

# Innovation in radiotherapy

New radiotherapy technologies and techniques aim to improve radiotherapy delivery, patient experience and treatment options. This resource explains these innovations and where action is needed to drive timely adoption and implementation.

We were a key player in the development of radiotherapy, which is a vital tool used to treat cancer. Across the UK, it's estimated that around 4 in 10 people with cancer should receive radiotherapy as part of their treatment [1]. Over the last decade, more than one million people with cancer have been treated with radiotherapy in the UK [2]. Radiotherapy is used across the treatment pathway to manage most cancer types:



**Curative radiotherapy** is where it's the primary cancer treatment.



**(Neo)adjuvant radiotherapy** is where it's combined with other treatments to make them more effective.



**Palliative radiotherapy** is where it's used to relieve pain and improve quality of life if curing the cancer isn't possible.

We're driving efforts to diagnose cancers earlier and improve outcomes for people affected by cancer. Therefore, we need more effective and kinder cancer treatments to offer people and innovation in radiotherapy could provide a solution.

## Where are we seeing innovation in radiotherapy?



**New treatment machines** can deliver alternative radiation sources, such as protons or carbon ions.

These could be used to treat tumours that don't respond well to standard radiotherapy.

For some use cases, evidence of clinical benefit has been established. These machines are now delivering treatment to people at two centres in England. The evidence base is still being built for other machines. The cost of new equipment and the requirement to upskill the radiotherapy workforce are key challenges for implementation.



**New treatment planning approaches** can improve treatment planning, delivery and quality assurance by using new software or tools, such as artificial intelligence (AI) and automation.

This can optimise doses so they're personalised and targeted, and it can facilitate innovative dosing regimens.

Some new treatment planning approaches are now used as part of standard care. Evaluation of new approaches must consider the impact on workflows and clinician training.



**Image guidance systems**, such as MRI or CT, are being incorporated so that imaging and treatment can occur simultaneously, tracking the tumour in real time.

These enable monitoring of changes in tumour shape and can make treatment more accurate for tumours that move during treatment – for example, due to breathing or bladder filling.

Some centres across the UK are already using machines with image guidance systems. However, their adoption and implementation are impacted by the high cost of equipment and gaps in the evidence base.

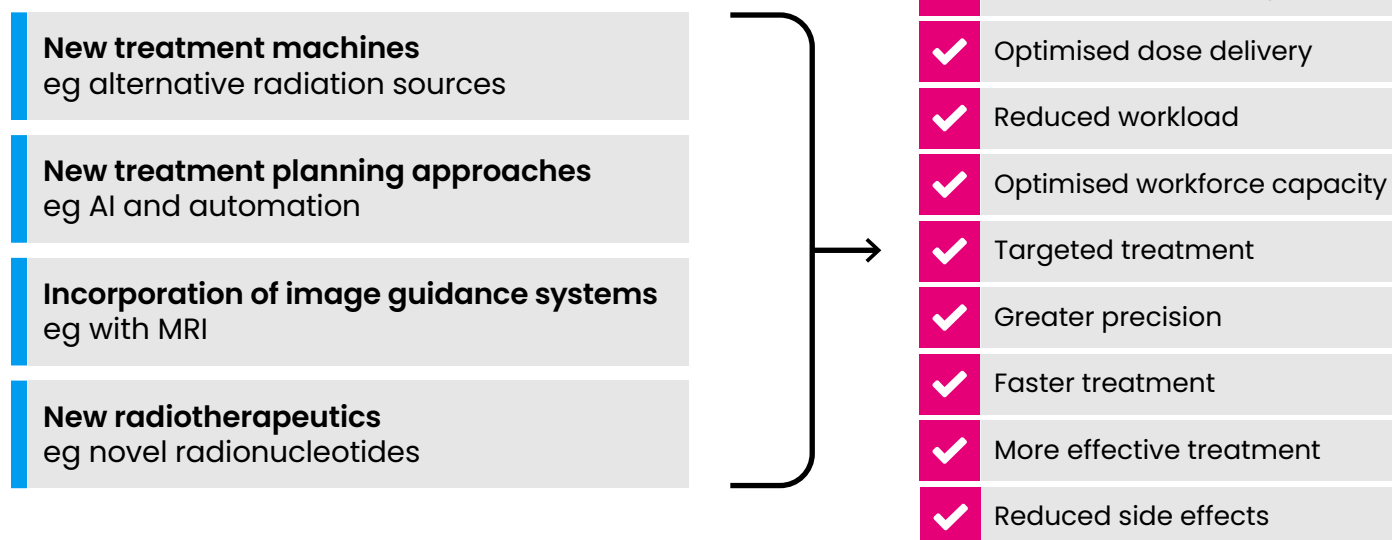


**New radiotherapeutics** are drugs that can direct radioactivity internally to target cancer cells.

These can be effective for people with advanced or metastatic cancer.

Some radiotherapeutics have approval from health technology assessment (HTA) bodies and are already available in health systems. A key challenge is that the delivery of radiotherapeutics crosses clinical departments, which will require upskilling, coordination and access to specialist expertise.

## Benefits of innovation in radiotherapy



## What's needed to progress the integration of innovations in radiotherapy into our health systems?

### 1. Further evaluation and research to plug evidence gaps

Standardised evaluation frameworks for radiotherapy clinical trials and set criteria to assess the value of innovations should be generated through expert consensus.

To help strengthen and progress evidence generation in the short term, we need well-designed clinical trials – for example, **read about standardised proton beam therapy trials**. Research gaps to fill include:

- understanding which patients across cancer types benefit from different techniques, including multimodal treatment
- comparison with innovative treatment options outside radiotherapy
- optimisation of radiotherapy data to link innovative treatments with patient outcomes

We have supported a network of radiotherapy research centres since 2019 to address major challenges in radiotherapy – **click here to find out more about RadNet**

## 2. Health systems that are prepared for the future

Demand for radiotherapy services is only set to grow [4]. Innovation in radiotherapy could deliver a range of benefits, including more effective treatment. Health systems need to plan ahead to support swift adoption and equitable implementation of proven innovations. Like other innovations, this will be reliant on IT integration and data infrastructure that can adapt to support emerging technologies. The radiotherapy workforce will also need to be upskilled and this resource could be leveraged with innovative deployment of staff.

Access to innovative radiotherapy was ranked the second highest priority for cancer patients and carers (after faster start of treatment) in one of our surveys [3].

## 3. Government investment and national coordination to ensure equitable access

Even for innovations with a sufficient evidence base for implementation, there's a severe lack of capital investment to support their uptake. In the longer term, governments need to invest significantly in radiotherapy infrastructure to ensure the equitable implementation of proven innovations.

Radiotherapy is a specialised service that requires skilled staff and kit for delivery. This means that some innovative treatments are only available in certain locations, which may widen health inequalities. We need nationally coordinated strategies to ensure the equitable integration of innovations in radiotherapy across the four UK nations. In the meantime, we need data on variation in access and interventions to support patients to access optimal treatments where they're not delivered locally, including those only available through clinical trials.

**To read more, [click here to look at our policy position statement on the future of radiotherapy in England](#)**

## 4. Sharing learnings

With sufficient investment and national coordination, we've seen the successful adoption and implementation of radiotherapy innovations – for example, **stereotactic ablative radiotherapy**. Researchers and health systems should share learnings from these successes so that more people can access the latest innovations in radiotherapy.



If you have any questions or ideas you'd like to share or discuss with us, email [seinbox@cancer.org.uk](mailto:seinbox@cancer.org.uk)

## References

1. Round CE et al. **Radiotherapy demand and activity in England 2006–2020**. Clinical Oncology, 2013.
2. Estimated based on Cancer Research UK analysis of England data for 2013–23.
3. Cancer Research UK survey – Tell us about your experiences of radiotherapy treatment in England. Unpublished, 2022.
4. Zhu H et al. **Global radiotherapy demands and corresponding radiotherapy-professional workforce requirements in 2022 and predicted to 2050: a population-based study**. The Lancet Global Health, 2024.