Improving cancer care:

Using innovation and collaboration
to achieve world-class standards.

GenesisCare

Foreword

The UK's health professionals achieve incredible things every day. People with cancer are cared for by committed, passionate teams focused on delivering the best possible care.

However, cancer outcomes in the UK lag behind many international comparators. Regional variation in access and clinical outcomes that existed before COVID-19 have been amplified by it. Data now regularly shows longer waits for diagnosis and subsequent treatment to begin, and there remain concerns about the long-term affordability of cancer care.[1]

We welcome the recent call for evidence which aims to make the country's cancer care system the 'best in Europe'. However, we believe the ambition shown needs to be greater and supported through an increased emphasis on innovation and collaboration.

The challenges facing the UK cancer care system are long-term, varied, and complex: demand is increasing - a result of both underlying demographics and the impact of the pandemic - yet capacity, within our clinical workforce, buildings and equipment, is insufficient. In some cases, a reticence to adopt 'novel' diagnostic techniques and treatments has delayed realising improvements in treatment and perpetuated cost and efficiency challenges.

The UK has pioneered treatment in some areas, yet in others it continues to rely on well-established but increasingly outdated models of care that are unable to meet the growing demand.

There are no quick fixes for either the required workforce or the necessary infrastructure. So, what can we do?

We see some 'green shoots'. The pandemic forced the healthcare system to innovate and operate differently. We saw a willingness to collaborate across the public and private sectors. Clinicians were encouraged and liberated to design and accelerate the adoption of new protocols and ways of working. We, therefore, believe we have a 'moment-in-time' opportunity to reset and transform how cancer care is planned and delivered in the UK, based on the best of both current and emerging global practice.

[1] Journal of Cancer Policy

No single organisation has all the answers – the problems are too large and complex. However, drawing on the expertise and real-world experience of leading clinicians globally, it is clear we can improve the treatment of cancer through, for example:

1. Increasing the use of precision medicine.
2. Increasing the adoption of hypofractionated radiotherapy treatment.
3. Optimising the use of modern LINAC and MR LINAC equipment.

For these initiatives to be successful, they will need:

- Capacity for clinical trials that enable, where appropriate, accelerated adoption of new techniques and treatments.
- A policy and clinical decision-making framework in the UK that better accommodates international evidence and practice.
- A willingness to re-look at regional models and the concentration of expertise to deliver dynamic efficiency; and
- Greater sector-wide collaboration, in particular between academic institutions, the NHS and private providers.

If we are to achieve the access, care and outcomes that the population deserves, all those involved will need to work across organisational, sector and professional boundaries. GenesisCare stands ready to play its part.

We believe we have a 'moment-in-time' opportunity to reset and transform how cancer care is planned and delivered in the UK. We should be aspiring to world-leading outcomes and whilst this paper focuses principally on examples from within radiotherapy and precision medicine, many of the principles on which our recommendations are based apply to other areas of cancer care.

Only by harnessing the expertise of all of those who work in and around cancer can we develop a truly outstanding solution for those living with the disease.

Justin Hely General Manager
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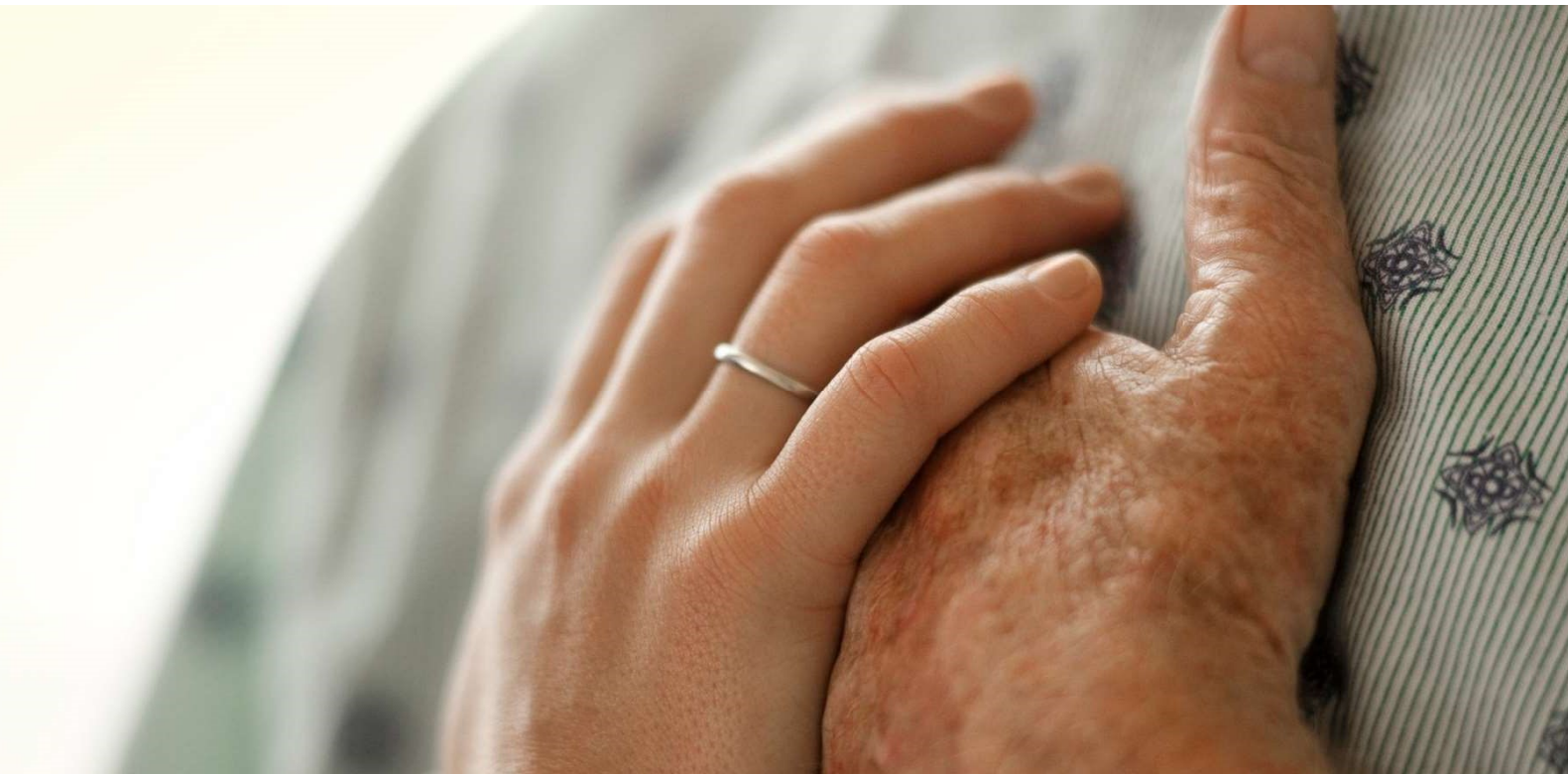


Problem statement: The UK's cancer outcomes need to improve

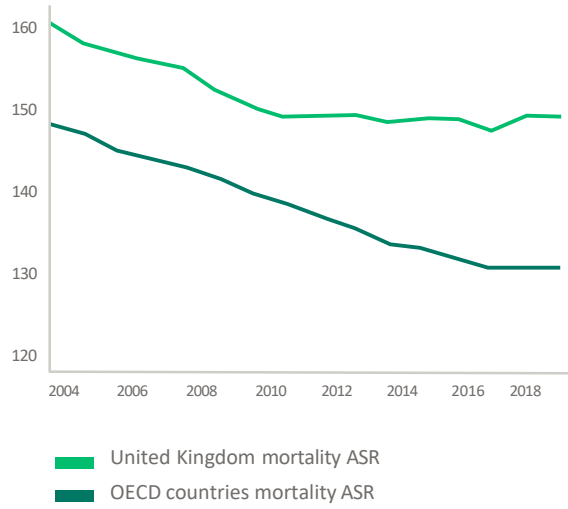
It is widely recognised that, next to international comparators, the UK's cancer outcomes lag behind where they could – and should – be. Mortality rates across all cancer types in the UK rank in the worst third globally (63 of 185, where 1 is the worst). Between 2009 and 2019, the UK's cancer-related mortality rate declined at a lower rate than the rest of the world, seeing an overall decline worth only 25% of that seen in the global average (figure 1).[2] Within the UK, cancer incidence and mortality vary significantly by region: for example, age-standardised incidence rate across all cancer types was 11.5% higher in the Northwest of England than in London.[3]

Performance against national cancer waiting time targets was declining before COVID-19. In March 2022, waiting times for cancer were the longest on record, with 1 in 4 individuals waiting more than two weeks to see a specialist (see figures 3 and 4).

Despite significant efforts to increase diagnostic capacity and improve surgical productivity and capacity, insufficient access across primary and secondary care is resulting in delayed diagnoses and treatment.

> "Recent NHS England data confirms the huge challenge still facing the NHS, with performance against cancer waiting times going from bad to worse over the last year."
>
> Head of Policy, Macmillan Cancer Support[4]

Figure 1: Age-standardised mortality rates per 100,000 people (UK and International Comparators, all malignant cancers)[5]



[2] Lancet Oncology
[3] Office for National Statistics
[4] Article published in the Metro, 2022
[5] Global Burden of Disease Collaborative Network, 2017. Variation from Figure 2 is driven by the different data collection methods between sources

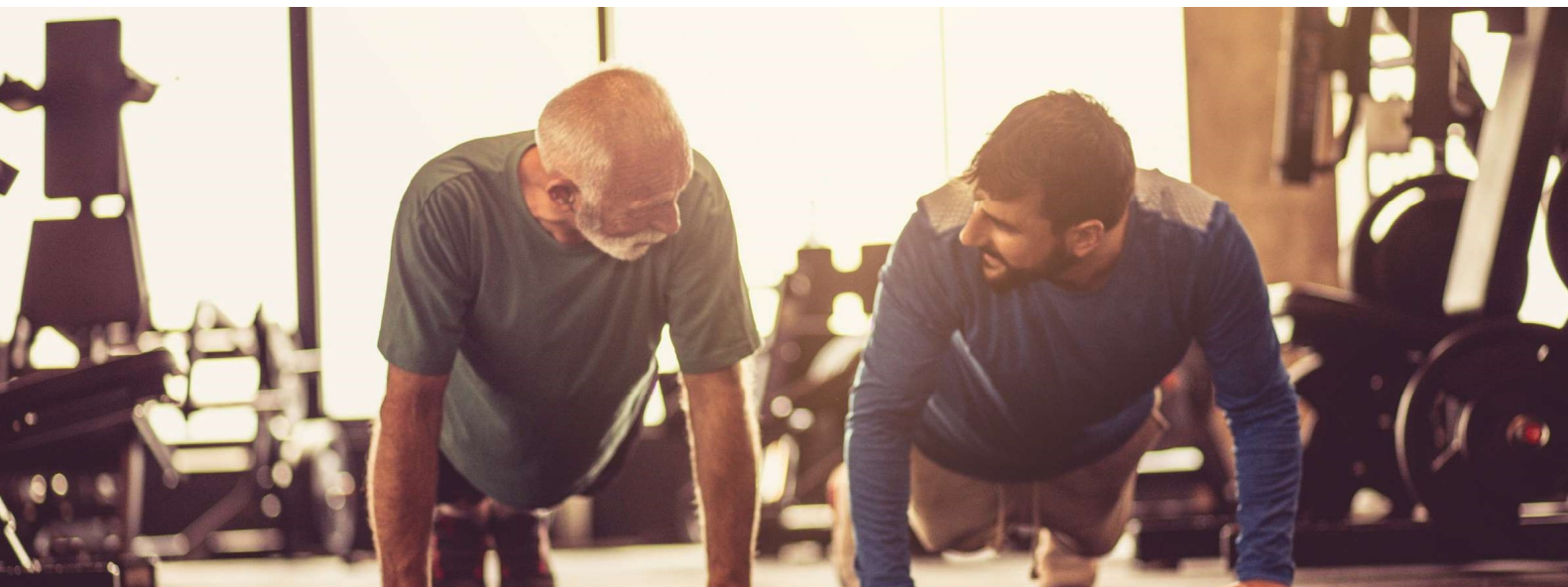


Figure 2: Age-standardised cancer incidence and mortality rates per 100,000 people (UK vs other countries, 2020)[6]

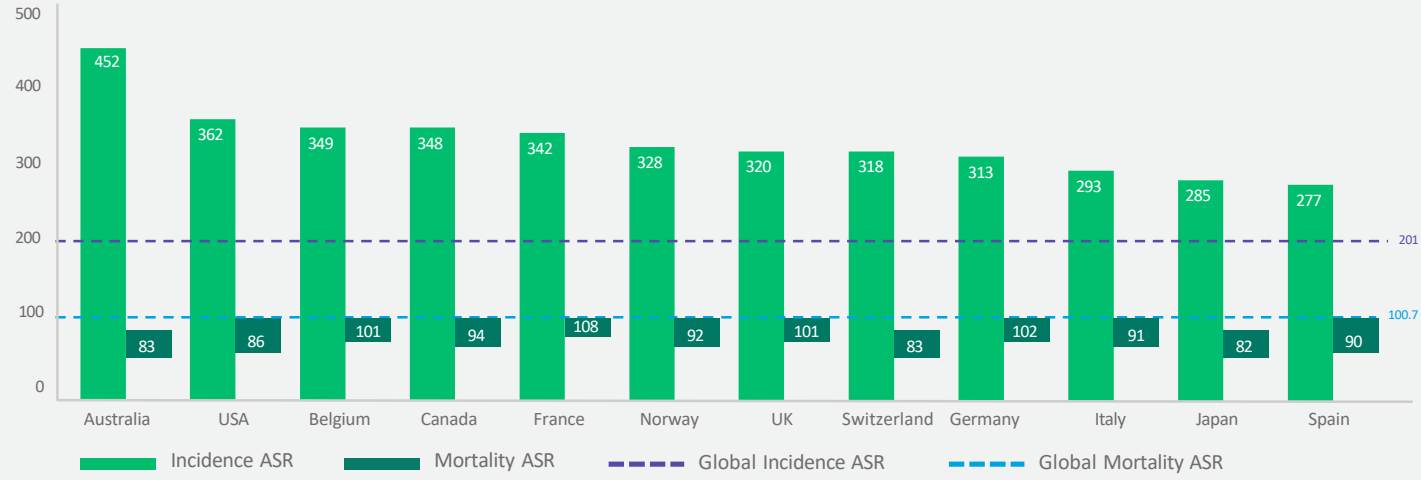


Figure 3: Percentage of cases that meet government waiting time targets, 2009 – 22[7]

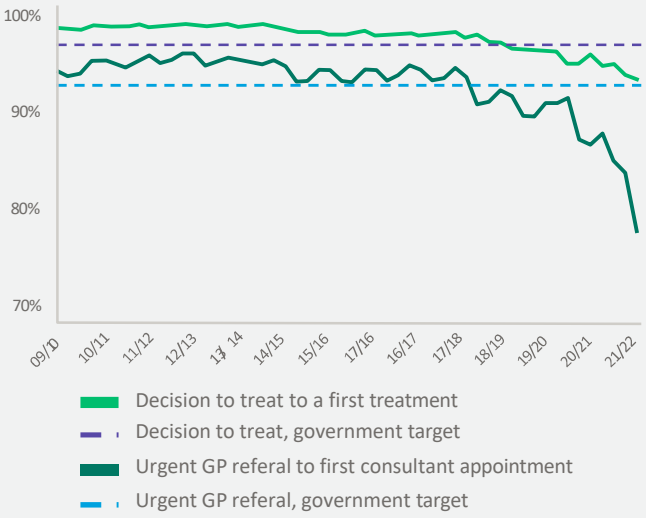


Figure 4: Percentage of cases that meet 31-day government waiting time to treatment targets by treatment type, 2009 – 22[8]

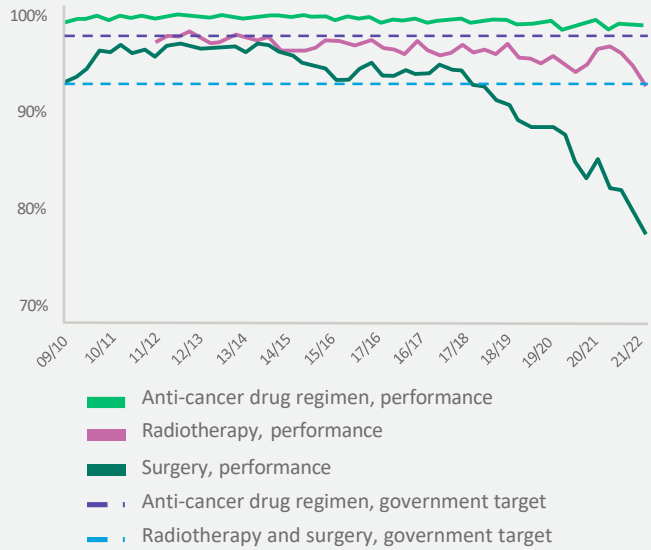
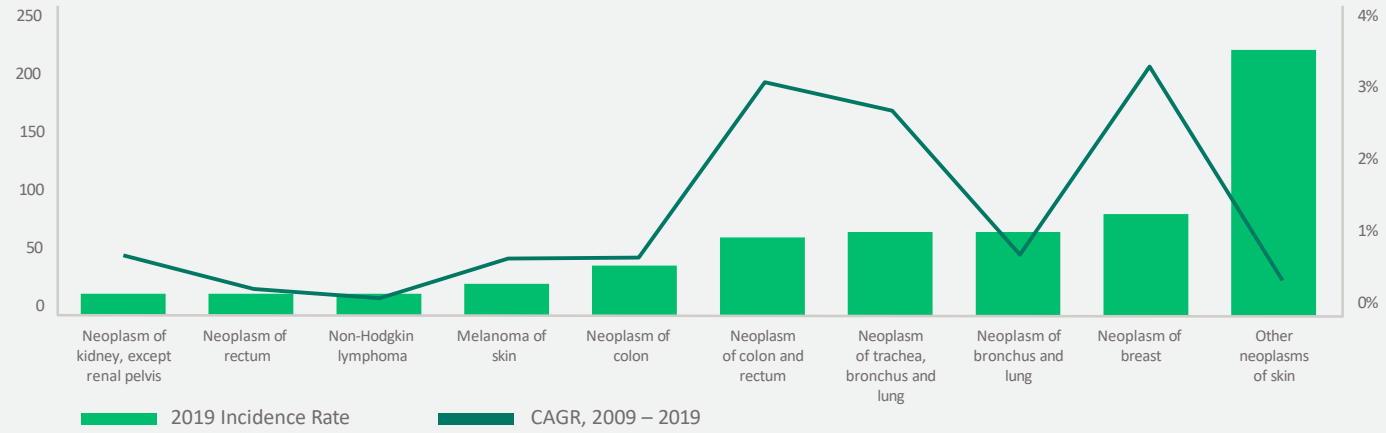


Figure 5: Incidence rate and growth in incidence rate by tumour type[9]



[6] GLOBOCAN 2020
[7] NHS
[8] NHS
[9] National Cancer Registration and Analysis Service

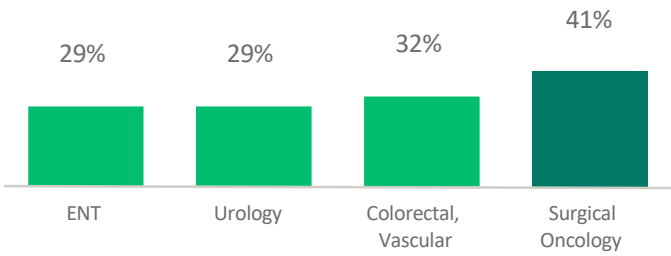
Issue 1: Insufficient capacity to meet rising demand

A major cause of the issues faced by the UK's cancer care system is a lack of capacity. Put simply, at present, the number of patients requiring treatment is more than the system can handle. Clinicians' time is stretched, waiting lists are growing, and regional variations demonstrate that the standard of care is variable – meaning inequitable outcomes for patients. The main drivers of the lack of capacity are threefold.

Driver 1: Workforce shortages

Across all role types, the oncology workforce in the UK is in crisis. 52% of cancer service leaders reported that workforce shortages have negatively impacted the quality of patient care they can deliver.[10] Whilst workforce shortages have been an enduring challenge across the NHS' 70-year history, oncology is facing a particularly acute workforce shortage.

Figure 6: Reported prevalence of burnout by specialty[11]

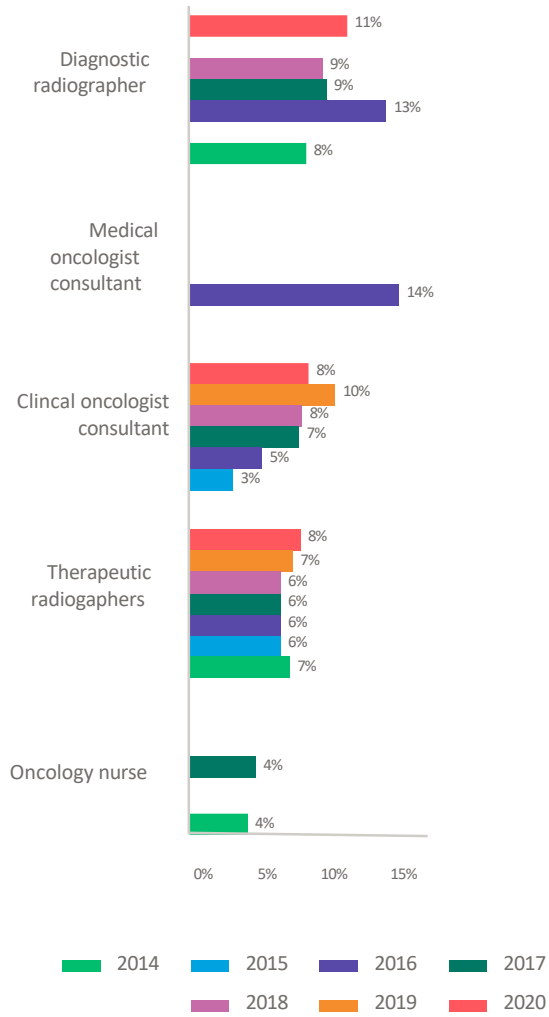


This shortage is mirrored across international comparators – indeed, by 2025, the United States expects to face a shortage of more than 2,300 medical oncologists.[12] This suggests that the drivers of the shortage are not specific to the UK – and the issue is not, therefore, straightforward to resolve.

This situation is expected to worsen. Growth in the number of consultant clinical oncologists is expected to fall from 3% to 2% annually with some regions forecasting an overall decline in the total number employed.[13] Less-than full-time working among consultant oncologists is projected to rise, leading to further shortages. While the number of trainee oncologist positions has increased, training takes years and overseas recruitment is unlikely to fill the gap.

By 2025 and in the UK, 1 in 4 Consultant Clinical Oncologist posts will be vacant. Given their central role in providing novel radiotherapy treatments, this is of particular concern (see below).[14]

Figure 7: Vacancy rate by role type, 2014–2020



The broader shortage of medical professionals in the UK is also likely to have knock-on impacts on cancer outcomes. The shortage of General Practitioners is expected to grow four-fold by 2028/29 to 11,500.[15] This will make it more – not less – difficult for individuals to get access to early diagnostic investigations and treatment.

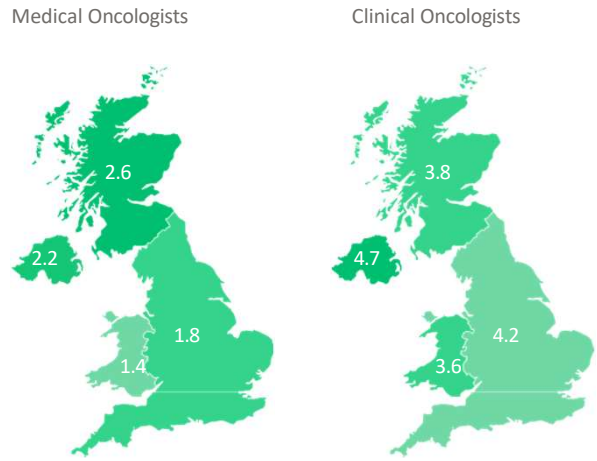
[10] Clinical Oncology UK Workforce census report, 2020
[11] Burnout within UK surgical specialties: a systematic review, Royal College of Surgeons of England, July 2021
[12] American Society of Clinical Oncology
[13] Clinical Oncology UK Workforce census report, 2020
[14] Clinical Oncology UK Workforce census report, 2020

Beyond simply limiting the quantity of care that can be provided to patients, workforce shortages present broader challenges to the system, including but not limited to:

- Reducing the resilience of the system, for instance when illness reduces staff availability.
- Increasing the risk of staff burnout, due to increased hours and higher levels of responsibility and stress.
- Reducing the capacity to invest in clinical trials, research and continued professional development.

Definitions	
Medical Oncologist	Doctor with an expertise in using drugs to treat cancer
Clinical Oncologist	Doctor with an expertise in using drugs and radiotherapy to treat cancer

Figure 8: Oncology Consultants per 100,000 population (50+ years), 2020[16]

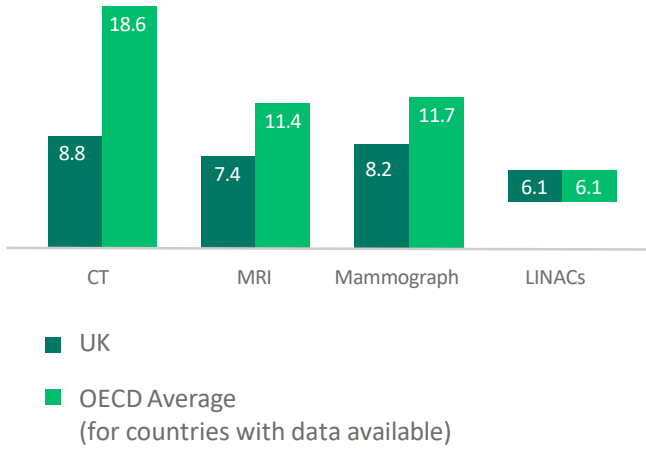


Driver 2: Underinvestment in infrastructure

Even if there was sufficient staffing in place across roles, the capacity of the UK cancer care system would remain constrained by the availability of both diagnostic and therapeutic equipment.

The UK has fewer MRI, CT and other complex imaging scanners per capita than comparable countries such as Germany (18.8 CT scanners in hospitals per 100,000 inhabitants compared to the UK's 8.8). Equipment is ageing and in some areas of depreciating quality. In 2021, 27% of trusts in England had at least one out-of-date CT scanner, while 35% had an out-of-date MRI machine.[17] At the end of 2019, 23% of Linear Accelerators (LINACs) in the UK were over 10 years old.[18] This poses challenges to the UK's ambition to provide European and world-leading cancer care. Older equipment is more prone to breaking down, causing cost inefficiency and risking delaying treatment. In some cases, older diagnostic imaging assets produce lower quality images and have hardware or software limitations which affect a clinicians' ability to prescribe newer treatments.

Figure 9: Number of selected medical technology assets in hospitals, per million inhabitants, 2019[19]



While £325m has been earmarked by the NHS for the replacement and expansion of diagnostic equipment (UK Budget Statement, November 2020), only £32m was allocated to LINAC replacements. Given the improved capability of new LINAC technologies this is likely to be insufficient to support the delivery of world-class cancer care over the coming 10 years.

[15] Closing the gap: Key areas for action on the health and care workforce, 2019
[16] Clinical Oncology UK workforce census report 2020
[17] Channel 4 Dispatches, FOI request
[18] European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry, December 2019
[19] OECD; COCIR

Driver 3: Increased demand

Workforce shortages and infrastructure challenges exacerbate the impact felt by the sustained demand for cancer care.

The COVID-19 pandemic has generated a severe backlog in cancer care. Estimates indicate that there are around 40,000 undiagnosed, "missing", people with cancer in the UK. This is the result of patients not presenting to primary care in the first place, and of an inability to get referral appointments.[20] It is expected that 90% of these "missing" patients will eventually present for treatment, almost inevitably with more complicated or greater disease progression.

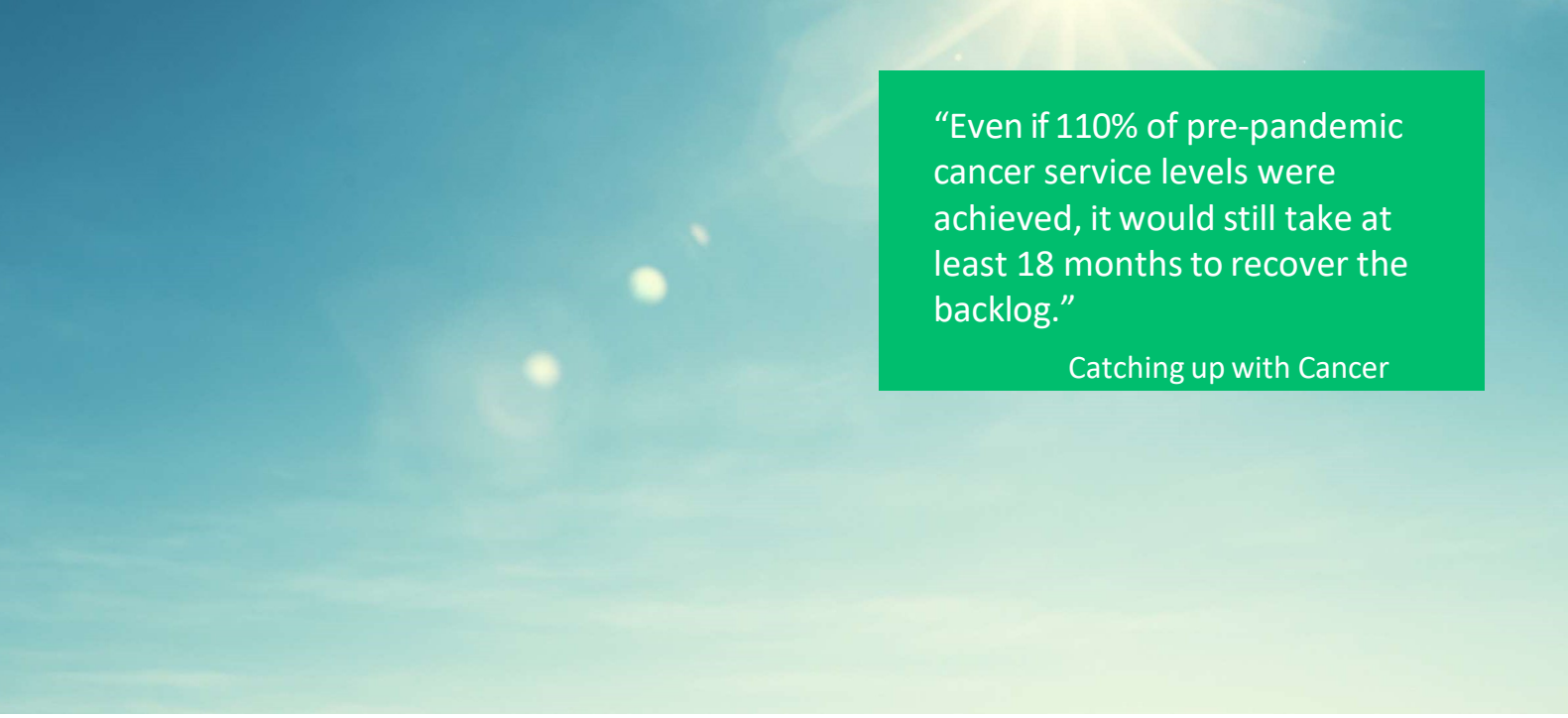
At a health economic level, later presentation is likely to result in more complicated, more costly treatment with a lower likelihood of success. For example, the cost of nine years' worth of treatment for individuals with a stage 3 or 4 breast tumour at diagnosis are more than 50% higher than for those diagnosed at stage 1 or 2.[21]

Demand for cancer services in the UK is projected to grow. This is driven by four key trends, each of which compound each other, and each of which is forecast to continue in the coming years.

Table 1: Drivers of growing demand

Driver	Last 5 years trend	Next 10 years trend	Impact on cancer incidence rate
Population growth[22]	+ 0.53% p.a.	+ 0.36% p.a.	Absolute volume of cancers will increase as the population volume rises.
Ageing population[23]	+12% in 60+ population (2017–22)	+17.6% in 60+ population (2022–32)	More than 75% of cancer diagnoses are in those 60 and over, so the proportion of the population with cancer is expected to increase.
Increased spending	↗	↗	While the real incidence rate won't change, the proportion of cancer cases that are diagnosed and, therefore, treated will increase with the expansion of existing screening and the implementation of new screening technology.
Improved life expectancy of cancer patients	↗	↗↗	Global improvements in our ability to treat cancer have driven a paradigm shift in the patient demographics and treatment burden. Whereas historically oncology patients would be cured or provided with short-term palliative care, many more patients now receive long- term, life-sustaining treatments over many more years – effectively increasing the duration and therefore volume of care.

[20] Cancer backlog could take till 2033 to clear without more consultants, says report, British Medical Journal, Clinical Oncology UK Workforce census report, 2020
[21] British Journal of Cancer
[22] United Nations
[23] Office for National Statistics



> "Even if 110% of pre-pandemic cancer service levels were achieved, it would still take at least 18 months to recover the backlog."
>
> Catching up with Cancer

Issue 2: Lack of agility in the system for approving and implementing novel diagnostic techniques and treatments

At present, introducing a novel treatment takes time. Licensing and regulatory approvals are significant and these can result in delays to patients being able to access treatments. In 2019, it took on average 726 days between a patent being granted and NICE approving a drug.[24] After this, contract negotiations, staff training and treatment roll-out often add further time. However, the COVID-19 pandemic has highlighted just how quickly approval processes can adapt, regulatory bodies can act, and guidelines can be updated in periods of crisis.

The UK already has a strong international reputation in relation to medical research. The uptake of novel therapies by the NHS, for example CAR-T, clearly demonstrates the effectiveness of NICE and the UK cancer care system working closely to identify, support, and translate innovation into clinical practice. This paper offers examples of other such treatments on the following pages, where we believe access is needed more widely if the UK is to provide leading care to cancer patients.

We believe that, as a range of novel diagnostics and therapeutics become increasingly important to the delivery of high- quality medicine, so optimising the approvals and rollout process will be key to the UK's success in developing a world-leading cancer care system. As the vaccine approvals process demonstrated during the pandemic, it is possible for new treatments to be robustly assessed and then approved more quickly. Therefore, the question we pose is whether a similar level of focus is needed to improve for new and emerging treatments for cancer.

We acknowledge that this is not the only question facing the UK's cancer care system. Nonetheless, it represents a significant barrier to improving care. We suggest that the increased use of innovative radiotherapy treatments, optimising the UK's existing radiotherapy infrastructure, and an increased use of precision medicine for all patient groups and tumour types (including a more agile approval process) will make a significant contribution.

[24] IQVIA

Radiotherapy

Radiotherapy is a crucial component in the treatment of cancer. Whilst used less in the UK than international standards recommend – for approximately 27% of patients rather than the recommended 50% – it still represents a sizable contribution to the cure and management of cancer.[25] Radiotherapy can, in some cases, be offered as an alternative to chemotherapy and surgery, is recognised as one of the most Covid-safe treatments available, and the cost to cure a patient can be as little as 15% of that of some chemotherapy.[26] Radiotherapy is, therefore, able to play a vital role in addressing the challenges facing the UK's cancer care system. However, the UK's ability to deploy radiotherapy across the patient population is currently limited by workforce shortages and the available equipment.

As it appears unlikely that there will be sufficient investment to address these challenges in the short term, the UK's cancer care system will need to adopt innovative models of care to ensure that limited resources are able to go further.

Although there is not a single, simple way of delivering this proposition, this section presents two proposals which will contribute to efficiencies and allow the system's existing resources to be used to their full capacity.

Hypofractionation:

This 'short and sharp' approach involves treating patients with higher individual doses of radiation over a reduced number of treatment sessions.

Linear Accelerators use:

A linear accelerator (LINAC) provides external beam radiation treatment to cancer patients, by emitting a stream of high- energy X-rays or electrons. These are aimed at cancerous cells, which they damage and, over the course of treatment, hopefully destroy.

Proposition 1: Increase the use of hypofractionated radiotherapy

Hypofractionation has the potential to mitigate some of the impact that workforce and equipment shortages present, by allowing a greater number of patients to be treated using the same workforce and equipment capacity. Essentially, total treatment times are shorter. Whist the move towards hypofractionated treatment is a long-running trend, current technological developments and a growing body of clinical evidence show that this can be taken further and that there are, therefore, additional efficiencies available within the UK's healthcare system.

Concerns about toxicity and the risk to healthy tissue have historically held back a more routine application of hypofractionation, both in terms of expansion to new cancer types and further increasing the dose per treatment. However, the use of more advanced modes of delivering treatment – namely SABR and MR LINACs – is helping to address these concerns.

The heightened accuracy enables higher doses to be used as the risks to healthy tissue are lower. It also offers the potential to transform care for advanced-stage cancers, where patients are likely to have multiple, small secondary tumours. For this patient group, MR LINAC hypofractionation could be used to give a very targeted, high-dose treatment to many more sites in one session.

Stereotactic Ablative Radiotherapy (SABR):

SABR uses modern LINAC devices with smaller, more configurable beams to deliver more precise application of the radiation to the tumour site. The beam is applied to the tumour in an arc around the body, meaning that while the tumour site is targeted with the full dose the surrounding healthy tissue receives a much lower dose. This enables patients to be treated with a higher dose without the associated side effects.

MR LINAC:

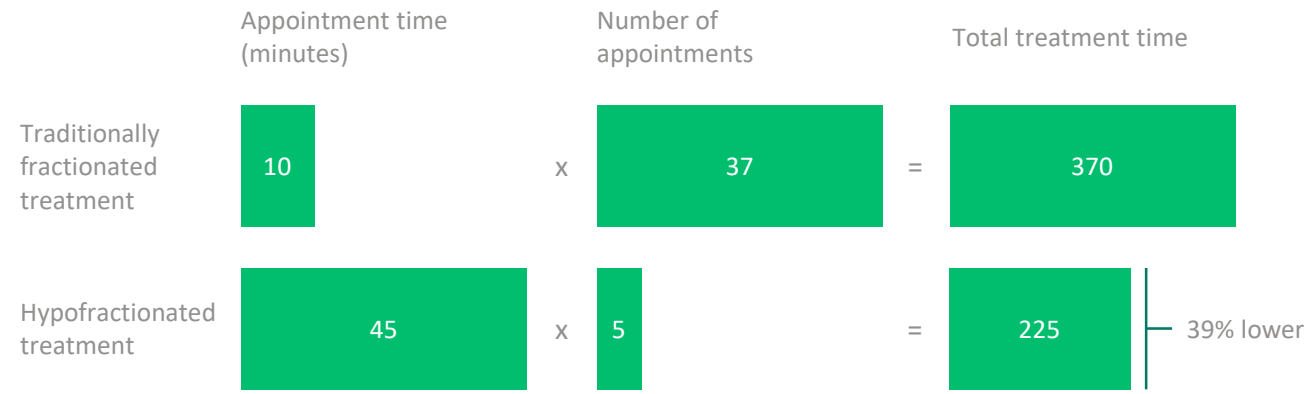
An MR LINAC combines MRI imaging technology with the treatment capabilities of SABR. This enables the beams to be targeted at the tumour in real-time, as it moves in the body – for example as the bladder fills – providing greater reassurance that healthy tissue will be protected.

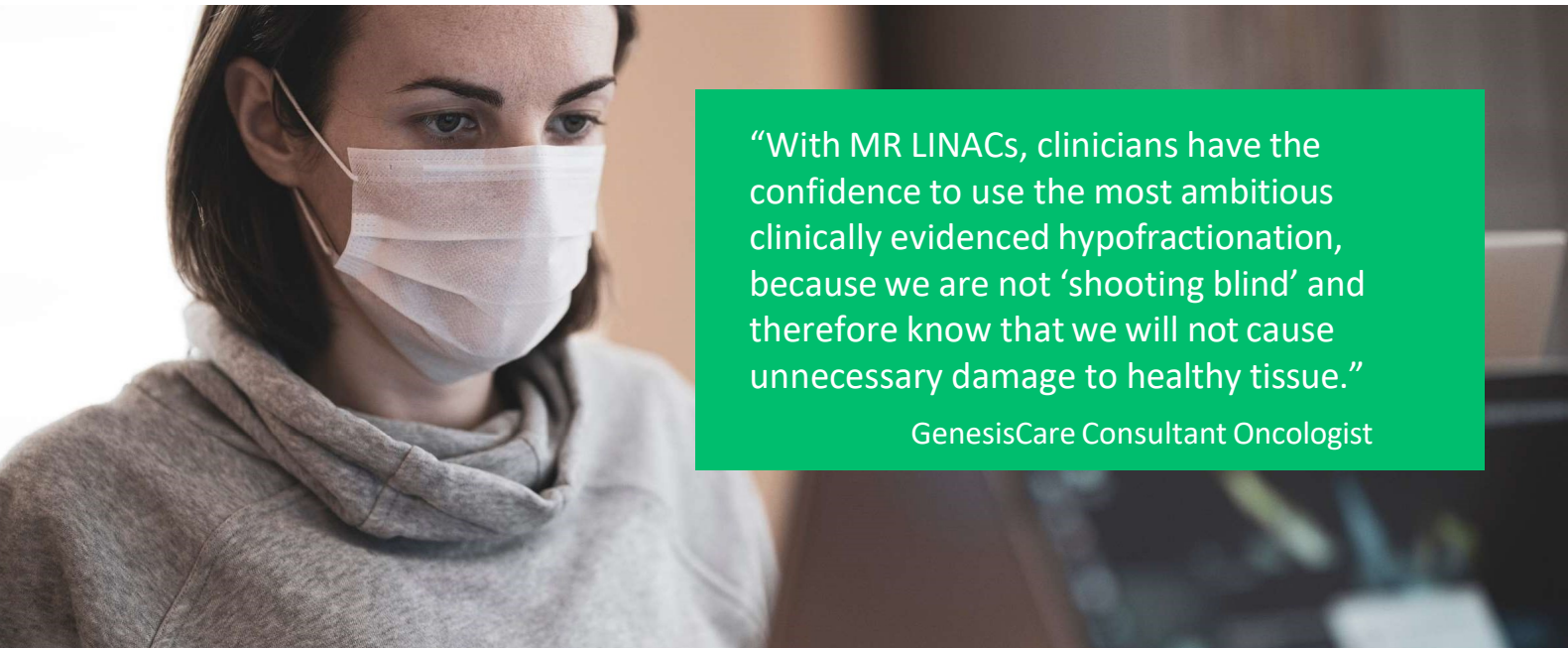
[25] Catch up with Cancer
[26] Catch up with Cancer
[27] Prostate Matters

Table 2: Reasons to increase the use of hypofractionated treatments

Improved patient experience	• Delivering treatment over fewer appointments reduces the travel burden on, and cost to, patients • Reduction in acute side effects, as the radiation dose to healthy tissue is lower • The requirement for surgery tends to be reduced, or even removed altogether in some cases, due to the effectiveness of the treatment, which removes the requirement for inpatient stays, invasive procedures and potentially long recovery times
Clinical equivalence or benefit	• For a growing number of diagnoses, in particular breast cancer, there is now consistent evidence of comparable outcomes for hypofractionation when it comes to recurrence, disease-free survival, and overall mortality, compared to more conventional fractionation • For example, the CHISEL study in Australia (2019) found that for patients with early-stage lung cancer, SABR treatment was more effective in controlling cancer growth than conventional radiotherapy. Whilst with SABR 89% of cancers were controlled two years after treatment, only 65% were controlled with conventional treatments. Furthermore, after two years, 77% of patients who received SABR were surviving, compared to 59% with conventional radiotherapy
Staff and asset efficiency	• Reduced overall treatment time reduces the number of staff hours required, across multiple job roles, and the time on the machine – creating capacity to increase patient throughput • As outcomes improve and the number of appointments declines, patients will become more willing to travel to regional hubs, delivering efficiencies by ensuring that assets are working at full capacity and centralising expertise. This is already being seen in the private sector

Figure 10: Impact of hypofractionation on total treatment time for an average prostate cancer patient[27]



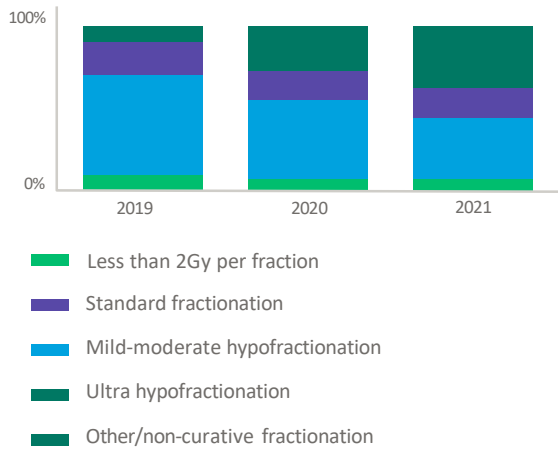


Current provision in the UK:

The use of hypofractionation – treating patients in fewer sessions - was accelerated during the pandemic to reduce the number of visits patients needed to make to hospitals, thereby helping to protect them and others from infection. NHS provision of hypofractionated SABR was also rising pre-pandemic thanks to a successful Commissioning through Evaluation programme and the number of centres offering SABR grew from 31% in 2012 to 75% in 2018. However, access remains geographically inconsistent and not all established SABR indications are funded. For example, whilst SABR for primary lung, liver and prostate cancer is available, it is not widely available or funded for renal and pancreatic cancers. Another example would be oligometastatic disease: whilst synchronous liver mets from a colorectal primary are funded for SABR, synchronous liver mets from lung cancer are not.

SABR in the private sector is more aligned with international best practice than with NHS commissioning rules. Insurers are generally willing to fund SABR for clinical situations in which existing evidence exists, particularly when the decision to offer treatment is taken in the context of a robust MDT process and in private centres with the requisite expertise. The private sector may also have access to more advanced equipment. For example, GenesisCare has offered primary pancreatic cancer with MR-guided SABR (which offers more accurate radiation targeting and therefore a lower rate of side effects) to private patients since 2019, and in 2020 established a Compassionate Access Programme that made this treatment available to 50 NHS patients free of charge – a treatment they would not otherwise have been able to access at any NHS hospital. It has also established partnerships with the University of Oxford to and other organisations to widen access to MR-guided SABR within clinical trials for NHS patients.

Figure 11: Radiotherapy treatments by fractionation, England[28]



Increasing the number of patients and range of cancers treated with hypofractionated SABR would make more efficient use of the NHS' resources and contribute to solving the capacity issues outlined in this paper. Critically, however, much of the UK's LINAC infrastructure is too old to provide this kind of treatment. Accordingly, to realise the potential benefits of hypofractionation, as much of the UK's capacity of MR LINACs and modern, SABR- capable LINACs must be used to deliver SABR treatments as possible – this forms the basis of our second recommendation.

Proposition 2: Optimise the use of MR LINAC and modern LINAC technology

Currently, patient pathways are not designed to take into account the capability of equipment to deliver hypofractionated SABR treatment. This means that (1) patients who would benefit from hypofractionated SABR are not receiving the most appropriate and efficient treatment, and (2) patients for whom hypofractionated SABR is not appropriate are being treated on the limited number of machines capable of delivering such treatment, effectively reducing the NHS's capacity to provide SABR to suitable patients.

Adopting a regional – or even national – approach to asset utilisation would enable physicians to channel patients to the most appropriate therapy, directing SABR-eligible patients to MR LINAC and modern LINAC machines, and directing patients who are not eligible to receive SABR to the older LINAC equipment, which is capable of delivering non-SABR treatment in the same time as is possible on a modern LINAC.

Table 3: Treatment time achieved by patient type and treatment modality

Patient Type	Shortest possible treatment time	Treatment time achieved on modern LINAC	Treatment time achieved on old LINAC
Suitable for MR LINAC	**A**	**B**	**C**
Suitable for SABR	**B**	**B**	**C**
Not Suitable for SABR	**C**	**C**	**C**

For instance, if a region has one modern LINAC, capable of SABR, and one older LINAC that could not provide this treatment, all patients suitable for SABR should be treated on the modern machine while non-suitable patients should attend the centre with the older LINAC (noting that some 'spill over' between these groups would be required to ensure neither machine is left underutilised). The overall throughput of the system would increase, as more of those patients who are eligible for SABR – with lower total treatment times on the machine – would receive this more efficient care. In turn, this would create additional LINAC capacity to provide treatment to additional patients.

[28] NHS England
[29] British Institute of Radiology
[30] NHS England

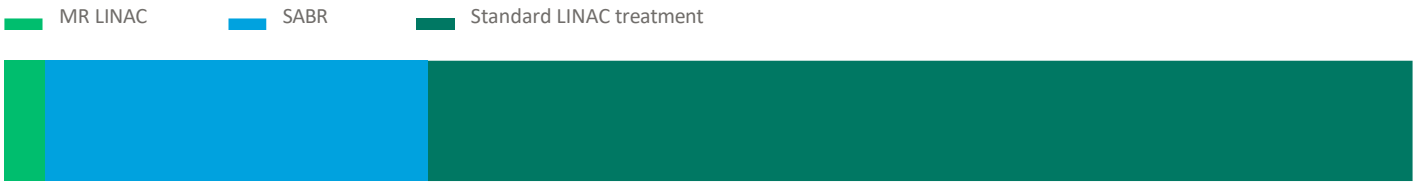
Whilst novel approaches to radiotherapy cannot resolve the whole cancer challenge, they can enable a meaningful re-design of treatment plans and patient pathways, and therefore increase the efficiency with which the UK's existing resources are deployed – increasing capacity and, ultimately, saving lives.

Figure 12: Current and future view of treatments and assets

Indicative patient breakdown and treatment flows

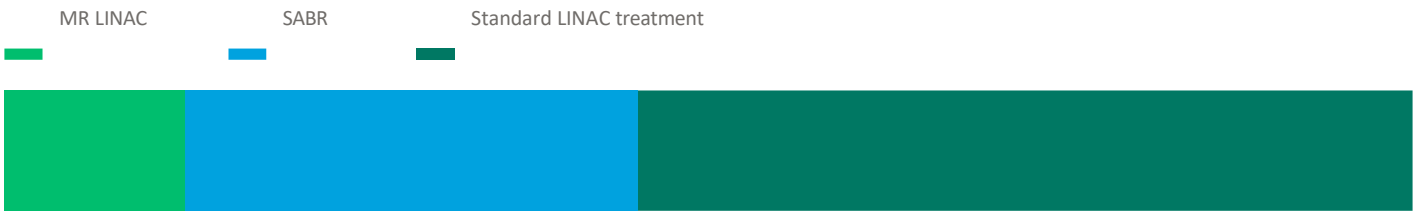
The NHS currently takes a conservative view on what radiotherapy treatments are appropriate for different patient groups, typically using less SABR treatment than the evidence would suggest

Patient population by appropriate treatment modality: NHS view

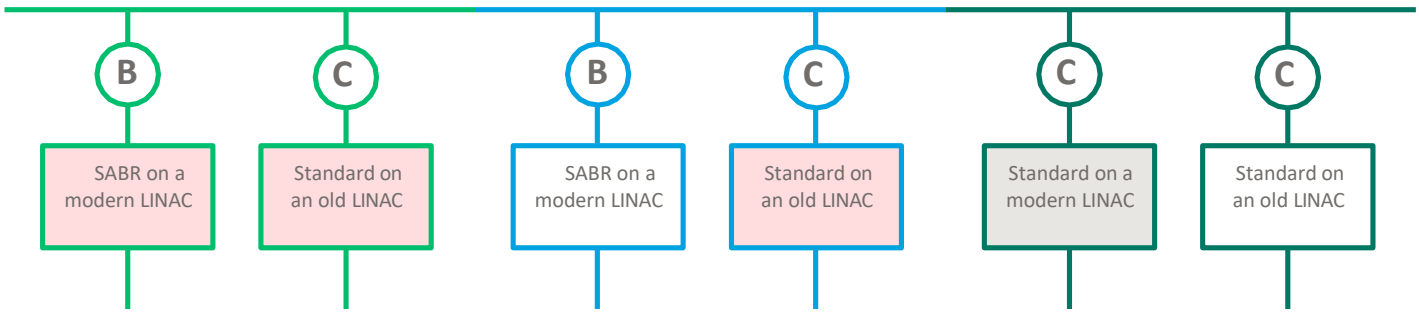


We believe that a wider range of cancers could be treated with SABR and MR LINAC radiotherapy, and that more hypofractionated regimens are possible. This would change the mix of equipment that should be used to treat patients

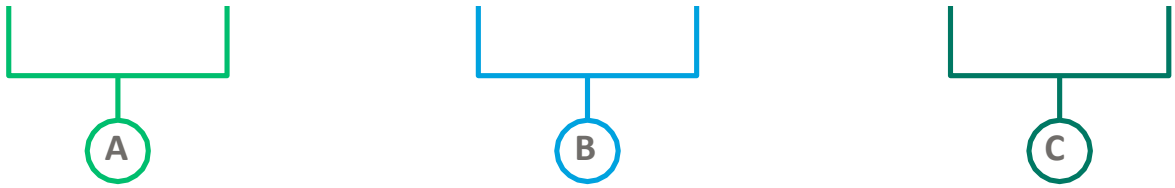
Patient population by appropriate treatment modality: GenesisCare view

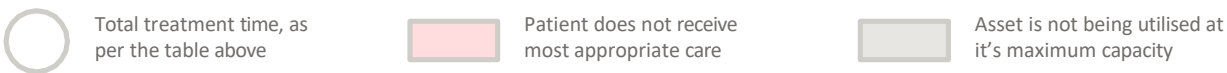


Currently, MR LINACs are only used in Clinical Trials on the NHS, and much radiotherapy is performed using old equipment that is unable to perform SABR. This means patients who would benefit from SABR are not receiving the most appropriate care, and the efficiency benefits of SABR in terms of throughput are not being realised



Allocating radiotherapy appointments – and assets – from a whole-system capacity perspective would improve the accessibility of appropriate care and ensure that all assets were being used at their maximum capacity





Personalised medicine

Novel cancer drugs are now highly specialised. Indeed, approximately 73% of oncology drugs in development are considered 'personalised medicines' in that a new drug may only be relevant to those with specific underlying characteristics or in certain patient demographics, even within a single tumour group.

It is widely recognised that personalised medicine will drive much of the advances in patient experience and outcomes in the next ten years.

However, to truly realise the potential value of these benefits, the UK must make sure that these services are being made available to as many suitable patients as possible.

Proposition 3: Increase the use of precision medicine for all patient groups and tumour types

In order to realise the benefits of these precision treatments within routine practice, cancer systems must excel in two key areas:

i. For each patient, the identification of a very specific diagnosis and the assessment of the best possible treatment option(s) in light of that diagnosis.

ii. The ability to monitor, develop, and approve new therapies and associated technologies, and the ability swiftly to integrate these innovations into care pathways.

Our ability to make these specific diagnoses, and use diagnostic information to inform treatment decisions, is being transformed by developing technologies. The establishment of next-generation sequencing (NGS) and the emergence of cell-free DNA (cfDNA) analysis represent two of the most promising techniques. In order to further develop and implement the use of these technologies, and therefore deliver on their potential, the UK must invest in the necessary infrastructure and human capital. We suggest that, as is already being done with NGS, regional hubs for this diagnostic work present an efficient model.

Diagnostic example 1: Next Generation Sequencing (NGS)

Next Generation Sequencing (NGS) is a high throughput sequencing technology which offers the scale, sensitivity, and speed to analyse genetic codes effectively at a target region through to genome-wide level. By locating genetic mutations in a biopsy of the patient's cancer, it can be used to recommend a personalised treatment – often one that would not usually be associated with that tumour type if following a standard treatment pathway. Within clinical research it has already revolutionised what is possible for cancer genomics, with the capacity to sequence thousands of genes simultaneously in parallel providing a depth and discovery power well beyond that of traditional technologies. This accuracy and detail improves the specificity of diagnosis, and supports more widespread personalisation of patient treatment plans based on molecular profiles.

However, the question of when and how to use NGS within routine practice continues to raise debate. NHS provision is primarily reserved for advanced cancer presentations for which a requisite number of established genetic sequences, and associated targeted therapies, are available. Within the private sector, access remains only marginally broader, with some cautious expansion into more aggressive tumour sub-types, as well as rarer diagnoses and individuals where stratification to clinical trials could open up further 'off-label' avenues to be explored. However, the recent development of infrastructure, aligned with the NHS Genomic Medicine Service, and the expanded availability of these targeted therapies has fundamentally shifted this dynamic. The integration of NGS earlier and more widely into routine care pathways could enable better access and more effective initial therapeutic selection. This would lessen the overall treatment burden placed on both patients and associated service providers, collectively improving patient outcomes, and driving forward care experience at a reduced long-term cost.

Once the system can accurately and effectively identify what therapeutic or treatment options should be offered, those treatments then need to be delivered to patients in a timely and efficient manner. This requires infrastructure – such as talent and training, equipment, manufacturing, and laboratory support – to be accessible across the UK. It also has a significant dependency on our ability to monitor the emergence of promising new therapies and support their development.

One way that personalised therapeutics can be delivered in an efficient manner is via the use of regional hubs or centres of excellence, as is currently being done with CAR-T cell therapy in the NHS. This generates quality and efficiency benefits, by limiting training requirements to a subset of the total medical oncology profession and increasing the utilisation of that training where it is given.

Over time, this concentration of experience will also generate more expertise and knowledge than a diffuse model across the UK. Whilst, historically, concerns about patient unwillingness to travel for care have predominated, as attitudes to health and wellness shift and patients become more demanding of personalised care this is expected to become less of a limiting factor – as is already being seen in the private market.

Diagnostic example 2: Cell-free DNA

As tissues within the body grow, breakdown, and are replaced, fragments of DNA are released into the bloodstream, and for many individuals with an underlying cancer diagnosis a small fraction of circulating tumour DNA (ctDNA) can be detected. Owing to the minimally invasive nature of these techniques, with samples largely derived peripherally from blood, and the broadening range of cancer sub-types which can be detected, cfDNA analysis appears ideally placed to take on a more substantial role within cancer screening, prognostication, and treatment planning moving forward, as well as enabling closer disease monitoring (both for those undergoing active treatment and for those in remission).

The application of cfDNA analysis within cancer services in the UK is highly variable, both regionally and across different stages of the patient care journey. Although there remains considerable work to be done to refine technical processes, the feasibility of ctDNA as a more standard biomarker within medical oncology is gradually filtering through to larger scale research trials and more routine practice. In England, the NHS-Galleri and SYMPLIFY trials now represent two of the world's largest clinical studies to date appraising cfDNA analysis as a screening test for cancer detection. However, the expansion of FDA-approval for ctDNA assays in the United States (used as companion diagnostics for tumour profiling and broader targeted therapeutics now available across ovarian, lung, breast, and prostate cancer) clearly demonstrates how these techniques can potentially play a far wider role in the future. Likewise, there is a growing body of thought that ctDNA may actually be of most value at later stages in the patient care journey. The use of cfDNA analysis as a means more accurately to measure treatment response, to identify earlier concerns regarding therapeutic resistance, and then as a routine method of high-risk disease monitoring for recurrence could transform precision medicine within clinical oncology, reducing exposure to unnecessary treatment, the frequency of periodic imaging, and the associated provider time and costs.

Therapeutic example 1: Theranostics

Combining advanced diagnostic imaging with radio-labelled therapeutic tools, theranostics allows real-time monitoring of treatment efficiency and local delivery of precise radiotherapy to tumours. Cancer-specific antibodies are radiolabelled before being given to the patient. They then attach to the cancer cells, and deliver radiation therapy to the tumour, whilst avoiding surrounding areas of healthy tissue. To date, most evidence and clinical success has been found in treating metastatic drug-resistant prostate cancer and advanced neuroendocrine tumours, but evolving technical advances and expanding applications in clinical research suggest this may only be the very tip of the iceberg.

A number of major NHS nuclear medicine centres, such as The Royal Marsden, have started to offer more established theranostic treatments, such as 177Lutetium PSMA for prostate cancer, and are playing an integral role in driving forward clinical research (such as iTIMM study in multiple myeloma). However, access remains very disparate across the UK. Furthermore, within the private sector, and at GenesisCare in particular, theranostics is already available as a more routine treatment for a broader range of cancer types, where clinical evidence is showing preferential outcomes. We therefore believe there is already an opportunity to expand the use of this treatment, but the UK must also be alert to promising future developments. Recent advances in nanoparticle engineering, allowing the more effective delivery of precision radiotherapy, is likely to be a step-change in the use of theranostics to manage metastatic disease, potentially expanding clinical applications and eliminating present multi-step processes that add considerable cost and delay treatment.

Therapeutic example 2: CAR-T

Cellular therapies is a broad school of personalised medicine that involves transferring intact, live cells into a patient to cure or lessen a disease, or to help repair or replace damaged tissue. The currently most common form of this is stem cell – also known as bone marrow – transplants. Chimeric Antigen Receptors Cell Therapy (CAR-T) is a highly promising type of cellular therapy that is showing increasing promise in improving patient outcomes for haematological cancers. This immunotherapy treatment involves modifying some of the patient's own immune cells, before reintroducing them to the body. NICE has currently approved CAR-T in some instances, and the NHS' rollout of this treatment is considered an example of good practice:

A. Relapsed or refractory B-cell acute lymphoblastic leukaemia where other treatments have been unsuccessful for those under 25 years of age

B. Relapsed or refractory diffuse large B-cell lymphoma after two or more failed systemic therapies, regardless of age

Moving forwards, if the UK is to lead Europe in the provision of cancer care, the government must ensure that this therapy is made available to patients across the UK. We must also be prepared to extend and expand the use of CAR-T to new patient groups and, as the technology develops, new cancer types (including solid tumours). Once these cells become available 'off the shelf', and so no longer need to be engineered for individual patients, the UK must be quick to re-evaluate and expand their use of the treatment, which will become simpler to deliver. This should involve moving quickly from evidence evaluation to infrastructure development and then to integration with standard patient pathways.

In order for UK cancer services to realise the potential benefits of this emerging, more personalised treatment landscape and the advancing technology it requires, there will need to be a fundamental shift in approach to how new and evolving practices are assessed, valued, and integrated. An element of treatment failure and disease recurrence is an unfortunate occurrence within almost all cancer sub-specialities. The only way to truly drive this prevalence down is by providing the most effective treatment as early as possible in an individual patient care journey. There are emerging therapies currently only accessible as 4th line interventions that increasingly demonstrate preferential control. Moving these treatments upstream to 1st or 2nd line could prove monumental in improving patient outcomes and experience in both the short and long-term.

Though this would require research and investment in the necessary companion diagnostics to ensure that patient suitability for these treatments is effectively assessed at an early stage, it would overall deliver considerable cost and efficiency benefits.

Figure 13: Cumulative resource benefit from moving high-efficacy treatments earlier in treatment pathways

Delivering these propositions: How the UK can rise to meet its cancer challenge, and provide Europe-leading care to patients

As outlined above, these approaches and models are only part of the overall solution to making our cancer care the best in Europe. There are multiple changes that will need to happen across the UK health system, spanning overall funding and new investment models, drug approval procedures, drug pricing, commissioning approaches, collaboration and the role of technology.

However, we believe that the following elements will be critical to unlocking the potential of these innovative approaches to cancer care.

Broaden the basis of policy and clinical frameworks to increase the use of international evidence

The UK cancer system has a widely acknowledged history of strong contributions to clinical research, and continues to play an integral role in driving forward new practices and therapeutic advancements. However, it has typically relied heavily on UK-based clinical trials for evidence.

There are several examples of where international precedent exists for, for example, providing CAR-T earlier in patient pathways or using MR LINAC treatment for routine patient care. Insurers in the UK already use this evidence to approve funding, and private providers are already delivering these pathways.

Moving forward, how we identify, assess, and integrate novel treatment options and diagnostic techniques into UK cancer services must evolve to make best use of the expanding wealth of global expertise. This will only become more important as the role of personalised medicine – and therefore the volume of drugs that need to be approved – increases.

Use regional models with specialist hubs to concentrate, and therefore optimise, investment in staff training and physical infrastructure

Historically, patient pathways have too often been fragmented, with organisations often operating in silos. There has been no clear solution to how patients are successfully placed at the centre of care, seamlessly transitioning between the most appropriate care setting and clinician as their condition and treatment requires.

To ensure patients receive the best care at the right time, and a voice in how their care is delivered, this approach must change. Some of the approaches outlined above will require patients to transition from local services to more regional ones and back again, as innovative technology will only be available at certain locations (although the reduced number of sessions will decrease the impact of this travel on patients). We would encourage exploration of more ambulatory settings, providing patients with convenient and high-quality cancer care without having to go to an acute centre. The development of digital solutions also means patients can enjoy MDT sessions with experts from across organisations and specialities, giving them a voice in their care plan.

Beyond the patient benefits, this approach promises to deliver a more efficient return on investment by concentrating investment into centres of excellence, and ensuring that the trained staff and physical infrastructure (such as labs or MR LINACs) are used at high capacity.

Patients should no longer get a one size fits all pathway – we must become more nuanced and work together as a system to flex with their needs and preferences.

Expand collaboration to be sector- wide rather than concentrated between specific partnerships of academic, NHS and private providers

COVID-19 was something of a watershed moment for how the public, academic and private sectors came together to help provide short-term capacity to cope with the demands of the pandemic. It is now clear that the Independent Sector will need to play a role in reducing the backlog over the coming years. There are some areas, such as Diagnostic Imaging, where the Independent Sector (IS) works strongly in collaboration with its NHS partners. Some Community Diagnostic Hubs will be fully NHS run, some will be IS operated, but a significant number will be partnerships between local Trusts and IS providers, utilising expertise from both organisations to deliver the optimum services for NHS patients.

This level of collaboration has never materialised in cancer care. However, we believe the scale of the challenge now needs new models. This will encompass the delivery of care, which may require hybrid assets and facilities that provide access to both public and privately funded patients. Many IS clinicians are leading experts in the novel approaches outlined above, and IS facilities may have greater access to capital to invest in new technologies or capacity – not tapping into this will represent a significant missed opportunity.

However, the role of collaboration will also have to be sector-wide if the UK is to deliver Europe-leading cancer care. Rather than being confined to the current model of singular partnerships between individual trusts or private providers and academic institutions, we must develop an effective mechanism for sharing learnings and best practices across the entire system.

Provide clear direction for expansion into new patient groups and tumour types as evidence develops

Across the services outlined in this paper, the NHS has generally integrated them into standard patient pathways as late-stage treatment for the 'main' patient and tumour types for which they were first evidenced. This is already delivering benefits in the form of improved survival and quality of life after treatment.

Where international comparators, and some private care providers in the UK, are moving ahead of the NHS is in the agility with which these treatments are being delivered to new patient groups as supportive evidence emerges at a global level. This is producing evidence and best-practice examples which should be built on across the UK. Meeting the cancer challenge requires a clear and robust system for directing care providers to expand their use of these treatments. This will need to be supported by the provision of investment for supportive infrastructure, as well as the collaboration models outlined above.

Be more willing to trial treatments earlier in patient pathways, for appropriately stratified patient groups

For all the treatments we have outlined above, and for many more 'novel' or developing treatments that are not covered here, there are material benefits to patients and the cancer care system. In the NHS, these results are achieved only in very targeted patient groups, such as where other more traditional treatments have failed.

However, given the scale of the challenge, it would be remiss for the UK not to expand the use of these treatments as far as the evidence base allows. By providing identified patient groups with access to these treatments, such as CAR-T cells, as a 1st or 2nd line treatment, the costs of delivering less effective, routine treatments beforehand are saved. The patient also benefits from a lesser treatment burden and shorter treatment time.

Currently, the requirement for UK-based evidence and a lack of UK trials of these treatments at an earlier stage in a patient's pathway is hindering this development. Moving away from this traditional approach, and using collaborative models to learn from providers already adopting these new pathways, is likely to be an effective and achievable way to improve cancer outcomes for patients across the UK.


GenesisCare