010 to five in 2011. The importance of specialist imaging services for children and young adults has been recognised for many years. This is mainly because the presentation of disease and pathology is unique in children, and the equipment and facilities most suitable for children are often different from facilities for adults (DH, 2010d).

There is currently no subspecialty training beyond core curricular requirements, and interested trainees have to arrange suitable training locally or by out-of-deanery experience. Few radiology trainees, therefore, express an interest in specialising in paediatrics. Additionally, there is little incentive for radiographers to specialise in PR, as it has no formal career structure, is not recognised as an extended role for radiographers, and has no recognition within Agenda for Change (AfC). Consequently, few dedicated paediatric radiographers exist outside specialist children's units. As a result, recruitment has been limited for both radiology and radiography trainees, and paediatrics is one of the least popular of all radiology subspecialties (DH, 2010d).

PR rarely breaches the 18 week, cancer, or A&E targets, and there are few complaints about the service. These factors may have contributed to the common notion that there is little concern about this subspecialty (DH, 2010d). However, there are wide variations in the

provision of the service, with the more complex modalities increasingly required to provide service (DH, 2010d).

In light of this, there have been a number of reports from the DH and colleges containing evidence and recommendations for changes to the PR service, including:

- *Practice standards for the imaging of children and young people (SCoR, 2009b)*
- *Delivering quality imaging services for children (DH, 2010d)*
- *Improving paediatric interventional radiology services (RCR, 2010b)*
- *Paediatric radiology experts (RCR, 2011c).*

Both the profession and the DH agree that there is a need to improve the delivery of and access to PR via expansion of this workforce, its service provision and facilities, and to balance the need for local imaging with the need for an integrated service offering specialist support and expertise (DH, 2010d). Both the DH and RCR encourage the development and implementation of the three-tier model of service delivery for paediatric imaging, as described in the *Delivering quality imaging services for children* report (DH, 2010d).

Academic workforce

There are currently a total of 39 radiologists in the UK with an academic contract; 24 with a mixed NHS/academic and 15 with a purely academic contact.

There is 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 (RCR, 2012d).

Interplay with related groups

Roles in radiology are changing as developments in science and technology bring new opportunities to diagnose and treat patients more effectively and efficiently. As a result, radiology interplay across the care pathways is constantly evolving.

The RCR is working to develop a dual training programme with nuclear medicine, and has experienced legislative issues when seeking to maintain the dual accreditation of clinical radiology trainees doing a sixth year of higher nuclear medicine training. The latest proposal is that nuclear medicine trainees have the same initial core three years in clinical radiology. This is work in progress and the college does not consider it to have any material effect on current workforce issues (RCR, 2012d).

CURRENT AND FORECAST SUPPLY

Current supply

Tables 13 and 14 show the number of qualified clinical radiologists employed in the NHS in England as at September 2011, and numbers of consultant clinical radiologists from 1997 to 2011, according to the NHS Health and Social Care Information Centre (HSCIC) Medical and Dental Census from March 2012 (HSCIC, 2012a). Clinical radiology is not listed on the latest available Migratory Advisory Committee (MAC) shortage occupation list for September 2011 (MAC, 2011).

Table 13: Qualified NHS workforce, England, September 2011– clinical radiology

NHS qualified staff clinical radiology	headcount (HC)	full time equivalent (FTE)	FTE/HC
all staff	3,639	3,481	0.96
consultant (incl director of public health)	2,480	2,354	0.95
associate specialist	28	21	0.76
specialty doctor	31	28	0.90
staff grade	8	7	0.90
registrar group	1,068	1,048	0.98
senior house officer	0	0	n/a
foundation year 2	13	13	1.00
house officer and foundation year 1	8	8	1.00
other doctors in training	0	0	n/a
hospital practitioner / clinical assistant	4	1	0.25
other staff	2	1	0.50

*Headcount totals may not equal the sum of components due to rounding in the census.
Source: NHS Health and Social Care Information Centre (HSCIC, 2012a)

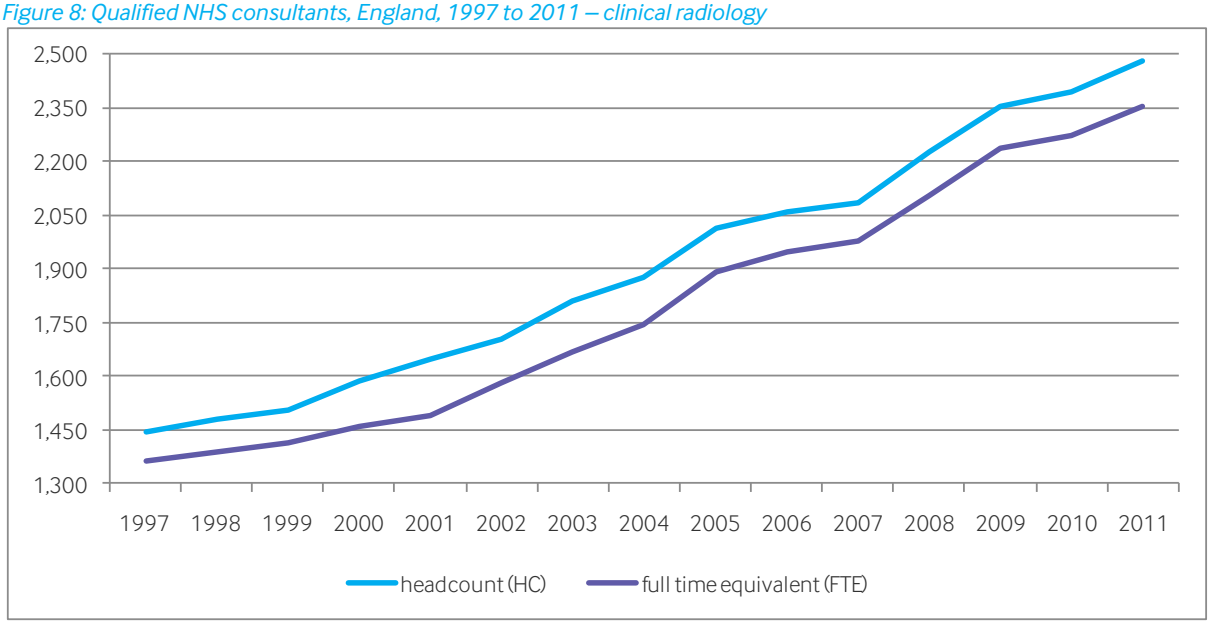
Table 14: Qualified NHS consultants, England, 1997 to 2011 – clinical radiology

Year	headcount (HC)	full time equivalent (FTE)	FTE/HC	population (England)	FTE consultants per 100,000 pop
1997	1,442	1,364	0.95	48,664,800	2.8
1998	1,481	1,387	0.94	48,820,600	2.8
1999	1,507	1,414	0.94	49,032,900	2.9
2000	1,585	1,460	0.92	49,233,300	3.0
2001	1,645	1,492	0.91	49,449,700	3.0
2002	1,702	1,582	0.93	49,649,100	3.2
2003	1,810	1,669	0.92	49,863,300	3.3
2004	1,876	1,746	0.93	50,109,700	3.5
2005	2,014	1,892	0.94	50,466,200	3.7
2006	2,061	1,945	0.94	50,763,900	3.8
2007	2,086	1,980	0.95	51,106,200	3.9
2008	2,224	2,106	0.95	51,464,600	4.1
2009	2,354	2,235	0.95	51,809,700	4.3
2010	2,395	2,273	0.95	52,234,000	4.4
2011	2,480	2,354	0.95	53,012,400	4.4

Source: NHS Health and Social Care Information Centre (HSCIC, 2012a)

Table 14 shows that the full time equivalent (FTE) consultant workforce had a compound annual growth rate (CAGR) of 4.7 per cent between 2001 and 2011, with the two fastest spurts in this period occurring between 2001 and 2005 at 6.1 per cent, and 2007 and 2009 at 6.2 per cent, also seen in figure 8 below. The data also shows a very consistent participation rate, averaging 0.94 between 1997 and 2011. The 2011 participation rate of 0.95 equalled the overall rate of all medical and dental specialties.

Figure 8: Qualified NHS consultants, England, 1997 to 2011 – clinical radiology



Source: NHS Health and Social Care Information Centre (HSCIC, 2012a)

Regional variations

Table 15 shows the number of consultant clinical radiologists employed in the NHS in England in September 2011 (HSCIC, 2012a), and the 2011 population in England by strategic health authority (SHA) according to those registered with GP practices at SHA and PCO level (HSCIC, 2012b), and according to the ONS 2011 Census (ONS, 2012b).

This shows the consultant HC at 2,482 and FTE at 2,354, translating into 44 FTE per million population in England when comparing against the ONS population census, with varied distribution per SHA ranging between 35 and 56 FTE per million. The varied distribution may suggest an imbalance, but further analysis is required before definitive conclusions can be drawn.

The RCR's 2011 census will provide the basis for further analysis of regional variation to determine the extent to which there may be an imbalance in consultant-to-population ratios.

Table 15: NHS consultants by SHA, England, 2011 – clinical radiology

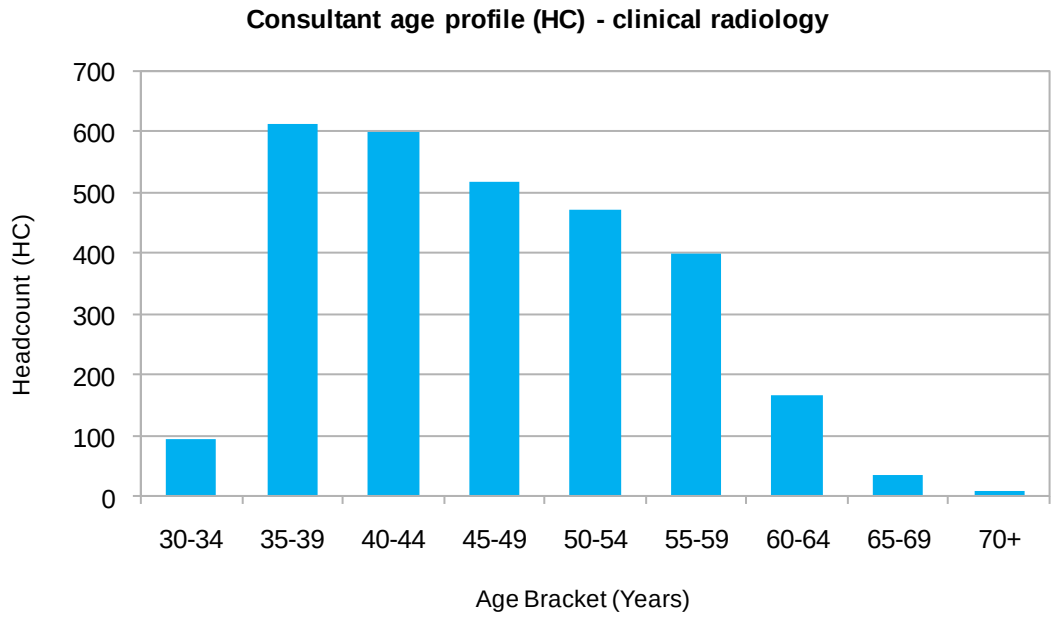
SHA	headcount (HC)	full time equivalent (FTE)	SHA population	FTE per million population
North East	124	119	2,596,900	46
North West	373	354	7,052,200	50
Yorkshire and The Humber	251	240	5,283,700	45
East Midlands	161	156	4,533,200	34
West Midlands	242	233	5,601,800	42
East of England	229	218	5,847,000	37
London	491	454	8,173,900	56
South East Coast	160	153	4,437,392	35
South Central	189	177	4,197,408	42
South West	262	249	5,288,900	47
	2,482	**2,354**	**53,012,400**	44

Sources: Office for National Statistics 2011 Census (ONS, 2012b), Medical Census 2011 (HSCIC, 2012a)
*Headcount totals may not equal the sum of components due to rounding in the census.

Age profile

The age profile of the current consultant workforce is shown in Figure 9. This shows a plentiful supply of younger staff with only a small proportion of consultants working beyond typical retirement age. The RCR 2011 workforce report indicates a possible shift in the average retirement age from 62 to 61, and the college expects those aged over 62 and still in the workforce to retire over the next four years (RCR, 2012a).

Figure 9: Consultant headcount age profile, England, 2011 – clinical radiology



Source: RCR 2011 Age profile data (RCR, 2012d)

Vacancies and employment

The HSCIC vacancy rate collections and publications were suspended for 2011. Both of these collections are being reviewed as part of the National Fundamental Review of NHS data collections, expected to be issued for consultation in late 2012 (HSCIC, 2012c). The latest available HSCIC vacancies survey recorded a three-month vacancy rate of 1.4 per cent (32 FTE) for radiology consultants in England as at 31 March 2010 (HSCIC, 2012d).

In December 2011 there were 221 consultant vacancies and 173 new CCT holders seeking consultant positions in England (RCR, 2012d). There are currently many unfilled consultant radiology posts, some of which have never been advertised because trusts doubt they will be able to recruit (RCR, 2012d). The RCR reports that as at September 2012, around 28 per cent (68 of 247) planned Advisory Appointments Committees (AACs) appointments for clinical radiology consultant posts were either cancelled or re-advertised due to a lack of suitable applicants (RCR, 2012,d).

Recruitment

Specialty training in clinical radiology commences at ST1and runs through to the award of Certificate of Completion of Training (CCT).

The 2012 national recruitment figures for clinical radiology ST1 reported by London Deanery are shown in table 16. This shows an overall fill rate of 100 per cent. However, there were four deferrals; two for London, one for East of England and one for Yorkshire and the Humber.

Table 16: National recruitment to clinical radiology ST1, England, 2012

Deanery	number of posts	number of acceptances	unfilled posts	fill rate
East Midlands	13	13	0	100%
East of England	14	14	0	100%
London	42	42	0	100%
Kent, Surrey and Sussex	5	5	0	100%
Mersey	6	6	0	100%
Northern	9	9	0	100%
North Western	14	14	0	100%
Oxford	5	5	0	100%
Severn	4	4	0	100%
South West Peninsula	12	12	0	100%
Wessex	9	9	0	100%
West Midlands	16	16	0	100%
Yorkshire and the Humber	20	20	0	100%
Wales	7	7	0	100%
	176	**176**	**0**	**100.00%**

Source: London Deanery national recruitment team for radiology, (London Deanery, 2012)

Workload projections

The CfWI expects the overall demand for and number of imaging/tests will continue to increase, mainly driven by:

- the growing population
- the ageing population
- increased cancer incidence
- increased long-term disease incidence
- existing and new imaging technology being introduced into new guidelines, initiatives and screening tests, with direct access to imaging and early diagnostics as the main driver – this is especially relevant for early cancer diagnosis initiatives for lung, ovarian, bowel and brain cancer, all of which require imaging; the earlier a cancer is diagnosed the greater the chances of effective treatment
- drives towards extending working hours/days (e.g. 24/7) to improve patient care (if achieved, this would require extended working for all relevant staff as well)
- increases in tests that are more radiologist intensive, such as CT and MRI
- increasing use of interventional radiology in place of surgical procedures
- the requirement for dedicated specialist radiologists, e.g. paediatric and breast
- non-invasive autopsies – the proposed policy could result in up to 50,000 autopsies per year being performed with CT scans (The Lancet, 2012)
- molecular imaging and functional imaging techniques coming out of research into established clinical practice
- the establishment of some imaging such as ultrasound in primary care settings, for example GP surgeries.

Table 17 shows the CfWI estimated number of tests by modality between 2012 and 2025, calculated using simple linear regression against the Department of Health's KH12 form data (DH, 2012) between 2000 and 2011.

This shows the total number of imaging/tests in 2025 to be around 51 million, up from almost 39 million in 2011, representing a 31 per cent increase overall. This is consistent with the RCR predictions in Figure 1. The percentage change in numbers of tests per modality between 2011 and 2025 is:

- x-ray increase by 13 per cent
- CT increase by 82 per cent
- MRI increase by 87 per cent
- ultrasound increase by 45 per cent
- radio-isotopes increase by 6 per cent
- fluoroscopy increase by 4 per cent.

The table also shows the total imaging/tests per head of population in 2025 to be around 0.87, up from 0.73 in 2011, calculated against the estimated total tests and ONS population projections for England (ONS, 2012a). This is consistent with previous increases and the

expectation that the total number of imaging/tests per head of population will continue to increase as a result of the drivers above.

Table 17: The CfWI estimated number of imaging and radiodiagnostic examinations/tests by modality in England between 2012 and 2025, calculated using simple linear regression against the Department of Health's 2000 to 2011 KH12 data

Linear growth based on known number of tests 2000 - 2011									
year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total	population	total imaging / head of population
2011	22,167,960	3,986,831	2,129,973	8,599,380	603,560	1,317,833	38,805,537	53,012,400	0.73
2012	22,076,961	4,065,385	2,116,562	8,506,188	614,647	1,296,625	38,676,367	53,106,500	0.73
2013	22,303,857	4,310,169	2,260,086	8,808,408	616,644	1,302,375	39,601,538	53,563,000	0.74
2014	22,530,752	4,554,953	2,403,611	9,110,628	618,641	1,308,126	40,526,709	54,017,900	0.75
2015	22,757,647	4,799,737	2,547,135	9,412,847	620,638	1,313,876	41,451,880	54,468,200	0.76
2016	22,984,542	5,044,521	2,690,660	9,715,067	622,635	1,319,626	42,377,051	54,909,800	0.77
2017	23,211,437	5,289,305	2,834,184	10,017,287	624,632	1,325,377	43,302,222	55,340,800	0.78
2018	23,438,332	5,534,089	2,977,708	10,319,507	626,629	1,331,127	44,227,392	55,766,600	0.79
2019	23,665,228	5,778,873	3,121,233	10,621,726	628,626	1,336,878	45,152,563	56,188,200	0.80
2020	23,892,123	6,023,657	3,264,757	10,923,946	630,624	1,342,628	46,077,734	56,606,600	0.81
2021	24,119,018	6,268,441	3,408,282	11,226,166	632,621	1,348,378	47,002,905	57,020,400	0.82
2022	24,345,913	6,513,225	3,551,806	11,528,385	634,618	1,354,129	47,928,076	57,428,300	0.83
2023	24,572,808	6,758,009	3,695,331	11,830,605	636,615	1,359,879	48,853,247	57,829,300	0.84
2024	24,799,703	7,002,793	3,838,855	12,132,825	638,612	1,365,630	49,778,418	58,222,400	0.85
2025	25,026,598	7,247,577	3,982,379	12,435,045	640,609	1,371,380	50,703,588	58,607,100	0.87
change 2011 - 2025	13%	82%	87%	45%	6%	4%	31%	11%	18%

Source: CfWI estimates, Department of Health's KH12 form data (DH, 2012), Office for National Statistics (ONS, 2012a)

Table 18: Estimated shifts in imaging and radiodiagnostic examinations/tests by modality, England, 2011 to 2025

Estimated modality balance 2011 to 2025							
year	x-rays	CT	MRI	ultrasound	radio-isotopes	fluoroscopy	total
2011	57%	10%	5%	22%	2%	3%	100%
2012	57%	11%	5%	22%	2%	3%	100%
2013	56%	11%	6%	22%	2%	3%	100%
2014	56%	11%	6%	22%	2%	3%	100%
2015	55%	12%	6%	23%	1%	3%	100%
2016	54%	12%	6%	23%	1%	3%	100%
2017	54%	12%	7%	23%	1%	3%	100%
2018	53%	13%	7%	23%	1%	3%	100%
2019	52%	13%	7%	24%	1%	3%	100%
2020	52%	13%	7%	24%	1%	3%	100%
2021	51%	13%	7%	24%	1%	3%	100%
2022	51%	14%	7%	24%	1%	3%	100%
2023	50%	14%	8%	24%	1%	3%	100%
2024	50%	14%	8%	24%	1%	3%	100%
2025	49%	14%	8%	25%	1%	3%	100%
change 2011 - 2025	-8%	4%	2%	2%	0%	-1%	

Source: CfWI estimates, Department of Health's KH12 form data (DH, 2012)

The estimated number of future imaging/tests also allows for calculating the estimated shift in modality balance of total imaging/tests over time. Table 18 shows the annual estimated

shifts in all modalities from 2012 to 2025. The significant changes between the existing 2011 split and estimated split in 2025 are:

- x-ray – reduction from 57 to 49 per cent of total imaging/tests
- CT – increase from 10 to 14 per cent of total imaging/tests
- MRI – increase from 5 to 8 per cent of total imaging/tests
- ultrasound – increase from 22 to 25 per cent of total imaging/tests.

These two tables indicate not only an overall workload increase in terms of increased numbers of tests, but also an increase of the more complex imaging/tests as a percentage of the total, which take longer to report as they are more radiologist intensive.

Consultant-to-population ratio

The RCR estimated in 2011 that the ratio of consultant clinical radiologists to population should have been 6 FTE to 100,000 population, and amended this in 2012 to 8 FTE to 100,000 population in order to reach comparable European levels. This represents an 82 per cent increase from the actual ratio in 2011 of 4.4 FTE to 100,000 population, and a 33 per cent increase from the college's suggested 2011 ratio.

However, as healthcare service regulations and delivery are not the same in the rest of Europe, the United States or Australia as they are in England, comparing Europe's consultant-to-population ratios does not accurately reflect the requirement in England. Also, since 2005, the current overall ratio of radiology workforce (with existing skill mix initiatives) to population seems to have coped so far with the increases, including those that are more radiologist intensive. Because of these considerations, the CfWI suggests that the estimated ratio of eight FTE to 100,000 population for 2012 is too high.

However, the CfWI agrees that the current ratio is too low for the profession to accommodate future increases in terms of increased imaging per head of population and increased number of complex images as a percentage of the total. Calculating an accurate or realistic consultant-to-population ratio should therefore consider the future number and type of tests/images, and the time required to report. It may also consider what and how much can be offset by further skill mix initiatives, the radiography profession, and to a much lesser degree other clinical specialties that are now undertaking some of the clinical reporting workload that was historically undertaken by radiologists, such as cardiac and brain imaging. It is important to note that where these other clinical specialties are undertaking work such as brain and cardiac imaging, those specialties need a radiographic workforce so this does not reduce the need for the radiographic workforce in these areas.

The RCR is currently updating its activity reporting guidelines. Table 19 shows the dated guidelines and the calculated times per test, based on the activity range. Because of the large variance in the RCR's activity guidelines in terms of the number of activities per hour per modality, there are three variable calculations; the slowest, the average and the fastest time per test/image.

Table 19: RCR activity reporting guidelines and calculated time per test/image, 2012

Modality	activity/hour with no confounding factors	time per test/image (minutes)		
		slow	avg	fast
x-rays	30 - 60	2.00	1.33	1.00
CT	3 – 6	20.00	13.33	10.00
CT (complex)	1 – 2	60.00	40.00	30.00
MRI	3 – 6	20.00	13.33	10.00
MRI (complex)	1 – 2	60.00	40.00	30.00
ultrasound	4 – 6	15.00	12.00	10.00
ultrasound (complex)	2 – 3	30.00	24.00	20.00
fluoroscopy	2 – 4	30.00	20.00	15.00

Source: The Royal College of Radiologists (RCR, 2012d)

There are currently no RCR suggested guidelines for radio-isotopes. As the predicted change in radio-isotopes as a percentage of total images/tests between 2011 and 2025 is minimal compared to the important movers such as MRI, CT and ultrasound, the CfWI has allocated a nominal figure to use in comparative calculations between 2011 and 2025.

The CfWI has also agreed with the national clinical director for imaging at the DH that, for the purposes of this report, the best guess for modelling purposes is as follows:

- Out of every 100 MRIs, 90 are standard and 10 are complex, including cardiac.
- Out of every 100 CTs, 90 are standard and 10 are complex, including PET CT.
- Out of every 100 ultrasounds, 90 are standard and 10 are complex.

This enables a combined factor to be calculated against these modalities for subsequent calculations. Table 20 shows this breakdown per test, based on speed of activity range.

Table 20: Factorised RCR activity reporting guidelines allowing for standard and complex reporting

Modality	time per test/image (minutes)		
	slow	avg	fast
x-Rays	2.00	1.33	1.00
CT	24.00	16.00	12.00
MRI	24.00	16.00	12.00
ultrasound	16.50	13.20	11.00
radio-isotopes	1.00	1.00	1.00
fluoroscopy	30.00	20.00	15.00

Source: The Royal College of Radiologists (RCR, 2012d)

Full-time consultant radiologists are contracted to work an average of 10.3 PAs, which includes approximately two PAs for administrative, research and other non-reporting duties. Eight weeks of the year are allocated against study and annual leave. Annualised averages for radiologist clinical reporting works out therefore at eight PAs over 44 weeks, and this has been used in subsequent calculations in this report.

Using the estimated number of tests by modality and calculating against the RCR's activity guidelines, agreed test type ratio assumptions, and annualised average PAs, the ideal number of consultants in 2025 can be estimated. These numbers are based on the various

assumptions, estimates and ballpark figures being accurate. Also, the calculations do not take account of changes or reconfiguration of future service delivery models, QIPP, the impact of skill mix and productivity, and new ways of working, all of which are likely to impact on the future workforce. Because of these complexities there are risks in these calculations.

The calculated ideal range of numbers of FTE consultants in 2025, based on the projected number of tests and activity guidelines, is between 3,762 and 6,706, with 4,797 being the median. The large range of around 3,000 FTE is due to the large activity guideline variance. This shows the significance of how correct use of skill mix and efficient working practice can affect service delivery.

Interestingly, based on the same guidelines and assumptions as above, the range of FTE consultants in 2011 was between 2,492 and 4,417. The actual number was 2,354 FTE (HSCIC, 2012a) or around 139 (approximately 6 per cent) below the minimum ideal, and the service was able to deliver without any apparent negative impact on patient median waiting times or the operating framework six-week wait percentage targets.

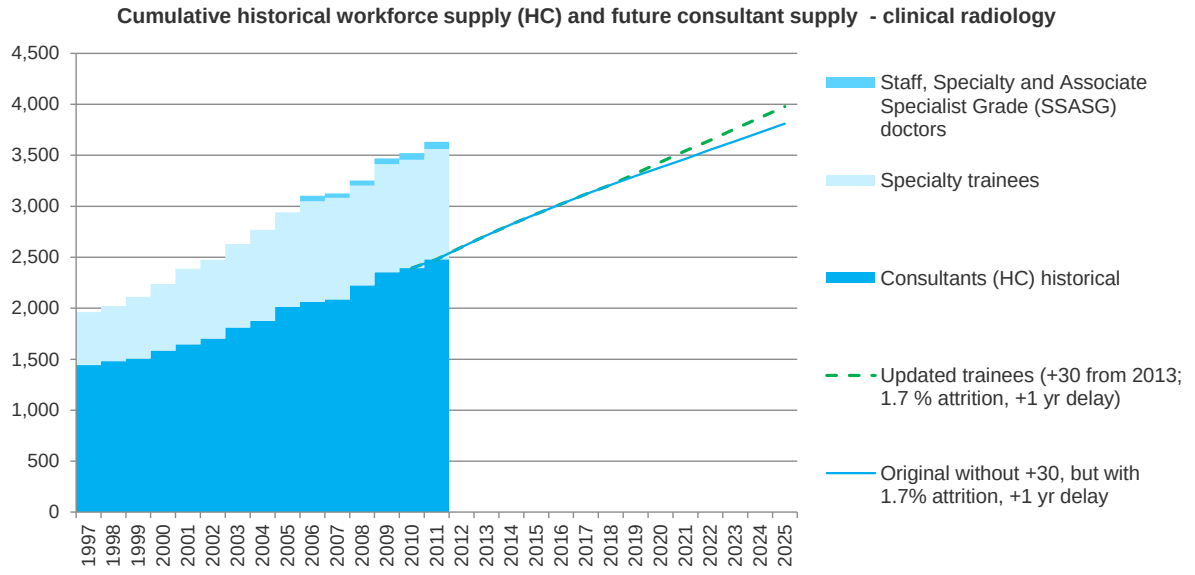
However, the RCR 2011 census indicates that consultant radiologists are spending more than 8 PAs on clinical reporting, and more than 10.3 overall, which could explain why, in addition to skill mix and other service improvement initiatives, patient waiting times and targets were not negatively affected. It also supports the view that there is an increasing imbalance between supply and demand. This additional work that consultant radiologists are doing beyond that undertaken within contracted hours needs to be accurately quantified and the RCR's activity guidelines adjusted and refined, taking all factors into consideration.

The figures also show that x-rays are predicted to be around 49 per cent of total images/tests in 2025, but correspond to 8 per cent of total reporting time across all modalities. This is an opportunity for the RCR and SCoR to further review the scope of skill mix with radiographers regarding imaging reporting responsibilities. This could be an opportunity to develop the radiographer remit and at the same time allow radiologists to concentrate on more complex reporting.

Supply projections

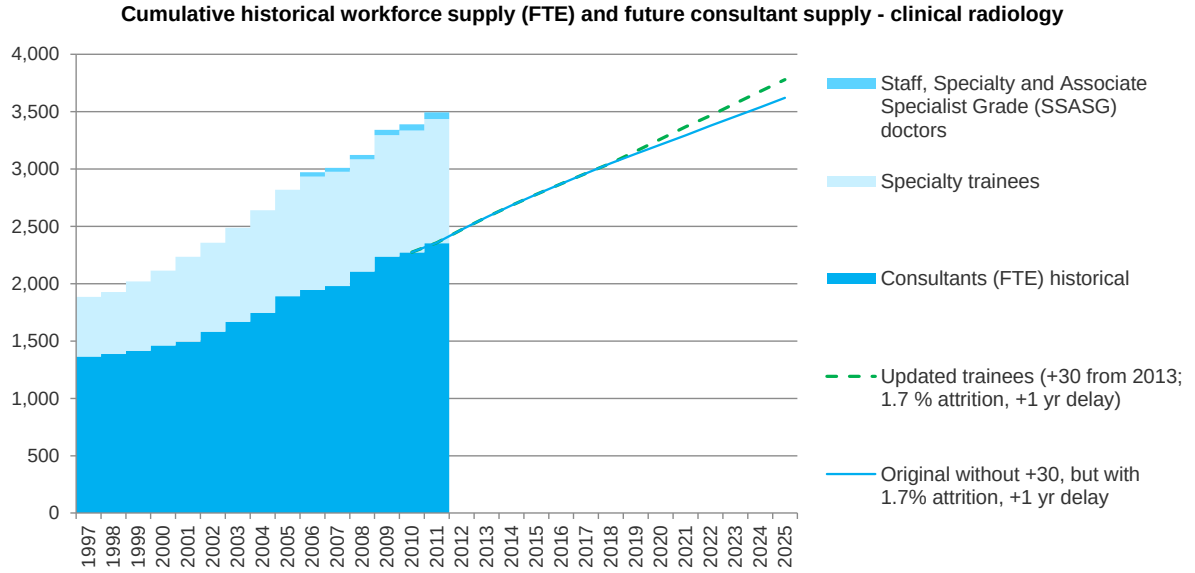
Figures 10a and 10b show the current supply and forecast of clinical radiologists in graphical format. Historical data is taken from the HSCIC (HSCIC, 2012a).

Figure 10a: Workforce supply and estimation of future number of consultants (Headcount) – clinical radiology



Source: CfWI modelling estimates, Historical Supply Data (HSCIC, 2012a), NHS Health and Social Care Information Centre (2010) Deanery monitoring returns and workforce assumptions.

Figure 10b: Workforce supply and estimation of future number of consultants (Full Time Equivalent) – clinical radiology



Source: CfWI modelling estimates, Historical Supply Data (HSCIC, 2012a), NHS Health and Social Care Information Centre (2010) Deanery monitoring returns and workforce assumptions.

The objective of the medical workforce configuration data in Figures 10a and 10b is to show historically how the service has been delivered in clinical radiology, with a combination of consultants, staff, specialty and associate specialist grade (SSASG) doctors, and trainee

doctors who may be in training towards another specialty, but are providing service in clinical radiology. The supply of middle-grade medical staff together with trainees (defined as specialty trainees (registrars and senior house officers (SHOs) providing input into clinical radiology) has also increased in this time.

The figures are based upon the latest data available (SSASG data dates back to 2005) and the supply forecast is based on the following modelling assumptions:

- Total NTNs in training are split evenly across the higher specialty training years, and NTNs are recycled upon trainees gaining a CCT. All recycled NTNs are assumed to be filled in the next application process.
- Every new CCT holder is assumed to start work as a consultant within the same year.
- The only source of joiners to the consultant workforce is through the training system. The modelling of this route takes into account the age of trainees, length of training, likely delays and attrition.
- The only leavers modelled are permanent leavers from the consultant workforce e.g. retirements. A distribution of retirements is modelled which reflects the variation in age of retirement between consultants.

For clinical radiology, the following additional assumptions have been applied. These assumptions were reached by analysing past trends, and engaging with the specialty in order to identify indications that trends may change in the future.

- Higher specialty training pipeline of five years (ST1-ST5).
- Expansion of ST1 posts by two variables:
    1. nil increase in the number of ST1 posts
    2. increase of 30 posts in 2013, maintained at this new level for 2014 onwards.
- Average delays in training of approximately one year to model the effect of out –of-programme experiences (OOPE) and maternity leave.
- Training attrition of 1.7 per cent per year, based on the RCR's latest estimates (RCR, 2012d).
- Participation rates for each age band remaining constant for the specialty, with an overall participation rate of 0.95. However, as the consultant age distribution changes by year, the overall participation rate may also vary by year.
- Average retirement age of 62, with those aged over 62 and still in the workforce expected to retire over the next four years.
- Nil young leavers from the consultant workforce, as these are balanced by non-UK entrants to the consultant workforce (RCR, 2012a).

Table 21 shows the modelled CfWI forecasts of consultant clinical radiologists (FTE) between 2012 and 2025 and the consultant-to-population ratios calculated using the ONS 2010-based population projections for England (ONS, 2012a) for the two ST1 variables mentioned above.

Table 21: CfWI forecast of consultant clinical radiologists (FTE) between 2012 and 2025 given +0, or +30 training posts.

Year	projected population	projected consultants +0		projected consultants +30	
		FTE	ratio	FTE	ratio
2012	53,106,500	2,470	4.7	2,470	4.7
2013	53,563,000	2,579	4.8	2,579	4.8
2014	54,017,900	2,682	5.0	2,682	5.0
2015	54,468,200	2,779	5.1	2,779	5.1
2016	54,909,800	2,872	5.2	2,872	5.2
2017	55,340,800	2,962	5.4	2,962	5.4
2018	55,766,600	3,049	5.5	3,049	5.5
2019	56,188,200	3,132	5.6	3,154	5.6
2020	56,606,600	3,212	5.7	3,261	5.8
2021	57,020,400	3,292	5.8	3,367	5.9
2022	57,428,300	3,377	5.9	3,465	6.0
2023	57,829,300	3,457	6.0	3,573	6.2
2024	58,222,400	3,538	6.1	3,677	6.3
2025	58,607,100	3,620	6.2	3,780	6.4

Source: CfWI modelling estimates, Office for National Statistics (ONS, 2012a)

This shows that with no increase in training numbers, the supply of clinical radiology consultants is forecast to increase to 3,620 FTE in 2025 (approximately 3,811 headcount), which is below the ideal range as defined above.

Increases in specialty trainee numbers are currently limited by financial constraints, and the DH has indicated that an increase of 30 NTNs would be the maximum possible (RCR, 2012d). The table shows that if training numbers were increased by this limit, the supply of clinical radiology consultants would increase to 3,780 FTE in 2025 (approximately 3,979 headcount), which is just within the bottom end of the ideal range as defined above. It also shows that, due to training length and one year's delay, there would be no difference in consultant output until 2019.

This increase would allow the profession to continue service provision with a more manageable consultant ratio than the current configuration. It would also provide the opportunity to refine the RCR's activity guidelines more precisely, and to support appropriate use of skill mix to expand the workforce where possible, especially regarding radiographers taking on more reporting, which would allow radiologists more time to concentrate on complex reporting.

The increased training attrition rate has had a negative impact on these supply projections and the CfWI recommends that the profession takes this opportunity to work with commissioners and education providers to reduce training attrition in order to curb fallout and strengthen future consultant numbers.

CONCLUSION

Across most modalities there has been not only an overall workload increase in terms of increased numbers of tests, but also an increase in the more complex imaging/tests as a percentage of the total. These tests take longer to report as they are more radiologist intensive. So even though the overall numbers of tests per consultant have decreased, the actual workload of each clinical radiologist has increased. The CfWI expects the number of radiology tests to continue to increase, along with the proportion that are more complex.

Measurable data indicates that the profession has managed the extra workload since 2005 because of the changes in number of tests per consultant, skill mix and other service improvement initiatives, including altered rotas and increased working hours. However, we do not consider the existing consultant workforce will be able to cope with the additional imaging expected in the future.

Current training numbers are not adequate to meet predicted demand to 2025. If not remedied, the profession will not be able to provide an efficient or high-quality service, and current standards may drop. To avoid this scenario, an expansion of clinical radiology trainee numbers is required. At the same time, the CfWI recommends the RCR to further explore the impact of service changes and activities to refine the RCR's activity guidelines to enable more balanced forecasting for workforce planning in the future, and to work with commissioners and education providers to reduce the current training attrition rate.

The CfWI recommends an increase of 30 clinical radiology ST1 posts above the planned ST1 posts for 2013, and that ST1 posts are maintained at baseline plus 30 for subsequent years so that the total number of clinical radiology NTNs increases by 30 per year until the next workforce review. This increase should include posts in interventional and paediatric radiology. However there is evidence for expansion of these subspecialties. Further detailed analysis is required to quantify their future requirements, which may increase the number of recommended NTNs for radiology overall. Ideally, future increases in these posts could come from converting posts from other oversubscribed specialties. Commissioners could consider dedicated training numbers for these subspecialties, the development and implementation of the three-tier model of service delivery for paediatric imaging, and the development of a formal career plan for paediatric radiographers.

As advances in science and technology become embedded in service, and radiologists work as part of multidisciplinary teams, planning for this workforce cannot be considered in isolation from other professions. A whole-team approach to clearly understand the scope, boundaries and overlaps of the imaging professions would enhance patient safety, skill mix initiatives and enable more effective workforce planning. This is an opportunity for further review of skill mix with radiographers to enable them to take on more image-reporting responsibilities, allowing radiologists to concentrate on more complex reporting.

The CfWI also recommends continued engagement with the specialty and employers in order to develop and revise the CfWI's understanding of workforce issues affecting the specialty, with a review of the specialty every three-to-five years.

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