Health Education England – Large Speciality Programme, simulation of new commissions for Clinical Radiology Trainees

Briefing paper – March 2016

DRAFT 1 (9th Mar 2016)

Contents:

Executive summary

This report provides intelligence to inform the commissioning decisions for Clinical Radiology based on the latest data and judgements by experts in this specialty area. This work will inform proposals for 2017 education commissioning onwards, including an initial geographical breakdown of the national picture.

The modelling approach has been developed over 5 years from work with LETBs in the Workforce Modelling Collaborative. As such the model structure and assumptions have been through several rounds of constructive challenge and validation by local planners and clinicians. The current set of assumptions and model logic are set out in this report and are based on HEE national and local assumptions and intelligence. The model assumptions also reflect the informed opinion of those with whom we have engaged (see Appendix). The modelling approach has followed WSP's 'best practice' in the use of System Dynamics modelling, attested in a range of settings over many years[1].

The model underpinning this work represents a 'shell' into which each LETB's data assumptions have been imported. The product at an all-England level is therefore the sum of 11 different models (counting London as a consolidated LETB). Each local model will be made available to the respective LETB, as well as access to all 11 models for benchmarking and aggregation purposes. This makes for effective collaboration across England in achieving a single overarching goal whilst respecting local difference now and in the future.

The model scope is described in detail in the report. The model pathway starts at ST1 training taking into account factors such as the age, gender and whether additional training for Interventional Radiology is undertaken, which in turn impacts on the length of training and subsequent migration into the workforce. Evidence on delays, migration and loss between training and taking up post as a consultant is used to inform availability and movement into the consultant workforce, which is in turn distinguished by broad age-band and gender. The latter impacts on participation rates and therefore overall capacity within the workforce.

The modelling tool provides an environment in which different scenarios and sensitivies can be tested. The broad conclusion of this report should not therefore be taken as definitive because a changing environment and assumptions will alter outcomes, but rather provides a current and coherent picture of demand and supply which can be modified to suit latest conditions and planned initiatives. The key parameters in the modelling and future view are:

1. Those that reflect future demand (specifically the notion of a target number of Radiologists per 100,000 population).
2. Training capacity in the system, and the extent to which this can be grown.
3. Recognising that the length of the training pathway may engender overshoot and over supply in the future unless anticipated and balanced earlier in the programme.

This modelling affirms the need for increasing training in Radiology, and recognises that constraints, in particular the capacity of the training system, mean that the likely outcome will fall well short of the Royal College aspiration for growth and the related target of 8 consultants per 100,000 by 2026. Follow on work suggested by the programme and related discussed includes further development of demand perspectives and a coordinated exercise to assess the impact of 7 day working on radiology services.

[1] See http://www.thewholesystem.co.uk/wp-content/uploads/2014/10/SD-good-practice-WSP.pdf

1 Introduction

1.1 Background

Growth in the demand for services supplied through Clinical Radiology consultants and other radiology professionals continues to grow steadily. The Royal College of Radiologists cites radiology examinations increasing by 42% over the previous 10 years, exacerbated by increasing complexity and the aging population (2015/16 Call for evidence as part of the HEE Workforce Planning and Strategic Framework (Framework 15)).There is potential for further growth linked to technological advance and 7 day working.

The training pathway for Radiology is relatively straightforward and was adopted as one of the early models used across the Workfore Modelling Collaborative from 2013 onwards. The model was initially developed with the support of Mark Alexander (Head of School Clinical Radiology, Health Education East of England, Treasurer Royal College of Radiologists), subsequently ratified by the WMC in March 2013, adopted by collaborative members, and used to benchmark LETB commissioning from November 2013. The modelling approach was reviewed in June 2015 to ensure it was fit for purpose for the Large Specialty Programme.

This report therefore sets out the assumptions, logic and conclusions of the simulation model, as well as outlining how the model is being made available to explore both national and local challenges in a single collaborative approach.

Figure 1 suggests a relatively stable pipeline of trainees, allowing for attrition over the training period, with relatively low OOP and maternity absence compared to some other specialties. CTR/ST6 numbers represent the Interventional Radiology trainees extra year.

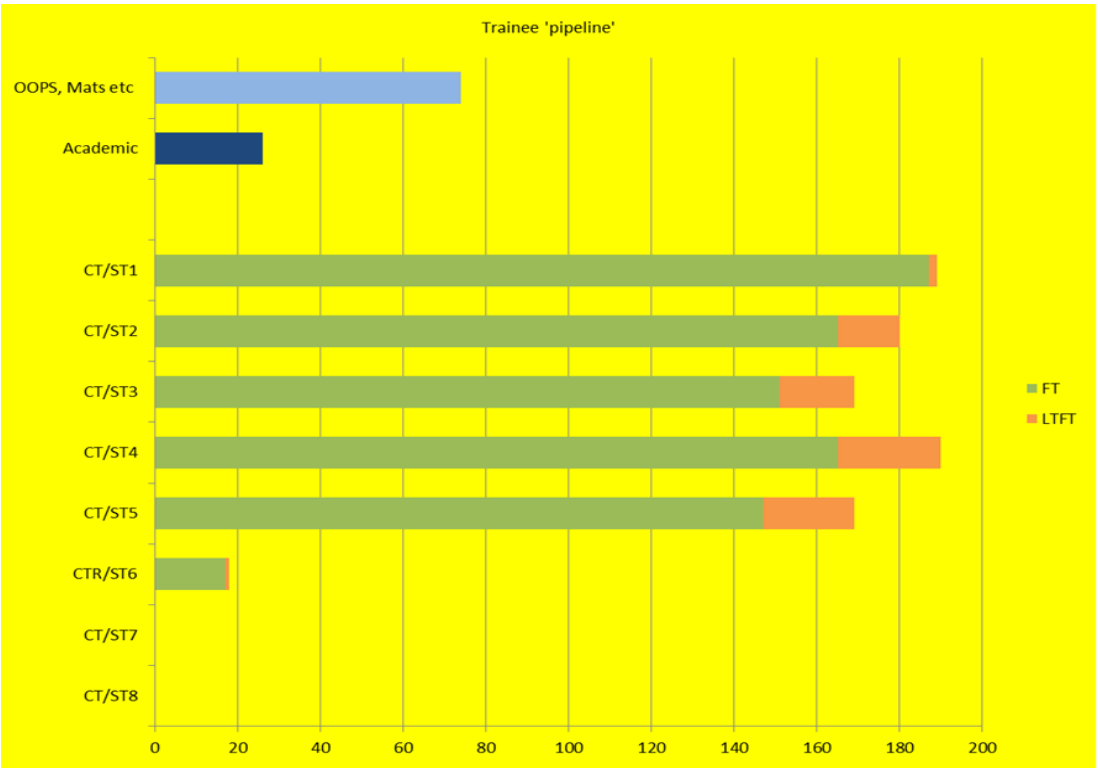

Figure 1 Snap-shot of trainee numbers from HEE 2015 trainee census

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1.2 Model purpose

The purpose of the model is to address the key issue: At what rate should we train Radiology consultants to provide sufficient supply across England and in each LETB over the next 20 years in the light of:

- Changing demographics;
- Ongoing development of networks and policy changes;
- Training capacity and any changes in retirement rates and other supply levers;
- Service contribution from those in training.

The modelling tool is able to answer this question at a national level as well as providing insights about local recruitment numbers.

1.3 Modelling approach

The approach adopted in developing a modelling tool that is 'fit for purpose' for both the issue and the context within which it has been developed has followed the 'good practice' guide published by the Whole Systems Partnership[2]. This has built on over 20 years of experience in using these tools. Using system dynamics modelling supports the development of understanding and decision support in a number of ways:

- It looks at flows through the system enabling identification of key drivers/components of the system;
- By being focused on the issue to be answered, it enables boundaries to be drawn, and prevents drift into non critical topics;
- It encourages clinical and data expert engagement, and the owning of models by those making the decisions;
- Through examination of 'what if' questions, practical and political constraints can be considered, thereby enabling the full range of determining factors to be taken into account;
- Using consistent modelling across local areas enables efficient calibration and benchmarking for enhanced understanding of regional variations.

The analysis, model development and testing are all embedded in an iterative engagement process that ensures clarity, transparency and ownership of the end product. The current version of the model has been developed as part of HEE's Large Specialty Programme, building on the previous work for the Workforce Modelling Collaborative, and has involved data gathering at a national level, with local validation, plus presentation and discussion at a national 'sharing and learning event' in November 2015, which involved clinicians, planners and education commissioners.

2 Model assumptions

2.1 Introduction

This section sets out the assumptions used to initialise the model for each LETB[3]. The modelling tool has been built as a 'shell' into which each area's data can be input and simulated independently. In addition, the aggregation of the outputs from these models at an all-England level is facilitated through data export and the use of an online tool. National assumptions can be used to provide an envelope within which local assumptions are made, which ensures a national steer that reflects policy commitments and resource

[2] The Whole Systems partnership has provided strategic consultancy services to a range of health and social care partners for over 20 years. Its good practice guide in the selection and use of systems thinking and system dynamics modelling can be downloaded here.

[3] For the purpose of this modelling HEE areas are the former LETBs with London being treated as one unit.

considerations. National and local planners have access to both their own off-line versions of the model and also to the on line benchmarking tool.

The model works on the basis of dynamic feedback at each time step, for example by capturing the wte of consultant radiogists expected to retire and factoring that in to the number of new trainees required. However, due to time delays, in this case between trainee starts and taking up a full time post, the model interface provides an opportunity for the user to over-ride and anticipate these changes in ways that are not possible for the model on its own. Because of the number of variables in play at the same time the user interface provides an invaluable learning opportunity with regard to the sensitivity of different assumptions and any unintended consequences arising from the decisions made.

2.2 Radiology Trainees and the training pathway

The model is initialised with the number of people in training by year of training and gender. This split was felt to be the most appropriate level of differentiation that would have impact on the outcomes of the model. Figure 2 shows a simple representation of the model structure.

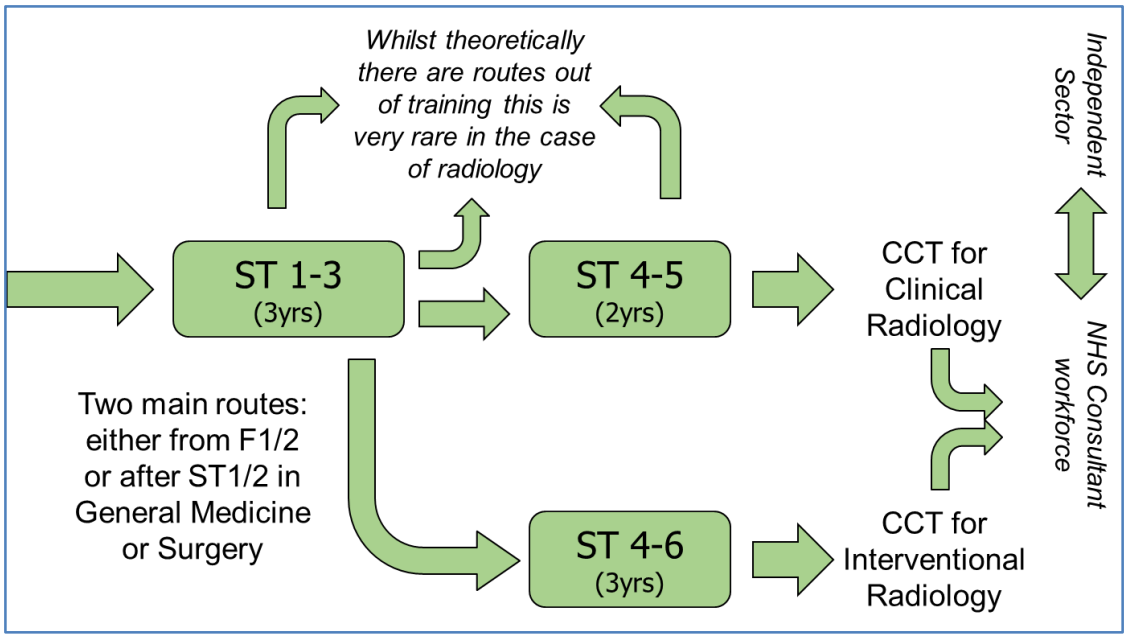

Figure 2 The simplified training and adoption pathways

Reflecting this overview of the training pathway the actual system model:

- Captures the number of trainees (split by gender) for each year of training, including an additional year for Interventional Radiology;
- There is minimal attrition from training with the vast majority successfully completing their training – although there is the functionality within the model to reflect loss between training and taking up a consultant post[4];
- That Interventional Radiology is a choice at the end of ST3 and consists of 3 years (ST4-6), i.e. an additional year.

The capacity required in the consultant workforce is supplemented by Independent Sector work. It is recognised that at present this is likely to be relatively high due to consultant

[4] There is some evidence of loss, presumably through outward migration from England to other home Countries or abroad. It is likely, however, that some of this is compensated for by inward Migration and so the initial model assumptions do not account for a net export until further evidence is found.

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shortages, although our discussions with Clinicians also suggests that there will always be a need for some of this additional capacity to manage peaks and troughs in activity.

2.3 Baseline data

At the September 2015 stocktake there were 1,024 Radiology trainees (including 91 Interventional) and 2,695wte Clinical Radiologists working in England (using an average participation rate of 94.5%). The average per 100,000 was 4.97, although when Independenat Sector capacity is taken into account (see later) then the estimated total capacity would be c.2,857 or c.5.3 per 100,000. There was significant variation between LETBs, as shown in Figure 3. London, the North West and Wessex had the highest level of consultants per 100,000, whilst the East Midlands, East of England, the North East and Thames Valley had the lowest.

There is a recognised shortage in Clinical Radiologists reported by Trusts, with an average of just over 9% across England. This is illustrated in Figure 4, which shows that London and the South have the smallest shortfall compared to the North which has the highest. In taken any shortages into account in our modelling we need to be mindfull of 'normal turnover', typically up to c.3%. Only when shortages are significantly above this, indicating significant numbers of unfilled but funded posts, do we factor this in – which is clearly the case for Clinical Radiology. How this has been factored in is described later in the report.

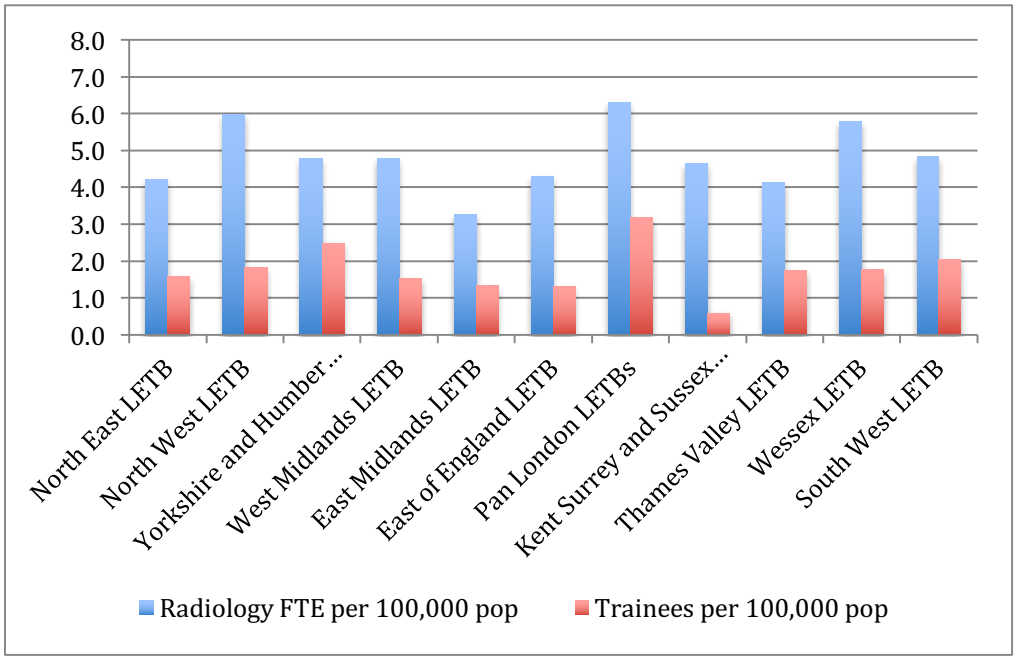

Figure 3 Consultants and trainees per 1M population by HEE area (HEE and ONS data)

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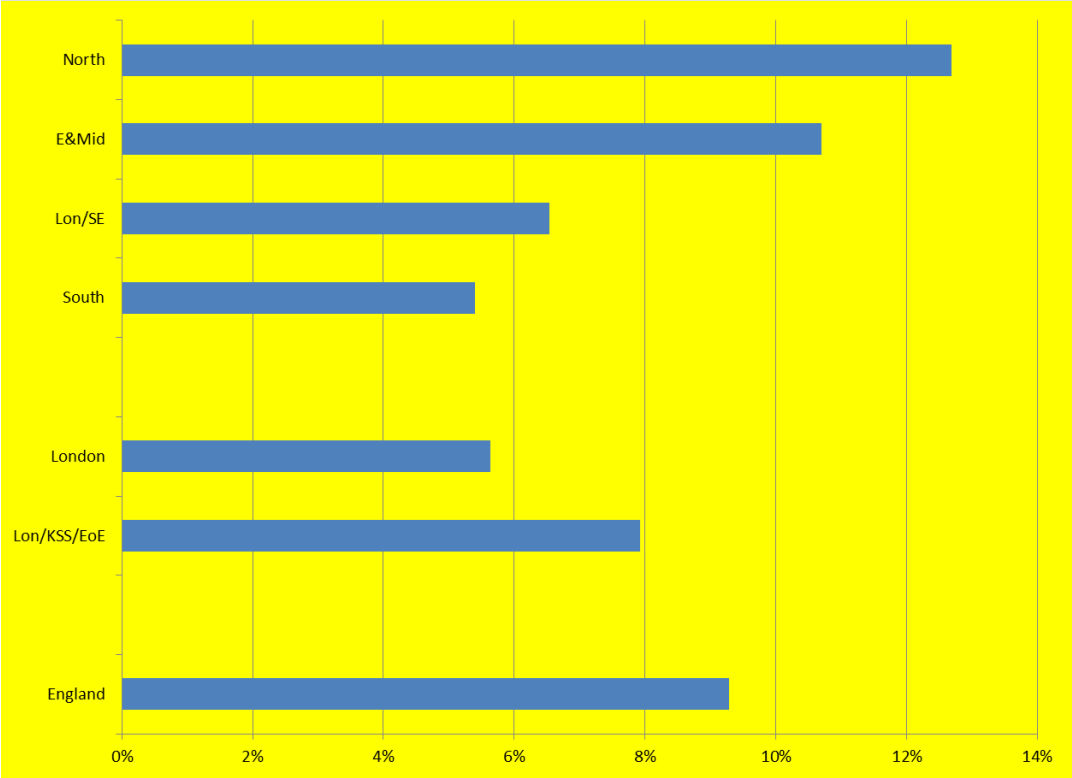

Figure 4 Underfill as a % of reported demand (April 2015)

Figures 5 and 6 illsutrate the variation taken into account in the model for gender split and broad age profile for consultants. These differences play a part in the overall requirements for replacement numbers as they generate different overall participation and retirement rates for each LETB. The overall gender split for consultants is 66:34, male:female, varying from 30% female in North West to 41% in London. 65% of consultants are under 50 reflecting the historical patterns of recruitment and retirement. The % varies from 57.7% in East Midlands to 72.1% in London.

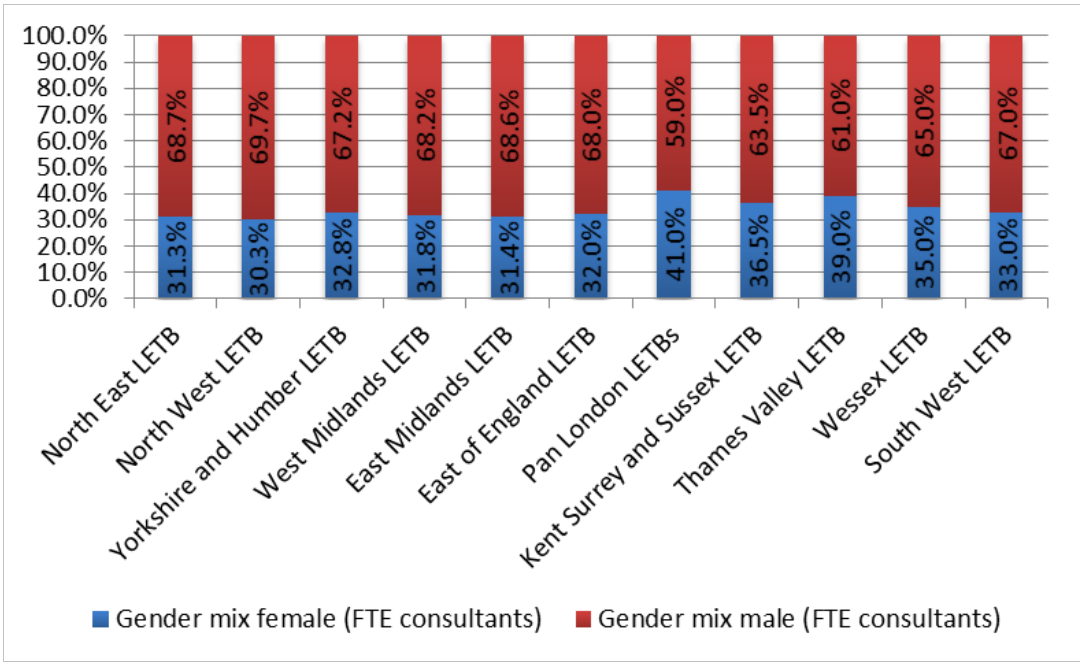

Figure 5 % gender mix consultants - HEE data ratified by LETBs

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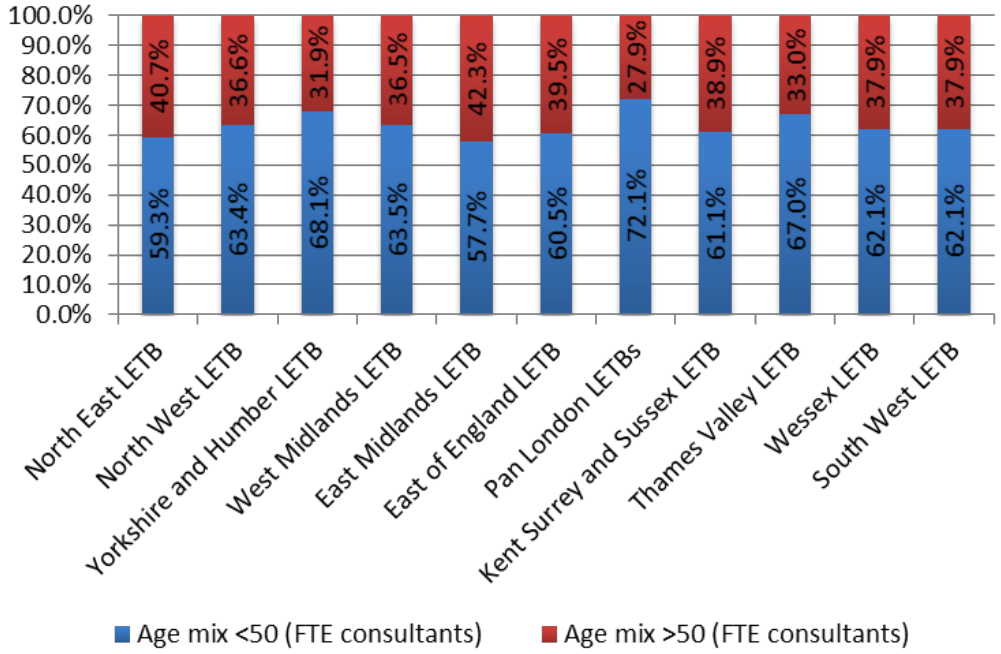

Figure 6 Age mix - consultants – HEE data ratified by LETBs

Finally, the model takes into account migration across LETBs between the completion of training and taking up a consultant post. This is shown in Figure 7, where London is shown to be a dominant exporter of trained Radiologists with the East of England, Thames Valley and Wessex being the main importers. In terms of wte this migration sums to zero across England.

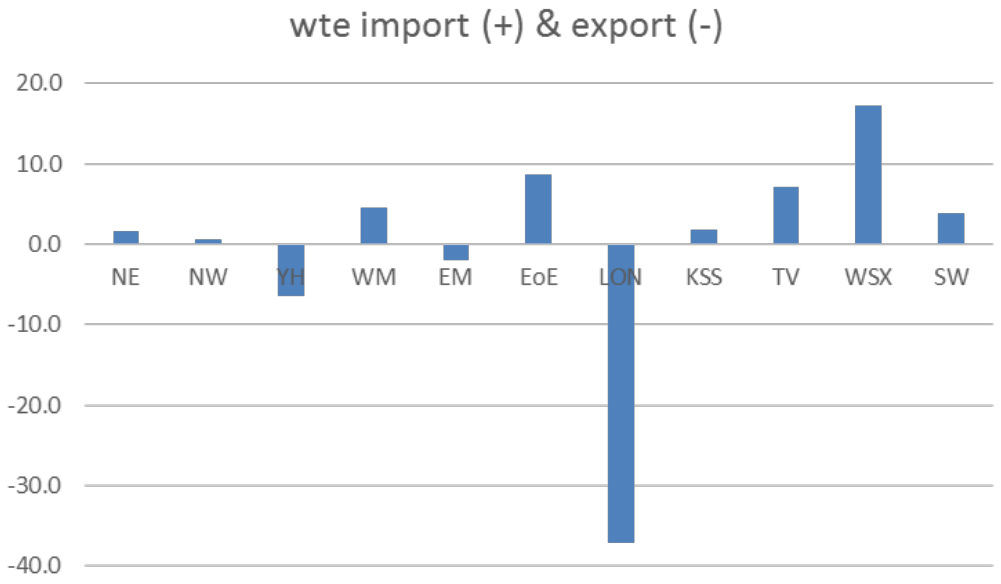

Figure 7 Migration between training and taking up a consultant post by LETB

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2.4 Views expressed during engagement

As noted above several opportunities to engage with clinicians were taken to inform and validate the model build and associated assumptions. These have been taken into account, as outlined above, and included the following:

- That feminisation of the workforce must be taken into account – reflected in the split of both the training and consultant workforce in the model;
- That there are minimal or no career breaks and only a small number of breaks for pregnancy – meaning that the model takes a relatively simple approach to extended training period for these reasons;
- Clinical Radiologist workforce should be planned in line with Radiographers – some skills development (1yr training) can enhance radiographer roles – this is not within scope of the current model, although consideration to the skill mix for delivering Radiology should inform the ultimate target set, as outlined later in the report;
- A private sector estimated at c.15-20% of total capacity eases peaks and troughs in demand – factored in to the model as a 'multiplier' of demand over and above current consultant numbers, although this is reduced as an effect as targets for Consultant wte capacity is approached.

The increase in demand for Clinical Radiology is being driven by a number of factors, including:

- An increasing need for OOH/24-7 working;
- Increases in GP open access especially for MRI;
- That Clinical Radiology is accreting an increasing range of procedures in most specialities but particularly in vascular surgery, oncology (tumour ablation and targeted therapy), gastroenterology (biliary intervention), obstetrics (stopping bleeding) and general and specialist surgery (e.g. Drainage and many other procedures);
- CT/MR in particular are critical in achieving reduced hospital length of stay and preventing admission or outpatient referral (currently growing at c.20% a year).

The modelling tool does not seek to capture this demand side in detail, but allows for it in setting the target number of consultant radiologists per 100,000.

2.5 Modelling changes incorporated following review for LSP

Whilst the modelling tool unperpinning this report has been in use for a number of years the introduction of the Large Specialty Programme by HEE, in which Clinical Radiology was included, meant that a number of model elements were reveiwed and updated, including:

- That the training pathway would be modelled by year rather than these being grouped;
- Revisions to retirement age assumptions and post-retirement capacity would be made;
- A rate per 100,000 population would be used as a demand driver, but with the option in the model to vary this from the Royal College target of 8;
- A long term rate of 1 in 6 trainees would follow the interventional route, whilst in the short term the model should allow for this to be increase (e.g. to 1 in 5, 4 or 3);

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- An approach to modifying assumptions about fulfilling current demand is explored in the model development as the supply comes closer to the target level of capacity, particularly as this is expressed in post-retirement work and additional private sector delivery capacity;
- Ensuring that OOP activity is reflected in the model and trainees identified as OOP are incorporated in the assumptions;
- Consider the inclusion of a migration factor mid-career including overseas movement – this is the only additional element not factored in due to the current absence of intelligence, although it remains a goal of the modelling approach.

3 Model outputs

3.1 Aggregate position developed for 30 Nov Learning Event

Although LETBs start from differing positions there is a general recognition of a resource shortage in Clincial Radiology. The Royal College of Radiologists (RCR) have suggested achieving 8 consultants per 100,000 population by 2026, which according to ther modelling would need 455 new trainees per year at ST1. This perspective was tested in the model with options of 6, 7, and 8 per 100,000 population to identify the implications of these demand levels. One difference from the RCR modelling is that population growth has been applied to the target rate per 100,000, meaning that the actual 'target' grows over time.

The results of these model tests on the number of ST1 starts is shown in Figure 8. A constraint was applied in each LETB version of the model used to create this aggregate picture to limit the number of new ST1 starts to the level suggested by the RCR, i.e. 455. In Figure 8 this 'maximum' level of new starts is slightly under-shot due to 'rounding' between LETBs.

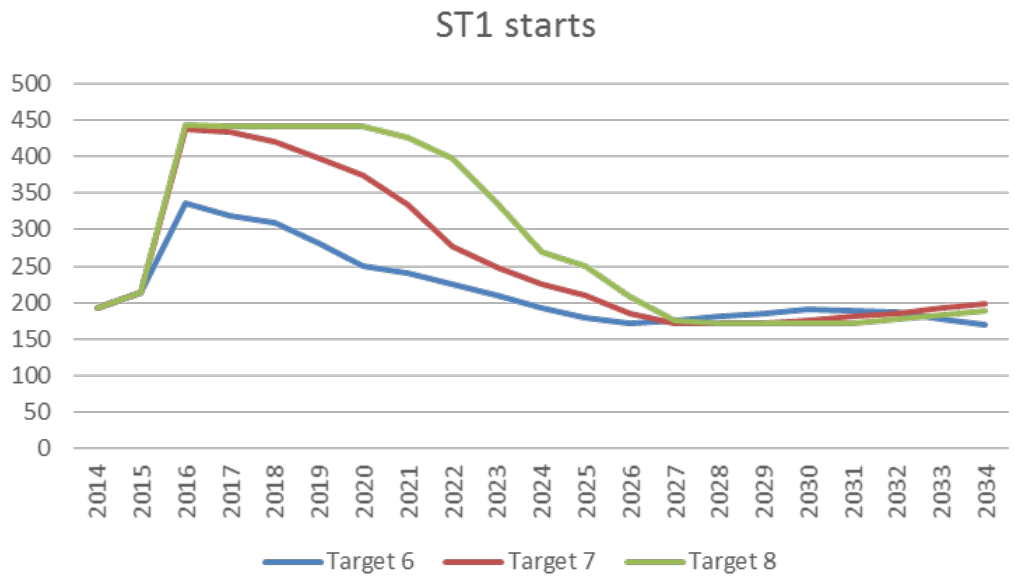

Figure 8 ST starts implied by varying demand levels

Under the demand profile based on 6 consultants per 100,000 population the model suggests a one-year increase in recruitment to just under 350 per annum, followed by a gradual reduction there-after. A higher initial number, and sustained for longer, is

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suggested in the 7 and 8 scenarios with variations. The 8 per 100,000 scenario is broadly consistent with the RCR modelling, suggesting that a sustained level of c.450 new ST1's would be required until 2020, closing c.90% of the initial gap to the required level of consultant capacity (see Figure 9).

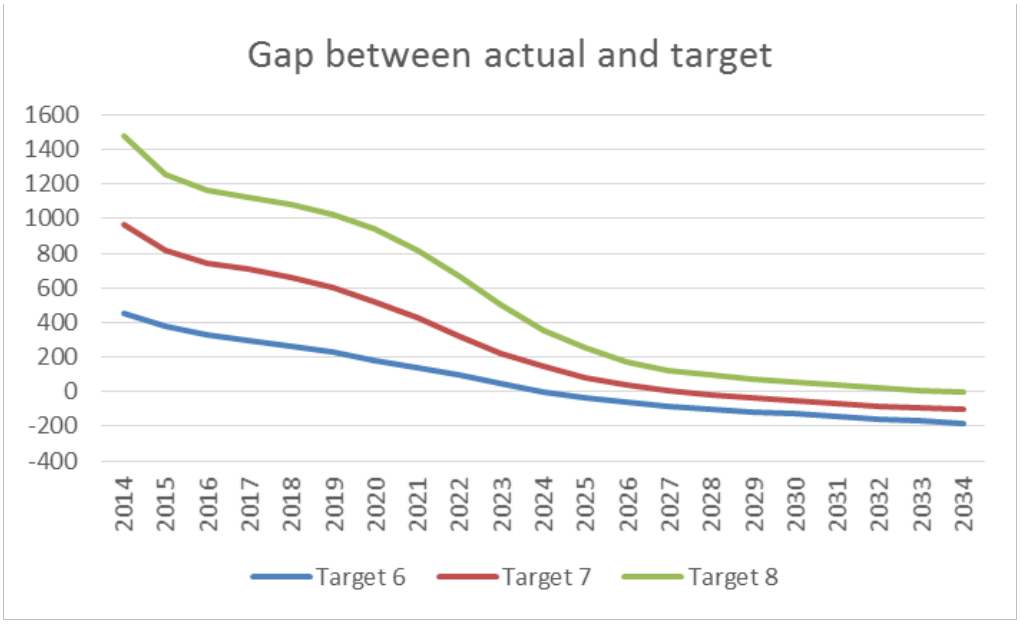

Figure 9 – rate at which the gap is reduced to varying targets

Training numbers are increased significantly in each scenario and feed into a system which will continue to turn out trainees when the target is approached. This runs the risk of oversupply, as illustrated in Figure 10. To avoid this risk a tapering down of recruitment earlier in the timeframe would be advisable, with the consequence of a 'softer landing' as the target is approached.

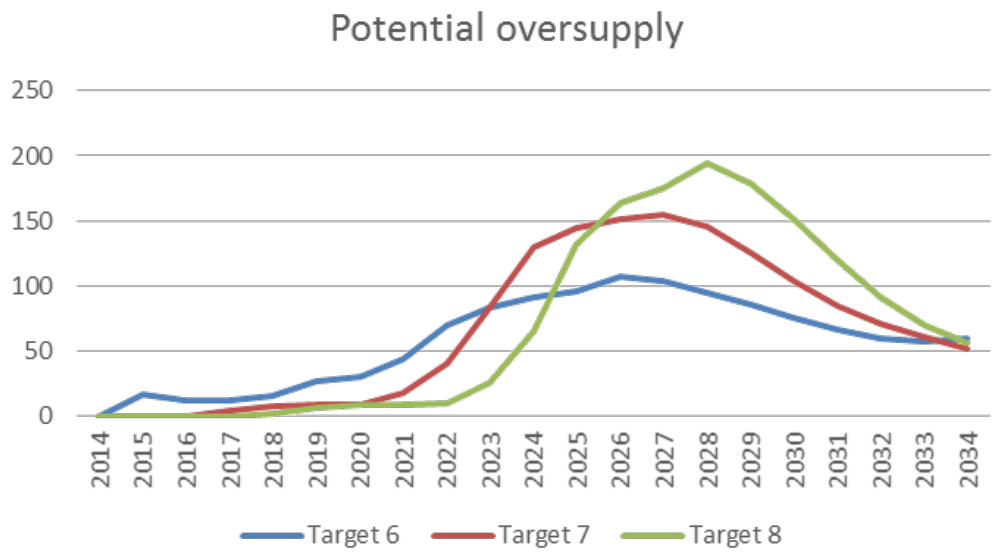

Figure 10 – potential oversupply generated by varying demand levels

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In summary - a comparison of the model output with the workings in the RCR 'call for evidence' for an 8:100,000 target shows the following:

- The RCR suggested 455 new trainees pa from 2016 to 2020 to achieve the 8:100,000 by 2026 – the aggregate of the LETB models, using 455 as a national 'cap' on trainees distributed across the LETBs, also suggests that the elevated numbers should continue to 2020, but that the target is slightly under-achieved, reaching 7.7:100,000 by 2026 – the possible reason being that the modelling takes account of the growing population, whilst the RCR figure does not;
- This level of aspiration, however, has the risk of the largest over-supply, although this does not begin to emerge until the early 2020's.

At the Learning Event in November 2015, consideration was given to constraints that could impact on the higher aspirations for growing the Radiology workforce. The results of this exercise are covered in the next section and form the basis for the final report scenario.

3.2 Capacity Review

An exercise was undertaken to ask each LETB what their maximum training capacity could be immediately and by 2020, were there no financial constraints. The opportunity for growth appears relatively focused geographically and relies on the establishment of a small number of 'academies'. Virtually all the possible expansion to 2016 comes from London and EoE, later potential is heavily dependent on the South West. This would have implications in the context of existing lower levels of trainees and consultants in the North, and higher gaps in rectuirment as outlined earlier in this report. A pro-active approach to addressing these regional differences would therefore be required.

Constraints identified in this brief consultation with LETBs focussed on the numbers of trainers, placements and training facilities. The potential capacity, barring setting up further academies, is far short of the Royal College 455 figure, with capacity potentially reaching 300 by 2020. This is reflected in Figure 11.

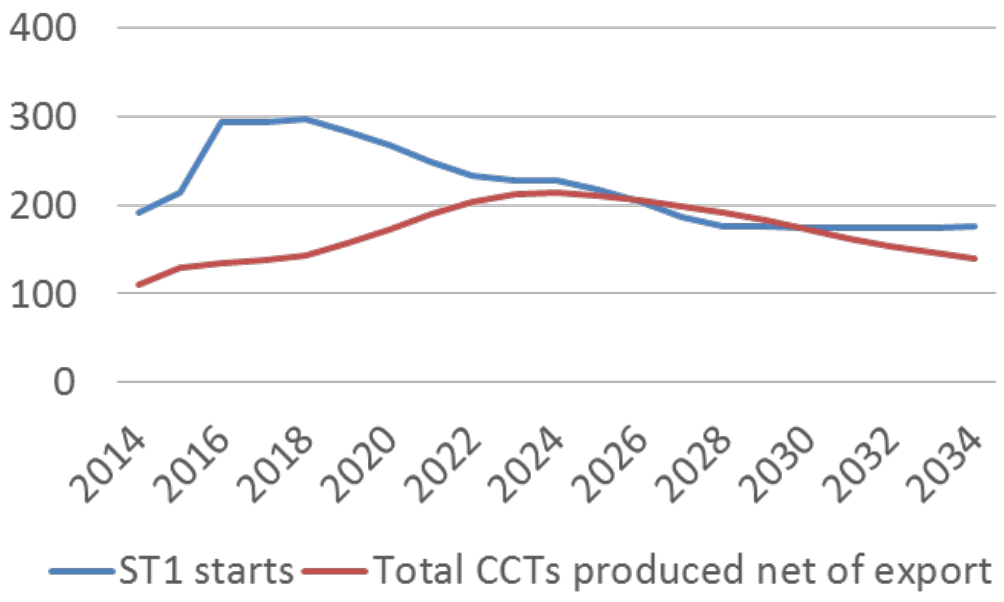

Figure 11 – Starts and completions allowing for capacity constraints

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	2014	2015	2016	2017	2018	2019	2020	2021	2022
Consultant FTE	2,857	3,115	3,234	3,307	3,382	3,464	3,555	3,651	3,763
Rate per 1,000	5.3	5.7	5.9	6.0	6.1	6.2	6.3	6.4	6.6

2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
3,883	3,991	4,096	4,190	4,285	4,368	4,439	4,496	4,547	4,598	4,644	4,690
6.7	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.5	7.6	7.6	7.6

Table 1 Growth in Clinical Radiology capacity relative to population.

Similar issues arise in needing to refine changes to provide a smoother path for effective training delivery should this scenario become the basis for HEE proposals and LETB plans. Similarly refinements can be made to the models at a LETB level which minimises over supply and optimises the balance of demand and supply across the relevant years of the modelling.

3.3 Conclusions and next steps

There is clear evidence of the need to increase training of Clinical Radiologists to meet future demand. There are, however, practical constraints to increasing training numbers in the capacity of the training infrastructure, which inhibits the pace of growth of the consultants workforce. The ability to increase the capacity of Clinical Radiology is therefore constrained by training capacity. Under the final scenario described in this report, with an increase of ST1 starts to c.300 over the next 2-3 years, there is the potential to achieve an increase in Clnical Radiology capacity from just over 5 per 100,000 at present to c.7 per 100,000 by the mid-2020's.

Training has been provided to HEE in the understanding and use of these models, which will form part of the HEE proposals on education commissioning in radiology from 2017 onwards, and the relevant LETB breakdown of the National targets.

Next steps for this work include:

- A coordinated approach to the planning for and application of 7 day working;
- Development of alternative approaches toassessing future demand;
- Consideration of mechanisms for increasing training capacity.

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Appendix 1: Key Engagement events/contacts

Dates	Attendees	Content
15 Mar 2013	Workforce Modelling Collaborative signs off model	Model development
27 Nov 2013	Planners and Clinicians review the comparative output from 5 LETBs	Testing prototype Collaborative Simulation Platform
30 June 2015	EoE and London clinicians review Radiology model and assumptions	Basis for refined model
7 Aug 2015	HEE generated data produced for Radiology	Data production
30 Aug 2015	LETBs ratify data	Data validation
30 Nov 2015	HEE Large Speciality Programme Learning event including clinicians	Review of model and assumptions
15 Feb 2016	Model pasover session with HEE	Training in use of model
March 2016	Summary report produced	Final report

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