Cancer in the Long Term Plan for the NHS
RCR response, 17 September 2018

Royal College of Radiologists: the backbone of the cancer pathway

The Royal College of Radiologists (RCR) leads, educates and supports doctors who are training and working in the specialties of clinical oncology and clinical radiology.

Many of the solutions to achieving world class cancer diagnosis and care are already outlined in the English Cancer Strategy 2015–20. However, they are unachievable given the current shortfall in clinical oncology and clinical radiology workforces, the inadequate IT connectivity across NHS systems and the piecemeal nature of capital equipment replacement.

A **clinical oncologist** is the only medical specialist trained in prescribing radiotherapy in addition to systemic anti-cancer therapies (SACT) (chemotherapy, hormone therapy, biological therapy, immunotherapy) and the use of radioactive isotopes. The clinical oncologist is often the only doctor, together with the general practitioner, to manage the patient through the whole course of his/her therapeutic pathway. Clinical oncologists use high level communication skills to inform patients about their conditions and discuss the best options for treatment, which are increasingly delivered in combinations. Of those cured of their cancer, 40% of cases are attributable to radiotherapy (compared with 50% attributable to surgery and 10% to chemotherapy). Carefully chosen combinations of chemotherapy, radiotherapy and surgery are often needed. This approach requires the co-ordination of many teams to be delivered effectively and efficiently, especially as patients have increasing levels of comorbidity. Clinical oncologists co-ordinate this scheduling, acting as the pivotal point in the multi-disciplinary team (MDT) meeting but also assisting patients in determining their own treatment choices. Increasingly patients are surviving longer after their cancer diagnosis, receiving more lines of treatment, but also managing the, often debilitating, long term sequelae of therapy. The major increase in cancer diagnoses is in those older than 70 years. They are often frail and multiply comorbid, so therapy requires appropriate tailoring. Often, radiotherapy is substituted for surgery, and the clinical supervision required of those undergoing therapy is significantly increased. The aim of screening to improve detection of cancer at an earlier stage does not always negate the need for radiotherapy or chemotherapy.

Clinical Radiologists are the only specialists trained to deliver and interpret all diagnostic imaging modalities and perform image-guided biopsies of suspected cancerous tissue, with **interventional radiologists** providing image-guided, minimally invasive diagnostic, curative and palliative procedures for cancer patients. Early diagnosis is a key pillar to a world class cancer service, and radiology is the foundation on which this pillar stands. Increased demand for early diagnosis will result in an increase in the prevalence of cancer, longer survival of patients with cancer, and an ageing population with more multiple co-morbidities. This will only escalate the need for image guided biopsies, as well as the number of required imaging reports for staging, treatment monitoring, and follow up of cancer. A drive for early diagnosis of cancer escalates the requirement for imaging, since patients' symptoms are non-specific at that stage, and their clinical signs and investigative blood tests are usually negative. New, more specific, radioisotope tracers in nuclear medicine stage cancer with greater accuracy. This offers patients treatment regimens appropriate for the true stage of their disease. New pathways and cancer screening programmes such as lung cancer screening, multiparametric MRI (mpMRI) for prostate cancer and whole body MRI for multiple myeloma will not be universally deliverable for the foreseeable future unless the workforce issues are addressed urgently.

Managing and making the best use of sensitive and specific imaging techniques will be fundamental in facilitating accurate diagnoses and targeting for biopsies. Cancer investigation is estimated to make up at least 50% of an imaging department's workload already. In breast and gastrointestinal imaging, it can be argued to approach 100% because patients are referred primarily to rule in or rule out the potential diagnosis of cancer. The radiologist is central to multi-disciplinary team meetings, and most of these are related to cancer.

Clinical oncology: some facts

- The clinical oncologist consultant workforce is composed of 680 WTE of which 49% are female. The trainee workforce is 65% female. This feminisation is increasing over time.
- 28% of all consultants work less than full time (LTFT). LTFT working becomes much more common as consultant age increases.
- Mean age at retirement of consultants fell below 60 for the first time in 2018.
- 65% of consultants deliver care on more than two hospital sites due to a common "hub and spoke" service delivery method.
- Currently the shortfall in clinical oncology workforce is at least 15%. The CRUK "Full team ahead" document made a compelling case for significant clinical oncologist expansion, even with the new models of care already adopted.

Clinical radiology: some facts

- There has been rapid growth in complex imaging over the past five years - SPECT scans (211%), PET CT scans (87%), CT scans (44%) and MRI scans (43%).
- From the period 2012 - 2017 the increase in consultant radiologists across the UK has been only 13.1%. This means almost all radiology departments' workloads vastly exceed capacity. In 2017, only 3% of radiology departments met all their reporting requirements within staff contracted hours.
- Outsourcing/insourcing expenditure was estimated to be £116 million in the financial year 2016-17 (based on RCR census data), which is double the estimated expenditure three years ago. This sum would pay for more than 1,200 consultant radiologists' salaries annually.

Interventional radiologists, a subspecialty of clinical radiology, supply an increasing demand in all aspects of cancer care, which will continue to increase over the next 10 years, especially in the frail comorbid population that will see most of the rise in cancer. "Interventional oncologists" (interventional radiologists who treat and palliate cancer) treat patients through tiny incisions, as day cases, most commonly without anaesthetic, reducing costs and improving patient experience. They offer the complete spectrum of interventional care from curative therapies for example for lung cancer; through facilitating treatment delivery in central venous access device (CVAD) placement; to significantly enhancing patient wellbeing by intervening at the end of life with palliative image-guided interventions. Relieving pressure symptoms due to the growing cancer, and optimising organ function at the end of life contributes significantly to patients' quality of life in the terminal phase of cancer in a cost effective way.

Workforce first

The additional funding announcement offers a unique opportunity for delivering the best patient outcomes across the whole cancer pathway fully, efficiently and at scale. The provision of realistic funding over the next ten year period could see real gains, but cannot wholly rely upon innovation and different ways of working. The increased funding has to be made available now, and should focus on workforce and IT connectivity as a matter of urgency. NHS England must recognise that this is unlikely to be immediately transformative, but is fundamental to realising all other ambitions. We look forward to a collaborative partnership in striving to achieve a world class cancer service.

RCR Priorities for Cancer in the Long Term Plan

Priority 1
Commit to providing the required skilled workforce

Priority 2
Equipment and IT infrastructure

Priority 3
Universal access to effective treatments

Priority 1 – Workforce

As outlined in the introduction, the entire plan will be realised or run aground on the workforce. Diagnostic imaging radiologists, interventional radiologists and clinical oncologists will be the backbone of the service. While the dearth in available consultants is well known, the RCR have made some projections which explain the adequate staffing levels required.

Data from the annual RCR Clinical Radiology and Clinical Oncology Workforce Census reports and from Health Education England) show:

There is currently a **national shortfall of approximately 1000 WTE consultant radiologists** i.e. the difference between the number of extant consultant radiologists and the number required to report all the diagnostic imaging studies performed. This is an underestimate because it excludes all interventional radiology procedures. In 2023, on a linear 5-year projection, the shortfall will be 1614 WTE consultant radiologists. Note this is also likely to be a significant underestimate because of the factors listed below which increase the demand for imaging investigations in a non-linear fashion.

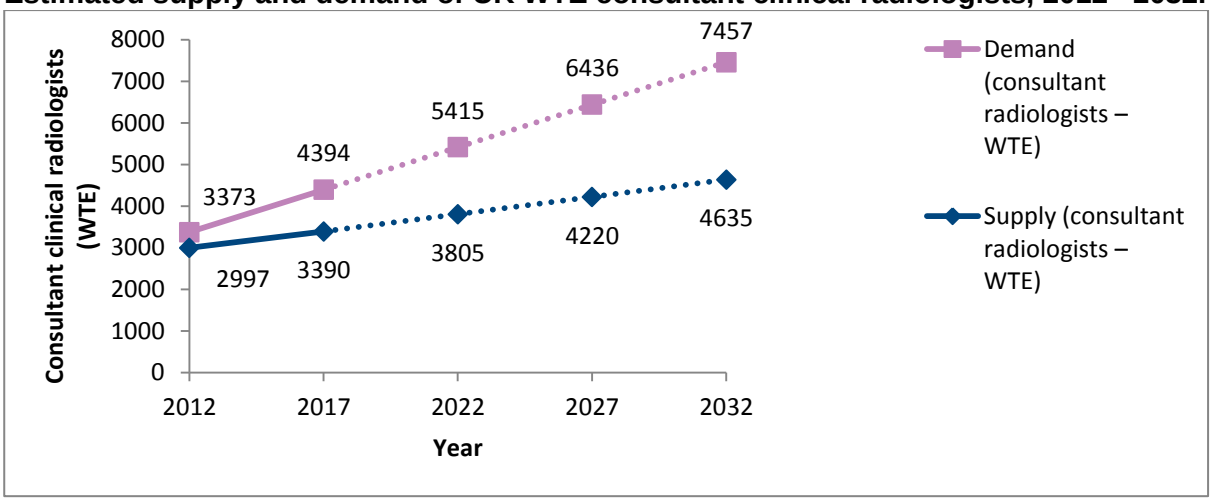
Causes of escalating cancer imaging workload in the next 10 years:

- *non linear escalating workload, and the certainty of more functional imaging in the next 10 years as more specific diagnostic radioisotope tracers are introduced into clinical practice*
- *increasing complexity of workload: hundreds more images per scan with various post processing algorithms and image manipulations required*
- *yearly technological advances which increase the gamut of diagnostic radiological investigations which can be done*
- *aging and growing population*
- *increasing obesity leading to more morbidity*
- *increasing diabetes with all its medical complications needing more imaging*
- *increasing numbers of people living longer with cancer, needing more imaging follow up and more interventional radiology for both treatment and palliation*
- *increasing screening programmes – almost all involving imaging*
- *policy to detect cancer earlier which will require almost every patient with vague symptoms to have a CT*
- *falling consultant radiologist retirement age*

In short, **at least 2000 more radiology trainees are needed** to generate the 1614 extra consultants in 5 years' time. This assumes current rates of 20% attrition (3% loss due to LTFT working patterns, and 17% loss due to those finishing training but not taking up NHS consultant posts within 5 years). Note that all 2000 radiology trainees would have to start their training now in order to plug the consultant gap by 2023. Clearly this is not feasible, so trainees starting 5 years hence will not finish their training until around 2029. A realistic projection is cumulatively to increase the number of trainees entering ST1 radiology training by **135 each year for the next 5 years** (from 2019-2023 inclusive). i.e. Year 1 = 135 more; year 2 = 270 more; year 3 = 415 more; year 4 = 540 more; year 5 = 675 more (total 2035). These numbers then remain steady from 2024,

resulting in the amount of WTE equivalent consultant radiologists meeting the demand across the UK by 2032.

Estimated supply and demand of UK WTE consultant clinical radiologists, 2012 –2032.



The above graph assumes supply and demand will increase in a linear fashion.

Salary costs would be in the region of £336M for these 2000 additional trainees (reference cost of £168k per trainee, based on the 2017-2018 HEE training tariff and a five-year training duration). This would need to be matched by the employing trust. Year one trainees should be funded 100% centrally by HEE, rather than 50%, as the employing trust does not gain much service utility from Year 1 trainees.

As the trainees are progressing, **international recruitment will still be needed** to fill the immediate radiology consultant vacancies (>10% average UK-wide, which is an underestimate) building on the RCR-HEE "earn, learn and return" initiative starting in 2018 and benefiting from the Tier 2 visa cap removal for doctors. This investment would lead to reductions in private teleradiology outsourcing (which cost the NHS around £100m in 2017) and re-integrate imaging services into trusts with consequent efficiency gains.

Radiologists work in multidisciplinary teams. There are national shortages of radiographers and sonographers which impact on image acquisition and service delivery. The additional reporting radiographers announced in the cancer plan will support some plain film reporting but will have minimal impact on the more complex imaging studies (which include all cancer imaging studies). The RCR is working with HEE and the Society and College of Radiographers to develop standards for curricula, assessment and governance frameworks for reporting radiographers and undergraduate sonography..

Additionally, to address the **shortfall in interventional radiologists** for cancer treatment and palliation, the RCR assert the need for ring-fenced Year 6 funding, an extra 15 Year 6 interventional radiology trainees every year for 5 years, and an extra 3 Years 4-6 paediatric interventional radiology posts every year for 5 years. Using the same reference cost, this would amount to approximately £666,000.

The necessary extra radiologists will demand a substantial **increase in the number of PACS workstations** at which radiologists work, and space to house them (the number is already insufficient in many hospitals).

The clinical oncology workforce requirements are no less urgent. Radiotherapy can only be delivered safely via a co-ordinated, integrated multi-professional team effort. Extended role development has streamlined patient pathways, enhanced patient experience and forged closer multi-professional working and understanding. This has had major efficiency gains, but there is a limit to how far the gains of skill mix can be realised without a sustainable workforce pipeline in each of the professions who combine to deliver nonsurgical cancer treatment. In radiotherapy clinical oncologists, therapy radiographers and medical physicists all have significant gaps in their

workforce. The increase in courses of radiotherapy of 2% per year significantly underestimates the clinical input required to support the rising complexity of therapy as technology advances. For chemotherapy the picture is the similar. Medical and clinical oncologists work closely together in multiprofessional teams with nurses and pharmacists to deliver increasingly complex drug treatments. All are shortage specialties; so again, extending skill mix has become problematic in many areas. The 8% per annum increase in courses of systemic anticancer therapy (SACT) is associated with a significant increase in the complexity of managing therapies in the frail, elderly population where most of the cancer increase is seen.

Currently 8% of consultant clinical oncologist posts are vacant, with one in three being vacant for more than one year. Vacancy rates continue to increase year on year. The WTE workforce has grown by 4% on average per annum in the past five years, but service demand, due to increasing technological complexity and new drug development, has outstripped this. The clinical oncology workforce is key to delivering all non-surgical cancer services and is currently between 200 and 300 WTE below demand - as outlined in *Clinical oncology workforce: the case for expansion*. Among both clinical scientists and therapy radiographers, vacancy rates are much higher (at least 20%). There is major concern that changes to funding of training places may negatively impact recruitment in these essential technically demanding specialties.

Ideally, the consultant workforce should double in 15 years so that the demands caused by early diagnosis, more complex scanning, more advanced radiotherapy and SACT treatments are met. To achieve this, we recommend an additional 30 trainees per year for first three years, to increase to 40 trainees thereafter (year 1 = 30 more; year 2 = 60; year 3 = 90; year 4 = 130; year 5 = 170). Using the HEE training tariff 2017-18 as the reference cost, and assuming a five year training duration, roundly this would be £180k per trainee or about £5.40m for 30 additional trainees. As before, this would need to be matched by the employing trust.

Priority 2 – Equipment and IT Infrastructure

IT connectivity needs to be the immediate concern with all patient data accessible from any N3 connection (and all providers treating NHS patients). It must be seamless for patient information to be recorded once and used multiple times, reducing the cost of data re-entry, frustration for patients and data safety issues. The ability to link planning and treatment data across all commercial systems for remote delivery of centrally planned courses of radiotherapy is essential to realise the benefit of increased use of technologies to deliver cancer cures. Costing this is very difficult but is unlikely to be less than £50m. Use of artificial intelligence (AI) will need to be further integrated throughout the patient pathway. This will be a continuously moving environment but given the potential reach of new technologies, it is likely to be at least £100m (based upon anecdotal experiences of researchers).

Procurement of equipment nationally for England to common standards for functionality, and interconnectivity will improve equity of access, reduce variation throughout the pathway, facilitating improved outcomes and patient safety and movement of the workforce around the country. It will avoid “feast and famine” equipment procurement cycles which result in using ageing, inefficient equipment and massive, one-off replacement bills. Such replacement cycles lead to higher unit prices (industry cannot plan on certainty) which lock the NHS into a frozen specification rather than benefiting from incremental improvements.

A **rolling equipment replacement programme** would also save clinical time which is poorly directed in writing multiple business cases (that are often rejected). Modern equipment enables swift adoption of new techniques, software and machine learning algorithms, improving patient experience and outcomes and augmenting clinician time. Funding for equipment needs to include the costs of enabling works and state-of-the-art software with regular software upgrades, not just the machine cost.

The main equipment required covers both diagnostic (MR, CT, PET-CT and ultrasound scanners) and treatment (radiotherapy delivery machines (LINACs) - and CT and ultrasound to support planning). We strongly recommend replacing old equipment every 7-8 years for MR, CT, PET-CT and SPECT-CT scanners. This is the lifespan allowed in Private Finance Initiative (PFI) trusts, after which time breakdowns, repairs and lost scanning time render the machines non-viable. Ultrasound machines should be replaced every 5 years, and we should increase the number of these machines to keep pace with the current rate of rise in demand for imaging studies.

A rolling radiotherapy equipment replacement programme, including CT planning machines, would cost approximately £159m per annum. The breakdown as follows:

LINAC

- Replacing a LINAC costs approximately £2.8m (including software).
- There are approximately 340 LINACs in England, including some private providers who are treating NHS patients due to capacity issues.
- LINACs need replacing every seven years,

(2.8 x 340/7=£136m).

CT planning machines and software

- There is an average of two CT planning machines per centre (52).
- These need to be replaced every five years,. The cost of a CT scanner is £864,000.
- Radiotherapy planning software is required for each treatment course. A rolling replacement cost of upgrades, including planning licences, would be approximately £0.5m per annum.

(52 x 2 ÷ 5 x 864,000 = 17,971,200) (17,971,200 + 0.5 = £22,971,200)

Total: £136m + £23m = £159m per annum

Brachytherapy machines are less numerous - approximately 50 in England. Brachytherapy is a highly demanding technique which requires the concurrent use of ultrasound to guide placement of the applicators inserted into the patient who is anaesthetised. Both sets of equipment need to be replaced every 10 years. This cost is £1.75m per annum (i.e. 5x [cost of brachytherapy machine £300K + cost of ultrasound machine £50K]).

To ensure that imaging equipment meets the demands of the push for early diagnosis, the 10 year projection cost for a **large** trust in England (based on Imperial College Healthcare NHS Trust figures and using current average machine costs including 20% VAT) is as follows:

- 14 new MR scanners @ £1,020,000 each, for a 10% demand increase = £14.3m
- 6 new CT scanners @ £864,000 each, for an 8% demand increase = £5.2m
- 1 new PET-CT scanner @ £1.9m, for a 9% demand increase (likely to be an under-estimate since cancer (and other) imaging is becoming more functional requiring more PET scanning)
- 1 new SPECT-CT @ £0.8, for a 7% demand increase (including early dementia/cognitive impairment scanning)
- 6 new ultrasound machines @ £102,000, for a 3% demand increase = £0.6

Total diagnostic scanning equipment cost for one large trust for 10 years = £23m (excluding fluoroscopy equipment, mammography machines, digital plain radiography machines and PACS workstation costs). Given that this is based on a larger trust, and is using simplified multiplications, **for the 198 trusts in England, total scanning equipment cost will be no more than £4,554m**.

Picture Archiving and Communication Systems (PACS) workstations are already at a shortage, resulting in radiologists sometimes being unable to find space for reporting. Extra radiology trainees will exacerbate this shortage. An **extra 2000 PACS workstations are an essential investment.** This number of PACs systems with integrated speech recognition software and hardware, + VAT, would cost approximately £20m. (Replacement should be on a 5 year cycle).

Priority 3 – Universal access to effective treatments

Of patients currently cured of their cancer, approximately 40% of those cures are attributable to radiotherapy. Current technological advances also reduce debilitating and costly long term side effects. A robust It and equipment infrastructure to support the rapid rollout nationally of new technologies will improve cancer outcomes. This IT and equipment infrastructure also needs to be support by clinical mentorship and radiotherapy quality assurance practices, often best fostered through clinical trial participation. Radiotherapy services in the UK have an excellent track record of converting one off cash injections into improved accesss to advanced technologies for patients, supporting improved outcomes.

The **current spend on radiotherapy in the UK is less than 6%** of the total cancer spend (data from House of Commons library). Using NHS reference costs the total cost of radiotherapy to the NHS in 2016-17 in England was £383m. An extra £100m per year would increase this to about 8%, which is still less than other western countries. Current tariff stifles change and provides perverse disincentives to innovation. Modernising the reimbursement structure to encompass pathways rather than single items would encourage adoption of new technologies rapidly, improving outcomes.

There are 52 cancer centres delivering radiotherapy in England. All but one centre delivers radiotherapy routinely for more than eight hours per day Monday to Friday. All centres deliver chemotherapy routinely for more than eight hours per day Monday to Friday. Nationally, the clinical oncology workforce provides care 24/7 and there is seven day access to therapy for those who require it. To eliminate variation of practice and improve outcomes, there must be effective Cancer Alliances fully integrated with other planning and service delivery structures / mechanisms using a common, nationally agreed framework.

All radiotherapy treatments should be available to all patients that will be seen to benefit from it as part of the clinical oncologist's treatment plan. NHS England's proposed Radiotherapy Networks model makes sense as a vehicle to support the rapid and safe roll out of new technologies to all cancer Centres. . However, as mentioned earlier in this paper, IT infrastructure is critical to the success of the network model. Current IT connectivity issues can hinder productivity and give rise to patient safety issues. Additionally, patients who need to travel for treatment should be given adequate support to access that treatment. Radiotherapy is given daily, often over 4 – 6 weeks and travel can pose significant financial burden. This can impact differently on different patient groups. The RCR 2014 lung cancer audit found that 48% of eligible elderly patients chose to receive less than optimal therapy due to travel distance. People need to be supported to access therapies at a distance in innovative ways, including hostel accommodation and enhanced local support to take over caring roles, for example, grand children and spouses.

Stereotactic ablative radiotherapy (SABR) is a highly focussed, advanced targeted therapy which improves survival rates in many conditions. Currently SABR treatment for lesions inside the skull is commissioned by the trauma national programme of care (NPoC) under the neurosciences clinical reference group (CRG), and everywhere else in the body via the Cancer NPoC and radiotherapy CRG. Fragmentation of services is inefficient and wasteful of resources.

Further recommendations for achieving a world class cancer service

These recommendations are straightforward and have a disproportionate beneficial impact -

- **Bring all radiotherapy commissioning under a single structure.**
- **Address the perverse incentives in the tariff structure**: a best practice cancer pathway tariff that covers the full episode of treatment, regardless of treatment duration/modality to encourage service development and innovation.

- **Introduce iRefer radiology referral guidelines across England in clinical decision support software** integrated into GP and hospital requesting software. (iRefer guidelines drawn up by the RCR are evidence based and regularly updated.) This will ensure the right imaging test is performed avoiding multiple, unnecessary investigations and provide educational support for all involved NHS staff.
- **Facilitate rapid adoption of new imaging and radiotherapy techniques into clinical practice**, supporting services to adapt practice accordingly with effective IT connectivity
- **Introduce risk-stratified screening programmes** to minimise the unnecessary distress and anxiety to the vast majority who are well.
- **Demographic screening for lung cancer** – AI to identify high risk populations and to identify which nodules require follow up, biopsy or ablation (using interventional oncology (IO)).
- **Breast screening using genomics** to support stratification of high, moderate and population risk screening. AI support for screen reading. Image guided biopsies & vacuum excision reduce the requirement for open surgical biopsy/treatment for indeterminate lesions
- **Advanced bowel cancer screening** – AI support for radiologists reading CT Colonography and genomics incorporated to stratify risk and chance of recurrence. NHS England need to continue enabling the smooth transition to the new faecal immunochemical test (FIT), effectively replacing the guaiac faecal occult blood test (gFOBt). NHS England should drive pick up rates of this screening test for this to be effective.
- Nine **Rapid Access Diagnostics centres** have now been set up and have begun to take patients with complex symptoms through to diagnosis, we recommend replicating this model in areas of greatest unmet need.
- **Cancer Alliances** are also developing and establishing similar centres for specific conditions, such as prostate cancer. For prostate cancer, multiparametric MRI is essential to stratify those at risk into surveillance or biopsy and requires the expertise of uroradiologists to undertake the interpretation of mpMRI and biopsy as a one-stop service.
- Monitor the pilot data of the **28 day faster diagnosis standard** to see if can be replicated – 6 cancer pathways involved - gynaecology, urology, head and neck, lung, lower and upper gastrointestinal.

What the cancer diagnostic and non-surgical cancer treatment workforces could look like with sustained workforce and equipment investment:

Role of clinical radiologists in a future NHS

- Clinical radiologists will become the lead medical diagnosticians: they are already essential to the whole of medical diagnosis, surgical planning, the trauma pathway and the entire cancer pathway.
- After referral from GPs (or direct entry through multi-diagnostic centres), they will triage patients to the appropriate pathways or advise that no treatment/intervention is necessary.
- Clinical radiologists will increasingly manage the entire diagnostic pathway. They already play a major part in interventional radiological and oncological treatment and palliation in cancer, and in situations of acute haemorrhage and trauma, and this role is continuously increasing .
- As artificial intelligence matures, such technologies will increasingly assist and support human diagnosis.
- AI will in time take on straightforward reporting tasks as “first reader” freeing radiologist time for their vital, wider medical role, including radiology clinics explaining patients’ imaging to them and the consequences for their future management.
- Continuing ability to innovate and develop: more functional imaging – taking advantage of whole body PET CT scanning techniques (the first whole body PET CT machine is being launched this year: able to scan a patient in three minutes – compared with more than one 1 hour per patient on current, limited body part machines – and with far greater sensitivity and accuracy). Accurate PET scanning functional data, and whole body MR data are fundamental in determining what type of cancer treatment should be given, and in dictating when a change in treatment is needed.

Role of clinical oncologists in a future NHS

- Clinical oncologists will lead the non-surgical cancer team, delivering individualised care to every patient at all stages in the therapeutic pathway.
- They will continue to manage directly the most difficult cases and carry the risk for complex, non-protocol treatments in direct partnership with patients.
- They will have oversight of the complete therapeutic pathway, which will lengthen as cancer increasingly becomes a chronic disease, being responsible for managing other medical comorbidities and uncertainty especially around end of life care.
- They will continue to transform the patient experience by advancing skill development across the non-surgical cancer treatment team, supported by artificial intelligence technologies at all stages of the pathway from diagnosis to end of life care.

In collaboration with NHS England and sector partners, the RCR is ready to lead this transformative change.