Radiotherapy UK

Curing more patients with cancer, quicker: Unlocking Modern Radiotherapy.

Introduction

Radiotherapy, a powerful tool in cancer cure and treatment, stands at the intersection of science, technology, and patient care.

Lord Darzi's recent report on the NHS exposes an escalating cancer crisis defined by limited resources – people, equipment and investment, stating: "The 62-day target for referral to first [cancer] treatment has not been met since 2015." "More than 30 per cent of patients are waiting longer than 31 days for radical radiotherapy." [1] To address this challenge for patients with cancer today, we must urgently fast-track the modernisation of proven cancer cures.

Smart investment in modern radiotherapy offers a vital way to treat more patients, better. **Simply replacing radiotherapy machines that have exceeded their recommended lifespan could free an additional 87,500 appointments a year.**

Radiotherapy cures cancer and is the most cost-effective cancer treatment for the UK's second-biggest killer. It is needed by 1 in 2 cancer patients and contributes to cure in 40% of cases. Its technologically advanced, innovative and versatile capacity means it is uniquely placed to treat more cancer patients quicker and better.

Following on from the landmark report published earlier this year, 'World-class radiotherapy in the UK: Right Patient, Right Treatment, Right Time', this report sets out how harnessing radiotherapy technology, when coupled with strategic investments in the workforce and infrastructure, could hugely boost cancer capacity and transform cancer outcomes in the UK.[2]

Radiotherapy UK patron, football legend and radiotherapy patient, Bryan Robson OBE, knows how important this life-saving treatment is;

"Radiotherapy is one our best players in the fight against cancer, so why is it on the bench? We must invest in this life-saving treatment so it can help cure thousands of UK cancer patients. I was one of the lucky ones. I got the radiotherapy I needed, and it saved my life. Now I'm campaigning to make sure every UK cancer patient gets the treatment they need, where they need it, and when they need it. Unnecessary delays in cancer treatment put patients' lives at risk and harms the health of our nation. Let's change this by working together, accepting there is a problem, and taking action to Catch Up With Cancer right now. I urge our new government and decision makers to get cancer services back in the Premier League."

PART 1

Radiotherapy – a life-saving cancer treatment

1. **Radiotherapy: curing cancer**

   Radiotherapy is a vital cancer treatment needed for half of all cancer patients and involved in 40% of cures.[3] It uses beams of ionising radiation to kill cancer cells and can destroy, shrink or control the growth of tumours. Personalised to each patient, radiotherapy plays a role across the entire cancer treatment spectrum – from curing early-stage disease to palliative care. It is effective and incredibly cost-efficient, costing only a few thousand per radical treatment course and a few hundred for palliative treatment.[4]

2. **Radiotherapy in the UK.**

   One in two people in the UK will develop cancer at some point in their lives. Cancer patients in the UK are currently experiencing a crisis in cancer care – facing some of the longest waiting times for treatment on record.[5] The impact of waiting is deeply concerning, as every four weeks of delay in cancer treatment leads to a 10% increase in mortality for some cancers.[6] We are in this position due to lack of, smart investment in cancer services and inadequate capacity for vital cancer treatment services, notably radiotherapy.

   Radiotherapy is delivered by a multi-disciplinary, specialised, highly skilled workforce of 6,400 professionals delivering 160,000 life-saving treatments each year. Clinical oncologists, therapeutic radiographers, medical physics teams and engineers work together to ensure that the treatment delivered is safe and effective. This highly skilled workforce currently faces chronic shortages across all disciplines, with recruiting and retaining skilled staff a key challenge for the service.

   A recent workforce survey undertaken by Radiotherapy UK highlights this, with 80% of respondents stating that they did not feel they had the staff to meet current patient needs, rising to 90% of respondents feeling that they did not have the staff to meet future patient needs.[7]

   A 30% increase in cancer diagnoses is predicted nationally by 2040,[8] primarily due to our aging population and lifestyle factors. This surge in cases will escalate the demand for radiotherapy. Diagnosing cancer earlier has become a key policy and investment focus, however, to cure the increasing numbers diagnosed, more radiotherapy treatments will be needed.

   Despite radiotherapy's critical role in cancer care and cure, access in the UK remains insufficient. According to publicly available NHS England data, in 2021 (latest complete data published) 34.9% of patients with cancer were treated with radiotherapy as part of their primary diagnosis,[9] falling short of the global benchmark of 52-53%.[10 11] International research underscores the impact of limited radiotherapy availability on cancer survival, highlighting those patients without access face poorer outcomes.[12] This low level of access indicates that many patients with cancer who could benefit from radiotherapy are not receiving it.

Why is modernising radiotherapy important?

Modernising radiotherapy is key to improving patient outcomes and quality of life. Several critical goals could be achieved: more cancer patients treated quicker, reduced waiting lists, optimised investment and resources, increased treatment capacity, reduced treatment related side effects, and most crucially, improved patient survival and outcomes.

Radiotherapy, as a technology-driven discipline, is well-positioned to drive transformation and leverage medical technology and digital advances, leading to productivity gains. In the UK a unique Radiotherapy MedTech industry task force has been working in a vendor-neutral capacity with the community to enable the transformational delivery of world-class radiotherapy.

Modernising radiotherapy for patient benefit and reducing inequalities.

Over 33,000 cases of cancer in the UK are linked to deprivation annually,[13] and health inequalities in access to cancer treatment are stark. Ensuring equitable, timely and appropriate treatment for all cancer patients is a fundamental way to improve patient outcomes, yet the significant variation in access to radiotherapy poses a huge challenge. Large treatment gaps have developed. For example, only an estimated 18% of 36,000 cancer patients who could benefit from stereotactic and whole brain radiotherapy receive it.[14]

Travel times analysis shows that 7.4 million people in the UK live further than the recommended 45 minutes by private car from their closest radiotherapy centre.[15] This rises to a shocking 49.6million when reliant on public transport.

Research in 2019 reported that 24% of households in England did not own a car, increasing to nearly 50% when considering groups in the lowest real income levels.[16] There is a clear intersectionality between reliance on public transport, poverty, and access to radiotherapy treatment.

Understanding and tackling these unwarranted variations in radiotherapy treatment is hampered by the lack of transparent data. A single integrated data source from radiotherapy providers, which can drive improvement in patient outcomes by linking analyses to systems that utilise the learning gained to deliver change quickly and effectively is urgently needed.

Investing in radiotherapy services would mean all cancer patients receiving the right treatment, delivered by the right workforce, on the right equipment, at the right time. The benefits for patients will be quicker treatment, increased access to advanced treatments and improvements in how long and how well patients live.

PART 2

Modernising Radiotherapy - Solutions

Many radiotherapy-focused solutions are available to optimize resources and improve patient care.

In this report we have gathered case studies of existing practice and innovations to show examples of how productivity in radiotherapy could be unlocked.

1	**Curing cancer earlier by ensuring access to SABR (Stereotactic Ablative Body Radiotherapy) for all cancer patients.**
✓	reduce waiting lists
✓	reduce health inequalities
✓	increase treatment capacity
✓	reduce treatment-related side effects and improve quality of life
✓	improve patient survival
✓	optimise investment and resource

CASE STUDY: SABR in lung cancer

Lung cancer is the leading cause of cancer-related deaths in the UK, accounting for 21% of all cancer deaths. When stage 1 and 2 lung cancers are treated with an advanced radiotherapy technique known as SABR a 30% improvement in survival has been shown.[17] SABR can be delivered in as little as 4 outpatient appointments (planning and treatment), compared to the standard fractionation of 21 outpatient appointments.

SABR treatment can offer suitable patients a more cost-effective alternative to surgery and can ease the surgical workload, as well as providing a better option for patient recovery.

Internationally, SABR has become the standard of care for medically inoperable Stage 1 and 2 lung cancer. In the USA and the Netherlands, over 90% of radical radiotherapy in this patient group is delivered using SABR. However, despite an increase in patients receiving SABR in England, patient access remains highly variable due to equipment availability, software limitations, and workforce constraints. Data from the National Lung Cancer Audit identified wide regional variation in the use of SABR over conventionally fractionated radiotherapy across England.[18] A broad regional variation was also noted with curative treatment rates varying from 8% to 80% across centers for stage III NSCLC management by Navani et al in their 2022 report on lung cancer in the UK.[19]

For patients not cured, treatment options are expensive drugs such as the NICE recommended pembroluzimab which costs over £84K for the recommended 2-year course. Although SABR implementation has increased since a boost in funding in 2020, the lack of SABR availability in every radiotherapy centre places a barrier to access for all patients that disproportionately affects older patients. A Royal College of Radiologists' audit of radical radiotherapy for lung cancer identified that older patients are less likely to get optimal treatment, possibly because of travel times.[20]

2	**Modern and up-to-date machines deliver high-tech, high quality and cost-effective treatment.**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	reduce treatment related side effects and improve quality of life
✓	improve patient survival

Modern radiotherapy machines provide high-quality treatment delivery, improved patient throughput, faster treatment times, minimised downtime, and reduced waiting time.

CASE STUDY: Benefits of modern radiotherapy machines

Compared to radiotherapy machines that have surpassed their recommended lifespan of ten years, industry intelligence indicates that modern machines can reduce the standard treatment time from 15 to 9 minutes, potentially allowing for an additional 5 appointments per day. While there is no publicly available data on the number of linear accelerators (the machines used for external radiotherapy) beyond this age, Radiotherapy UK's analysis—based on Freedom of Information requests and frontline intelligence—estimates that by the end of 2024, 70 radiotherapy machines in England will exceed their recommended lifespan. Updating these 70 machines, assuming they operate 5 days a week for 50 weeks a year, could free up 87,500 appointments annually.

With the capability to deliver advanced techniques, these machines provide a high dose to tumours while minimizing exposure to healthy tissue. This results in fewer side effects, leading to a better quality of life for patients and a quicker return to normal activities.

Although the initial capital cost of radiotherapy machines is substantial, studies show that modern machines can increase the number of patients treated per month from 497 to 610[21] and can reduce maintenance expenses and associated downtime compared to older equipment. Radiotherapy remains the most cost-effective curative treatment for cancer, with costs ranging from £400 to £7,000 per patient.[22]

Up-to-date machines also significantly save radiotherapy workforce time. They enable quicker and more accurate patient treatment, foster innovation, and facilitate the development and delivery of advanced techniques, ultimately improving treatment quality and patient outcomes.

To replace and upgrade the estimated 70 radiotherapy machines beyond their recommended lifespan and in use across England, a modest investment of £242 million (including infrastructure costs to replace and upgrade) would be necessary. To maintain sustainability, an annual investment of £80 million is needed to replace an average of 20 machines that will exceed their recommended lifespan each year.

3	**Delivering world-class radiotherapy improves outcomes and reduces side-effects.**
✓	improve patient survival
✓	reduce treatment-related side effects and improve quality of life
✓	optimise investment and resource
✓	increase treatment capacity

CASE STUDY: Adaptive Radiotherapy treatment in practice

Adaptive Radiotherapy (ART) is a technological innovation that modifies treatment plans and radiation delivery during the treatment process. It adapts to changes in patient responses, internal anatomy, organ motion and weight loss.

The goal is to enhance precision targeting of the tumour while minimising toxicity. ART relies on advanced imaging and state-of-the-art radiotherapy machines, allowing higher radiation doses in fewer sessions. It can also be applied to cases where conventional radiotherapy techniques are not feasible.

Full online adaptive workflows have low toxicity. For instance, in rectal cancer treatment, ART significantly reduces the treatment area compared to conventional techniques, sparing healthy tissues and improving patient comfort. [23] [24]

ART allows shorter fractionation, reducing the number of hospital visits. For prostate patients, the treatment sessions have been reduced from 35 fractions to just 2 fractions.[25] [26] Less hospital visits for patients also help to reduce the radiotherapy carbon footprint. In a study by Chuter et al initial findings highlight that the biggest contributor to the external beam radiotherapy carbon footprint was patient travel. [27]

Modern equipment streamlines ART for palliative patients. By eliminating the need for a planning CT appointment, it hastens symptom relief, reduces anxiety and minimises inconvenience for the patient. A study of bony metastases in the spine and pelvis shows 47 patients who were treated in a single visit without a planning CT scan. Adaptative plans were selected for all patients because of significant improvements in quality of the treatment plan generated. Patients reported satisfaction with length of the consultation and treatment session, with 80% of patients stating they would choose future radiation procedures in the same treatment pathway. [28]

Implementing ART, including MR planning, in each radiotherapy centre in England would require an estimated £50M investment.

4	**Investing in the workforce**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	improves staff efficiency and productivity
✓	facilitates future innovation and modernisation
✓	improves quality
✓	improve recruitment and retention of current workforce

Increasing workforce capacity in radiotherapy isn't about requiring the existing workforce to work harder and longer. While it's crucial to begin expanding the workforce now, an immediate plan for a modernised workforce model is necessary to back the existing staff and provide them with the tools to maximise output. This is vital for improving workflow efficiency. Such a strategy provides support with the present increasing workload and paves the way for workforce to focus on innovation, training, development, and planning for the future.

CASE STUDY: Remote planning specialist teams.

In the UK, the typical time to create a radiotherapy treatment plan—from the moment planning scans (such as CT, MRI, or PET-CT) are taken to treatment delivery—is typically 2 to 4 weeks. However, using remote treatment planning capabilities can significantly enhance the quality and timeliness of treatment plans.

International developments in planning indicate that a centralised team of specialists, equipped with advanced software systems, can greatly reduce the time required to create high-quality radiotherapy treatment plans. These treatment plans are unique to each individual patient and guide how the radiotherapy machine delivers precise radiation. Adopting a similar approach in the NHS could reduce waiting times along the pathway from initial planning to treatment delivery.

Allowing dedicated teams with the specialist skills and knowledge to remotely plan complex treatments has the potential to improve the speed and quality of the plans produced and expand access to advanced techniques for patients across the UK.

5	**Modern radiotherapy can mean less hospital visits for patients.**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	reduce treatment-related side effects and improve quality of life
✓	improve patient survival
✓	reduce carbon footprint

Historically, radiotherapy treatment has been delivered in 25 – 39 treatment sessions. With the introduction of modern imaging and advanced technology, radiotherapy can now be delivered in less treatment visits to the hospital. During the COVID pandemic, the radiotherapy community responded innovatively. For many breast cancer patients, radiotherapy sessions were reduced from 25 to 15 and then down to just 5. Remarkably, this streamlined approach has proven to be as effective in treating the disease without any significant increase in adverse side effects.

CASE STUDY: PACE-B Trial

In the PACE-B trial[29] researchers compared the long-term bowel and bladder side effects of two radiotherapy approaches:

- Stereotactic body radiotherapy (SBRT) delivered in five fractions over one to two weeks.
- Standard radiotherapy treatment, which involved 39 fractions over 7.5 weeks or 20 fractions over four weeks.

The findings revealed that:

- Nearly 90% of patients in the trial receiving 5 fractions experienced only minor side effects two years after treatment.
- An impressive 99% of these were free of severe side effects.

The study found that reducing the number of radiotherapy treatments that prostate patients underwent had no increased risk of long-term toxicity. Additionally, this reduced the need for frequent hospital visits, allowing patients to resume their normal lives.

Trials are now looking at the effectiveness of just 2 treatment sessions.

Colin, 74, from Surrey, was diagnosed with prostate cancer and received treatment through the PACE-B trial. He was randomised into the group to receive SBRT and after just five treatment sessions on the CyberKnife (an advanced technology), has been assured that his disease has been successfully eradicated.

Colin said: "My diagnosis was quite a shock and being told you need to have radiotherapy treatment is quite nerve-wracking, especially when you're reading about all the different side effects that could happen. I feel really lucky to have had treatment which was over so quickly; it hasn't disrupted my quality of life, routine or really stopped me working at all."

6	**Providing nation-wide Surface Guided Radiotherapy (SGRT) to increase treatment efficiency and improve patient experience**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	reduce treatment-related side effects and improve quality of life
✓	improve patient survival
✓	improve patient experience

Surface Guided Radiotherapy (SGRT) employs cutting-edge technology to precisely position and track the movement of radiotherapy patients during treatment. By enhancing treatment accuracy and streamlining the setup process, SGRT significantly improves the patient experience. A recent efficiency study revealed that implementing SGRT contributed to reducing appointment times by 3 minutes for both prostate cancer patients and those undergoing treatment for breast cancer while breathing freely. This lead to a capacity increase of 18 more appointments per week in that radiotherapy centre.[30] As prostate and breast make up over 50% of all radiotherapy patients this technology has huge efficiency saving implications for all radiotherapy centres.

Importantly, this method eliminates the need for traditional tattoos and permanent markers that are historically used for patient positioning. It has been shown to reduce the amount of on treatment imaging required. Additionally, by improving precision of treatment, SGRT helps minimise side-effects, enhancing the overall benefits to the patient

Implementing SGRT on all viable radiotherapy machines across departments would require an estimated modest national investment of £28 million.

7	**Harnessing AI innovation can increase efficiency and quality-improving patient outcomes.**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	reduce treatment-related side effects and improve quality of life
✓	improve patient survival
✓	improving workflow efficiency
✓	improve quality and standards

AI tools can be used to improve precision treatment planning and contouring, improve treatment and imaging quality, enhance clinical and workflow efficiencies and support improved data analysis and research. They have the potential to reduce radiation exposure and predict treatment responses.

CASE STUDY: AI in practice with NHS Addenbrooke and Microsoft

At NHS Addenbrooke's radiotherapy department, an AI program works behind the scenes, lightening the load for doctors during treatment planning.[31] By precisely calculating where to direct radiotherapy beams to target cancer cells while sparing healthy tissue, this technology is currently benefiting patients with prostate and head and neck cancers. Importantly, it has the potential to extend its impact to other cancer types across the NHS.

The team has harnessed machine learning models using open-source technology, reducing the time needed to mark-up patient scans by up to 90%. This dramatic reduction in preparation time means that potentially life-saving radiotherapy treatment can begin sooner. The contouring of organs at risk is an extremely time-consuming process that also creates variability in radiation therapy treatment planning when done manually. AI tools create consistent high-quality contours, standardize and optimize clinical processes, and realize operational and clinical efficiencies.

Notably, this groundbreaking approach also paves the way for other AI-driven medical treatments.

8	**Modernising the Radiotherapy Tariff**
✓	treat more cancer patients faster
✓	reduce waiting lists
✓	optimise investment and resource
✓	increase treatment capacity
✓	reduce treatment-related side effects and improve quality of life
✓	improve patient survival
✓	improving workflow efficiency

The tariff for radiotherapy payments to providers has remained unchanged since its introduction in April 2014, despite significant advancements in radiotherapy over the years. This means the current tariff no longer reflects modern radiotherapy practices or the recommended national and international guidelines for treatment and techniques.

Key advancements, such as multi-modality imaging, adaptive treatment planning, SGRT, and the collection of routine patient follow-up data (PROMs), which enhance patient outcomes and quality of life, are not adequately accounted for within the current tariff.

Additionally, the tariff imposes unworkable financial constraints on departments, as tariff prices have not kept pace with inflation. This exacerbates the financial pressures on radiotherapy providers, who must absorb additional inflationary costs passed on by commercial vendors.

The impact of the current tariff is hugely detrimental meaning;

- Radiotherapy providers have difficulty investing in modern equipment and techniques that can benefit patients.
- Cancer patients experience variability of access, quality and safety across radiotherapy services.
- Payments received by providers have not kept pace with inflation, further restricting service delivery.
- Radiotherapy services offer piecemeal access to modern radiotherapy services and fall farther behind comparable international countries.

The Radiotherapy tariff in its current form is no longer fit for purpose. The development of an updated tariff that reflects inflationary increases, funds modern practices and technologies equitably and in a way that promotes developments and advances in patient treatment is essential.

Conclusion

Investing in radiotherapy technology, workforce and infrastructure can drive improvements in patient outcomes with higher cure rates and fewer side effects. **Five Key Points:**

1. **Patient Benefits:** By treating more patients efficiently, reducing waiting times, and minimizing treatment-related side effects, modern radiotherapy improves patient outcomes. It also addresses health inequalities, ultimately enhancing survival rates and quality of life.

2. **Unmet Needs:** Lung cancer is the leading cause of cancer mortality in the United Kingdom. The National Lung Cancer Audit data published in 2024, reports that the proportion of patients with lung cancer in the United Kingdom accessing curative treatment remains lower than the nationally agreed target.[32] The report shows that there is currently a large variation in the proportion of stage 1 and 2 lung cancer patients across England and Wales that receive curative treatment, ranging from less than half in some hospitals to over 80% in others.[32] The reasons behind this variation are not understood and need to be addressed urgently. A curative treatment for early stage lung cancer is stereotactic ablative body radiotherapy (SABR), this technique delivers accurate radiotherapy to tumours over 3 to 5 treatment sessions. There is a strong body of literature to support SABR for early stage lung patients who have a high surgical risk.[33] Implementing SABR results in better tumour control compared with more conventionally fractionated radiotherapy that requires a longer course of 20 or more treatment sessions.[17] Improving patient access to modern treatment techniques like SABR would improve the quality of care for patients and address inequality of treatment delivered across the country.

3. **Harnessing Technology:** Radiotherapy's hi-tech base allows it to leverage the latest scientific advancements. When coupled with strategic investments in workforce and infrastructure, a modernised radiotherapy service can revolutionise cancer care in the UK.

4. **Innovative Solutions:** Technological innovations, such as Adaptive Radiotherapy, enhance precision treatment, reduce side-effects and mean patients can be treated in fewer visits; improving treatment capacity.

5. **Strategic Planning:** The absence of a comprehensive radiotherapy plan hinders long-term strategic thinking and investment. Tackling the current crisis and preparing successfully for future challenges will require consistent strategic planning with associated investment.

Radiotherapy's transformative potential lies in understanding how to unlock its productivity through implementing modern, world class radiotherapy, delivered by a sustainable, skilled and valued workforce. In this way, we can revolutionize cancer treatment and improve patient outcomes, lifting patient survival from near the bottom of international cancer survival tables.

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