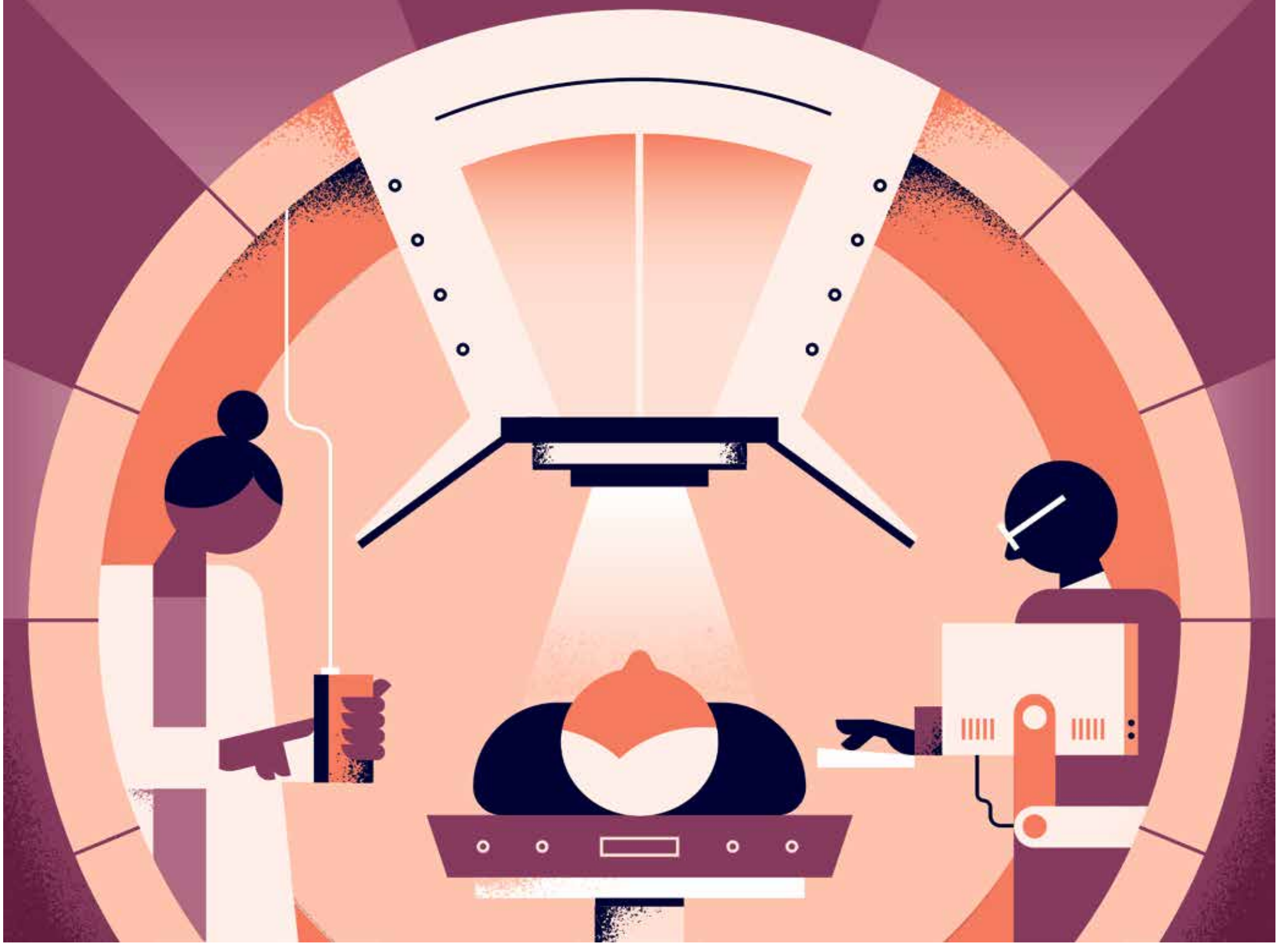
COMBATING CANCER



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COMBATING CANCER

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DIAGNOSIS

Life-saving potential of rapid diagnosis

Sometimes cancer is signposted with clear red flags, but what happens when it is not? New assessment centres around the country are now offering hope for patients who present with inconclusive symptoms

Janet Fricker

Kelly Smith visited her GP seven times over six months and had numerous diagnostic tests for vague symptoms that all came back negative. Finally, she was rushed to A&E with suspected gallstones, but a CT scan revealed a suspicious mass that resulted in a cancer diagnosis.

"My symptoms first started in October 2016 when I vomited after returning from holiday in Lanzarote and thought I'd caught a bug on the plane," says Kelly, a make-up artist from Macclesfield, Cheshire. "Two weeks later I was sick again and started experiencing agonising intermittent abdominal pain, like someone was punching my insides."

Over the next few months, her weight plummeted from ten-and-a-half to seven stone. "I was skin and bone, felt tired all the time and was going to bed at 7.00pm, the same time as my two-year-old son Finnley," she recalls.

Each time Kelly went to her GP's surgery she would be referred for a different diagnostic test, for Crohn's disease, coeliac disease, irritable bowel syndrome and suspected appendicitis. "The GP would organise the test and wait for the results to come back before considering yet another potential diagnosis," says Kelly, who was just 28 when she was eventually diagnosed with advanced bowel cancer (stage 4) in April 2017.

At the back of her mind is the niggling concern that, had her cancer diagnosis not been delayed, the cancer cells might not have spread to 14 lymph nodes and her liver, and her treatment might have been more effective. "After chemotherapy and surgery my bowel is clear, but there are signs of cancer in my liver and lungs," says Kelly, whose long-term survival now rests with a new trial combining immunotherapy with a targeted treatment.

For patients like her, presenting with non-specific but concerning symptoms, the problem with achieving a cancer diagnosis is that there are no established urgent referral routes in the UK. The current GP "gatekeeping" system caters best for patients with red-flag symptoms, explains Dr Brian Nicholson, from the Department of Primary Care at the University of Oxford. So-called red flags include signs such as a breast lump indicating breast cancer or coughing up blood indicating lung cancer.

"These provide clear signals where to perform diagnostic tests, allowing GPs to identify site-specific urgent referral pathways," says Dr Nicholson.


Bowel Cancer UK
Kelly Smith was diagnosed with advanced bowel cancer in April 2017

However, studies suggest only half of cancer patients present with classical alarm symptoms. The remainder experience vague symptoms, such as unexplained weight loss and fatigue, giving GPs the problem of deciding which specific pathway to refer them down if they meet the National Institute for Health and Care Excellence two-week urgent referral criteria of a 3 per cent risk of cancer.

"Anecdotally, GPs refer patients with non-specific symptoms down a number of different pathways, one after another, often leading to significant delays before cancer diagnosis," says Dr Nicholson.

Data from the National Cancer Registration and Analysis Service shows nearly half of cancers in the UK are diagnosed at an advanced stage (stages 3 and 4), and one in five are diagnosed as an emergency. "The higher the stage of the cancer, the greater the chance it will have spread and the more difficult it is to treat, reducing the likelihood of the patient surviving the cancer," says Sara Hiom, director of early diagnosis at Cancer Research UK.

Delays in cancer diagnosis provide one explanation for the UK's poor cancer survival record. Last month, a study in *Lancet Oncology* found that, although cancer survival has improved in the UK since 1995, for the period 2010 to 2014, five-year cancer survival still lags behind six other comparable high-income countries (Australia, Canada, Denmark, Ireland, New Zealand and Norway) for stomach, rectal, pancreatic and lung cancers.

To address the cycle of patients with vague symptoms being referred for multiple tests and poor survival, the Accelerate, Co-ordinate, Evaluate (ACE) NHS initiative, supported by NHS England, Cancer Research UK and Macmillan Cancer Support, has been piloting ten multidisciplinary diagnostic centres (MDCs) around the country. The idea is to provide rapid diagnostic centres for non-specific symptoms where tests are co-ordinated to take place where possible on the same day.

A key feature was appointing navigators, who support the patient from the point of referral to discharge. "Standard pathways have specialist nurses who support patients once they're diagnosed, but patients also need help in the diagnostic part of the pathway," says Dr Nicholson, who led the Oxford pilot.

The ACE pilots operated in a slightly different ways. For example, at Oxford the navigator was a radiographer, whereas the North Central and East London Cancer Alliance (NCELCA) MDCs in North and East London used a nurse specialist. In Oxford, almost everyone had a CT scan, whereas the London MDCs operated upfront triage to decide who needed scanning. In Oxford patients were seen in regular outpatient clinics, while London scheduled special clinics.

"The aim of all MDCs is to ensure a rapid diagnosis with the best possible experience for patients with non-specific cancer symptoms," says Dr Andrew Millar, a gastroenterologist at the North Middlesex University Hospital, who led the NCELCA pilots.

Evaluation of the ten ACE pilots, published by Cancer Research UK in April 2019, showed that between January 2017 and July 2018, 2,851 patients aged between 17 and 97 were referred, with 66 per cent experiencing weight loss, 36 per cent abdominal pain, and 30 per cent nausea and vomiting. Overall 239 (8 per cent) were found to have cancer and more than one third were diagnosed with non-cancerous conditions, most commonly diseases of the digestive system, such as diverticular disease. The model provided a fast route, with a median time from GP referral to cancer diagnosis of 19 days.

The work of the ten ACE pilots has guided the development of a national programme of rapid diagnostic centres (RDCs), which the NHS Cancer Programme and NHS England have announced will start accepting patients in the 19 UK Cancer Alliance geographical areas from January 2020. Over a five-year period it is planned that RDCs will provide a single point of access for all patients with symptoms that could indicate cancer, to support earlier and faster cancer diagnosis.

"Although it will be a challenge to set up services in time, particularly for Cancer Alliances that haven't had pilots, it is great the NHS is moving quickly to speed up the diagnosis of cancer across the population," Dr Millar concludes.

8% of patients with non-specific symptoms who visited diagnostic centre pilots were found to have cancer

67% of people with non-specific symptoms are diagnosed at a late stage

56% of cancer diagnosed by pilot assessment centres are rare or difficult-to-detect cancers

Rapid Diagnostic Centres Vision and 2019/20 Implementation Specification NHS England 2019

IMMUNOTHERAPY

Using the body's own defences to heal

Using the body's immune system to fight cancer is a fast-evolving treatment, which is giving patients a new lease on life

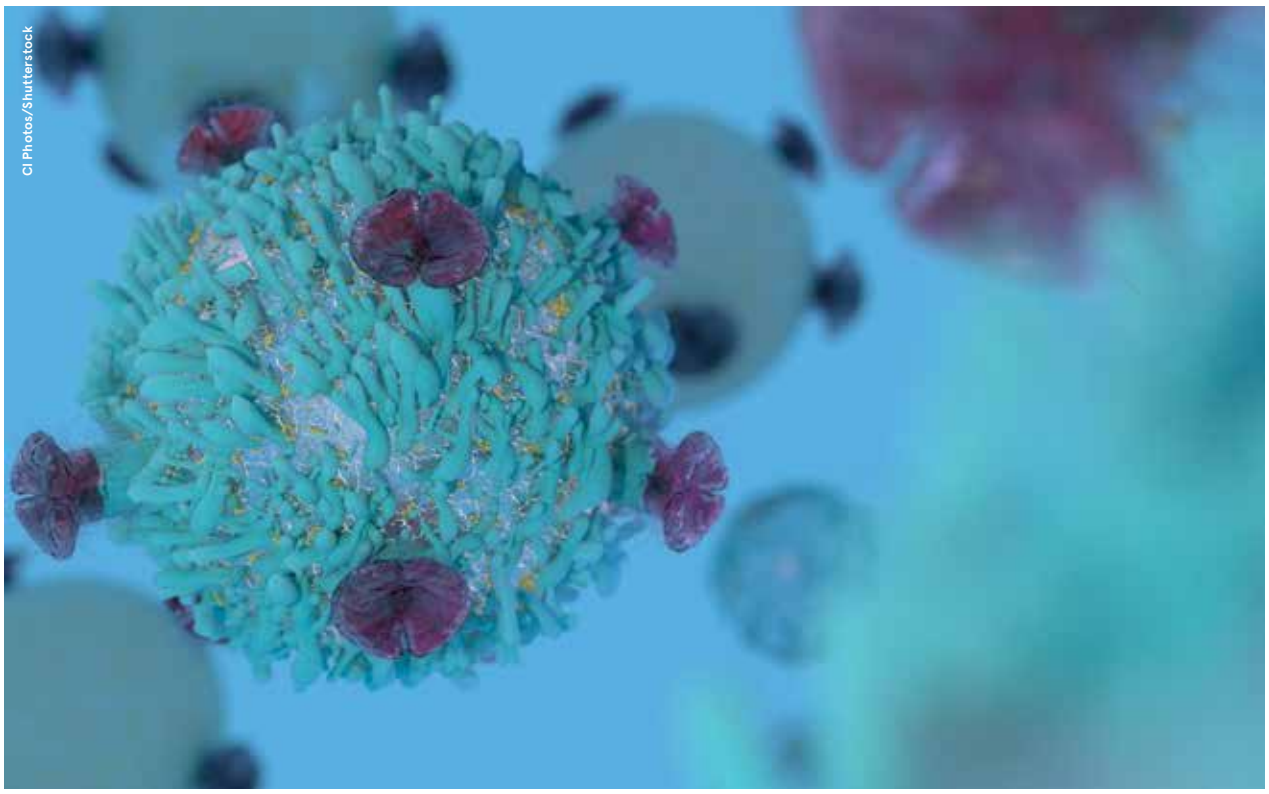

CI Photos/Shutterstock

Illustration of T-cell receptors

Linda Whitney

Immunotherapy in cancer treatment made headlines when clinical trials showed that over half of patients with late-stage melanoma given a combination of these innovative drugs survived for five years. A decade ago only one in twenty survived that long.

Professor James Larkin, consultant medical oncologist specialising in melanoma and kidney cancer at London's Royal Marsden NHS Foundation Trust, led the trial. He explains that in 52 per cent of patients who received a combination of two immunotherapy drugs, ipilimumab and nivolumab, tumours shrank.

"Immunotherapy research has attracted huge investment from pharmaceutical companies and academic institutions in the last five to ten years, but we need more understanding of how it works. Numerous trials are underway and immunotherapy will continue to be a major area of research," he says.

The same combination of drugs can also be used against non-small-cell lung cancer, kidney cancer, bladder cancer, head and neck cancers, and Hodgkin lymphoma.

Professor Larkin says: "I expect the five-year survival rate of kidney cancer patients given this combination to be greater than that of patients before these treatments became available."

Immunotherapy cancer treatments began in the UK in 2003, when the drug rituximab was licensed for use in B-cell non-Hodgkin lymphoma, a cancer of the lymphatic system. But now CAR T-cell therapy, which uses the body's own immune system to recognise and attach to cancer cells, has made a leap forward.

"This has meant exciting developments in treating aggressive advanced B-cell non-Hodgkin lymphoma," says Dr Adam Gibb, clinical research fellow in lymphoma at The Christie NHS Foundation Trust, Manchester, and honorary member of the Institute of Cancer Sciences.

CAR T-cell therapy causes the lymphoma to shrink in about two thirds of cases and in a third of patients the cancer has not progressed five years later. "They are effectively cured," says Dr Gibb. "But more work is needed if we are to save more than one in three lives."

A new drug, which secured official US backing last year and has now gained National Institute for Health and Care Excellence approval for suitable lymphoma patients in some parts of the UK, is polatuzumab vedotin, consisting of an antibody joined to a chemotherapy drug. "It is a targeted agent that kills cancer cells from the inside," explains Dr Gibb. "It can put patients into remission when there are few treatment options left."

Immunotherapy drug combinations are showing good results in tackling some kinds of advanced cancers, but what about early-stage cancers?

Professor Paul Lorigan, medical oncologist specialising in melanoma at The Christie, explains: "Initially these combinations were evaluated in people with advanced cancers particularly responsive to immunotherapy, such as melanoma, kidney and lung cancer, but because immunotherapy works better where there is only a small amount of cancer, it is being evaluated in earlier-stage disease and is already used in the NHS to treat earlier-stage melanoma after surgery.

"We can see that in patients with early-stage melanoma, adding immunotherapy to surgery to remove the tumour and lymph glands reduces the risk of recurrence by 40 to 50 per cent."

A trial to establish when this surgery-immunotherapy combination can be most effective starts soon. "Using it on all early-stage patients risks delivering unnecessary, toxic and expensive treatment," says Professor Lorigan. "The trial will test the use of a very sensitive blood biomarker to detect if the cancer is recurring and these patients will be treated straightaway.

"Vaccines are showing huge promise, used in combination with other forms of immunotherapy. There is exciting work underway on bespoke vaccines created using cells picked up from the patient's own tumour. Early-stage trials are underway now in using this for treating melanoma and lung cancer."

Meanwhile, research has begun into the potential benefits of combining radiation therapy with immunotherapy for cancer treatment. ●

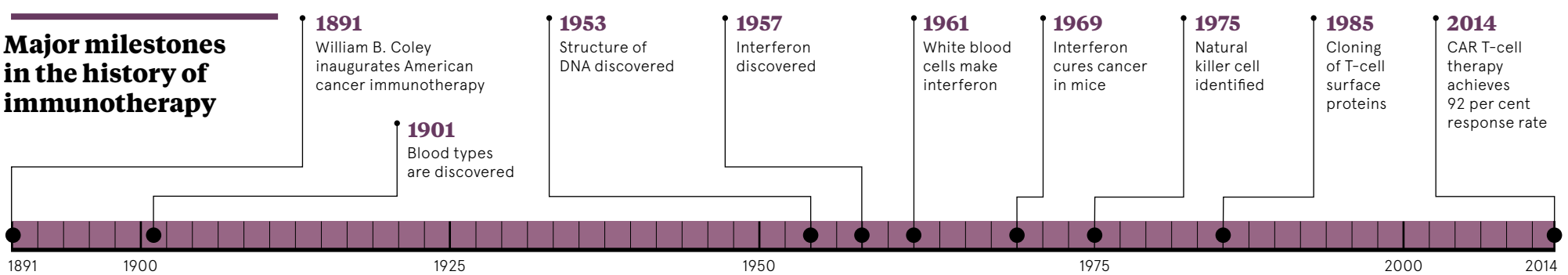

CI Photos/Shutterstock

What is immunotherapy?

Also known as biologic therapy, immunotherapy uses the body's immune system to fight cancer. Cancer cells suppress the immune system, so immunotherapy aims to re-empower it, allowing immune cells to find and kill cancer cells. Types of treatment include:

1. **Immune checkpoint inhibitors**, which block the signals that stop the immune system from attacking cancer cells.
2. **Monoclonal antibodies**, which connect to specific receptors found on cancer cells and either block the signals that stop the immune system attacking the cancer cells or flag up the cancer cells so the immune system can find them. The latter are called targeted therapies.
3. **Immune system modulators**, which improve immune system function.
4. **Adoptive cell transfer and T-cell therapy**, where a sample of a patient's white blood cells, which fight infection, is taken. From this scientists choose the cells that are naturally best at recognising cancer cells or modify the cells to improve their cancer recognition, grow them in the laboratory and reintroduce them into the patient, where they find and kill cancer cells. Chimeric antigen receptor or CAR T-cell therapy specifically uses T cells, a type of immune cell.
5. **Virus therapy** involves using a laboratory-created or altered virus to find and infect cancer cells, training the immune system in the process.
6. Some **vaccines** are used as a form of immunotherapy. The BCG (bacillus Calmette–Guérin) vaccine, used against tuberculosis, is also used to treat high-risk bladder cancer.

Major milestones in the history of immunotherapy



Why diagnostics is the next big challenge for NHS cancer services

The coming decade will see a new wave of advanced biotech capable of assisting enormous strides forward in cancer care, with potential for safer, more effective treatment, improved survival and a better quality of life for patients, says **Oli Hudson**, content director of Wilmington Healthcare

Expanding amounts of freely available, open access patient data can now be used by clinicians and the pharma industry to hone drug development and identify biomarkers that can help identify which drugs will work best to treat a patient's cancer, based on the tumour's genetic profile.

The pharmaceutical picture is exciting and personalised or precision medicine is increasingly expected to revolutionise cancer treatment, but its success depends on parallel development in companion diagnostics.

In short, this field involves bio-analytical methods designed to assess whether a patient will respond favourably to a specific medical treatment or not and the science in this field is advancing rapidly.

It has changed the shape of drug development, creating an ecosystem with many stakeholders. Whereas before a pharma company could develop a drug in relative isolation, they now need to collaborate with diagnostics manufacturers, testing laboratories, health informatics, commissioners and regulators to provide a viable, safe and cost-effective treatment pathway.

In addition, the role of the patient is of course paramount and a large-scale data-gathering exercise is required to establish the patient populations that will benefit from therapies. It is likely industry will need the help of healthcare systems to map patient populations, and get a better sense of what will work on whom and for which conditions.

Diagnostics in the NHS

With this as the background, cancer diagnosis has been put front and centre by the UK government and in England the *2019 NHS Long-Term Plan* has set in place two ambitious targets.

By 2028, the proportion of cancers diagnosed at stages one and two should rise from around half to three quarters of cancer patients. Then, from 2028, 55000 more people each year should survive their cancer for at least five years following diagnosis.

These two targets are intended to reinforce each other as we know that many cancers become more survivable if captured early, at stages one and two. And to capture them early, we need early diagnosis.

To make this a reality, the long-term plan has put in place two key pieces of infrastructure. The first is cancer alliances; groups of cancer clinicians that will drive the development of cancer pathways at a local level. The second is the emergence of rapid diagnostics centres.

Currently existing in pilot form, rapid diagnostics centres are multi-disciplinary and can cover much of the data-gathering work.

They provide a single point of access to a diagnostic pathway for all patients with symptoms that could indicate cancer, and a personalised, accurate and timely diagnosis of patients' symptoms. They combine all existing diagnostic provision, and use networked expertise and information.

Success will depend on corralling many disparate resources in the NHS, including GPs, who form a big part of this as, supported by the local alliance's clinical network, they will refer patients with suspected symptoms to rapid diagnostics centres. These can be non-specific. For example, lung cancer at an early stage can resemble a common cold, and the greater provision provided by rapid diagnostics centres and their networks can help pick this up.

Another benefit is, if the patient does not have cancer, but another condition, they can be put on the right pathway by the multi-disciplinary team.

Rapid diagnostics centres are currently clustered around the vanguard areas of London and Manchester, but the idea is for the cancer alliances to take this forward so all areas of England will be covered by 2023.

This is especially important as speed of diagnosis and cancer survival vary widely by healthcare community. Access to diagnostics services and therapies, and the outcomes from them, can depend on where you live.

Research by Wilmington Healthcare has shown that lung cancer is a particularly variable type. Most diagnoses are at stage four, by which stage the cancer is much less survivable. How likely a patient is to come forward before that is affected by a wide variety of factors, such as an area's deprivation, population and quality of screening services.

The use of novel treatment also varies widely and Wilmington Healthcare's specialist share data service has highlighted wide discrepancies in what is prescribed, with a significant trust-by-trust range for drug combinations, particularly for rarer cancers, such as chronic lymphocytic leukaemia and multiple myeloma.

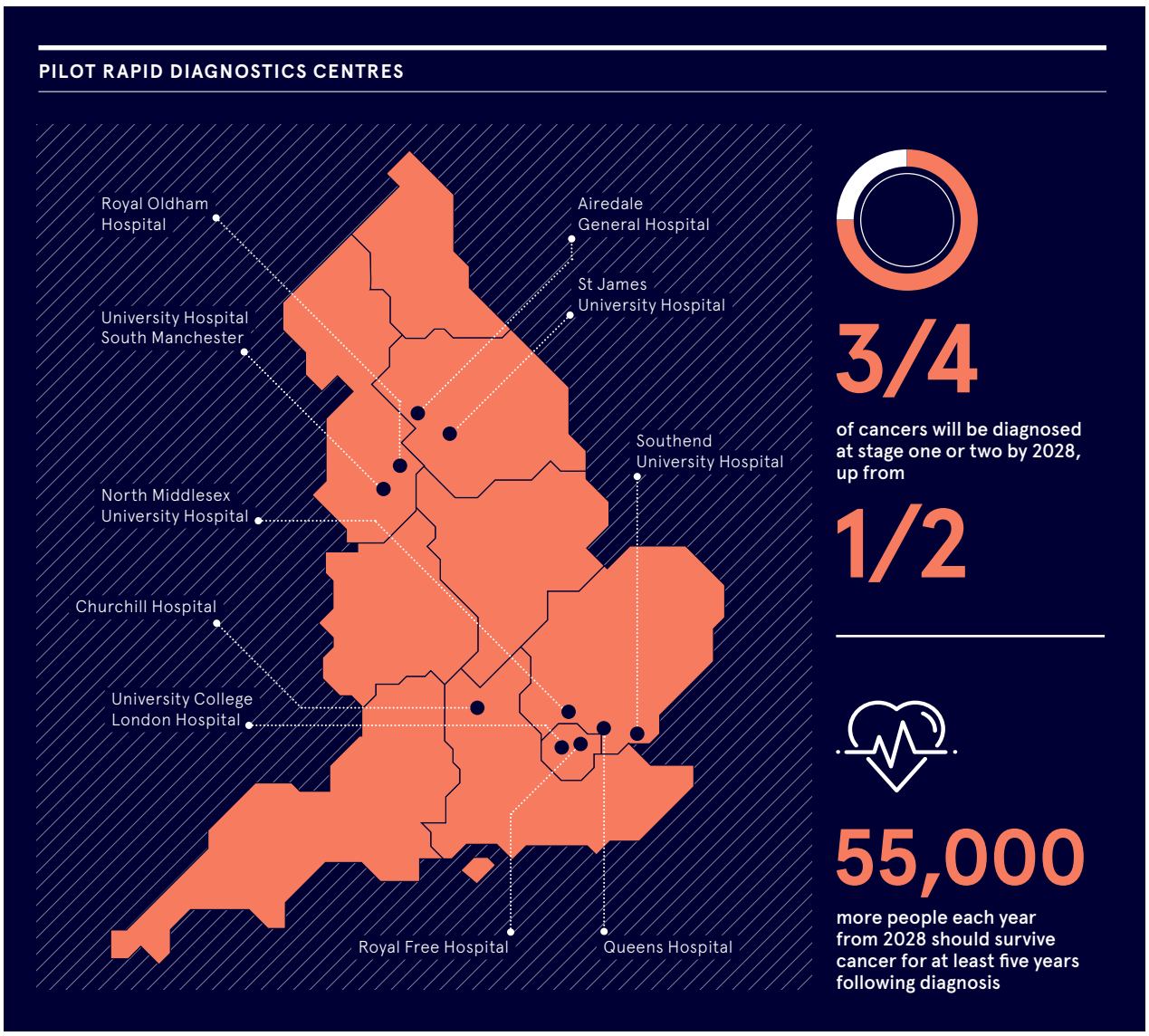
This can have the effect of patients being put on a drug that is first line in that healthcare community, but will not necessarily work on them. If NHS diagnostics is enabled in the way the government wants, and is matched with the rollout of precision medicine, this will begin to happen less, with patients more likely to be given an effective therapy.

Way forward

Rollout of high-quality and fast diagnostic services across the country, and the concomitant development of personalised medicine with companion diagnostics, could be transformative, but it will also require close and co-operative working between the NHS, and the pharma and diagnostics industries.

If they can get this right, progress against the disease could be considerable and, if the long-term plan's targets are met, we can consider this a great leap forward. As the industry has suggested, while cancer may lead the way in this process, there is scope for personalised medicine and companion diagnostics to transform the way we treat other conditions, such as asthma, diabetes, arthritis and Alzheimer's disease, and even mental health conditions, such as depression.

Oli Hudson
Content director
Wilmington Healthcare



ART THERAPY

Five ways art therapy is improving the patient experience

Art can have a remarkable impact on people's health. Chelsea and Westminster Hospital has found that using visual art for cancer patients undergoing chemotherapy decreased their stress, depression and anxiety, while other studies show the presence of art can reduce pain

Sarah Dawood

Relaxation rooms

Guy's Hospital in London opened a cancer centre in 2016, which includes The Living Room, a non-religious meditation space for patients, visitors and staff. The room features four listening stations where people can choose from 32 calming soundscapes, ranging from natural settings, such as the sea, to urban ones, including rush hour in Bangkok. The four zones use speakers incorporating directional sound, so only people sat underneath them can hear.

Screens show a written description of the soundscape's location, along with the current weather and time there, but do not feature imagery, encouraging cancer patients to explore with their imaginations. While pre-recorded, the soundscapes respond to real-time data, so if it's raining, the patient will hear it.

The room features bamboo and fabric furniture to help it feel less clinical and visitors can leave their thoughts in notebooks, with positive feedback including "peaceful, private and relaxing". Liz O'Sullivan, arts manager at the hospital, says: "Cancer treatment can be brutal and gruelling; it isn't just the physical condition, it's the mental strain. Having a place to escape, think and decompress is so important." Design was by Between Art and Technology and The Workers studios.

Interactive apps

Augmented reality (AR) is being harnessed to help young cancer patients. Liverpool's Alder Hey Children's Hospital launched Alder Play last year, an app where users choose a 3D character which is projected on to the real-world environment and travels with them through the hospital.

The app offers games and virtual tours, and encourages users to familiarise themselves with the hospital space by combining AR and physical art, such as a digital bird that flies around a real-life tree installation in the atrium.

It also has a virtual assistant called Ask Oli, so parents can ask questions. The technology aims to distract patients from difficult situations and empower them to learn more about their treatment, says Emma Hughes, associate chief innovation officer at Alder Hey.

"There was one cancer patient who was really unhappy with having chemo injected through his arm," she says. "We used the app to display an AR character on to his shoulder and suddenly he could look. It helped build his acceptance."

The app has reduced patient anxiety and decreased procedure time and, in doing so, has also benefited staff. "Patients' compliance with medication and tests has been much quicker and easier," says Ms Hughes. The app was developed by us two with Alder Hey.

Wall graphics and illustration

The Christie cancer hospital in Manchester opened its new proton beam therapy centre last year and decided to fill its children's department with animal-themed wall art to help its young cancer patients.

Designers created a jungle, centred on a "proton panda" and friends, including koala bears, elephants and flamingos. The art is in all rooms, with paw prints on the floor acting as navigation.

The centre has a playroom, which encourages patients to learn about their condition. They can put toy animals through mini medical machinery, such as computerised tomography (CT) scanners and attach prop-style magnets, such as intravenous drips, to animal illustrations on a magnetic wall.

They can also design their own mask to use during therapy and contribute to weekly wall art themes. "There's a lot to interact with," says Joanne Roberts, senior sister for paediatrics. "It's a really good distraction. The craft lets them bring a sense of home with them and make an impact on their environment." Design was by Music studio and illustration by Jane Bowyer.

Creative workshops

Sheffield Children's Hospital runs a charity-funded arts programme, which includes creative workshops for patients. It puts on three sessions a week, including pottery, creative writing, circus skills and ukulele, based on patient recommendations.

Charlotte Newton, workshop co-ordinator, says the sessions motivate patients, giving them a greater sense of purpose and helping them express themselves.

"A long-term patient can have less autonomy and stimulus than they would at home," she says. "They are susceptible to boredom, often feeling their identity is defined by their condition. Making art and music counteracts this; it's all about making decisions. It also has a powerful impact on their memories of hospital."

Taking part can be momentous for families, too. "I ran a workshop on the cancer and leukaemia ward where children and parents drew each other," says Ms Newton. "A parent told me that it allowed her to 'see' her child again and all his 'beautiful details', forgetting about the machinery surrounding him." The programme was developed by Artfelt.

Digital artwork

London's Chelsea and Westminster Hospital runs a charity-funded arts programme, which includes digital artwork installed in cancer examination rooms. To make cervical cancer tests (colposcopies) more bearable, the hospital installed screens featuring 60 hours of footage, accompanied by soundscapes. These include natural and urban settings, culturally specific and generic activities such as wood carving and baking bread. The speed of the films reflects a slow pace of up to 20 beats a minute.

Patients can choose the digital artwork they would like to see and the project is proving to be a positive distraction for most women during what can be an uncomfortable procedure: out of 50 women, 85 per cent said the art improved their colposcopy experience.

While the hospital still uses static art, the benefit of screens is that art can be easily adapted, says arts director Trystan Hawkins. "It's easy to curate, change things and personalise," he says. "We don't always get it right first time." The initiative is funded by the hospital's charity CW+.

New age for nuclear medicine

Radioactive drugs are not just diagnosing disease more effectively, they're now being used for exciting new therapies. They could be revolutionary in fighting cancer in the 21st century, says **Sandy McEwan**, vice president of radiopharmaceuticals at Ipsen

Mention the term nuclear medicine and it conjures up images of radioactive isotopes, such as iodine, deployed since the 1950s to treat thyroid cancer. But today there's a small, yet growing, class of drugs, called radiopharmaceuticals, that are ushering in a new age in oncology, way beyond treating this type of cancer.

What's groundbreaking about these treatments is that unlike regular radiation therapies, which attack all cells with larger doses of radiation, these are usually extremely targeted. They carry small doses of radioactive substances (isotopes) directly to tumour cells, allowing them to zero in and attack the cancer at close range. This normally means fewer side effects and less damage to healthier parts of the body.

Radiopharmaceuticals are already used for diagnosing diseases of the heart and kidneys, as well as some cancers, where a harmless amount of radiation is delivered precisely to an organ so you can get an accurate picture of it. If you see a bunch of bright spots on a screen image, they typically indicate a tumour, then you know you have the right type of cancer for potential treatment with that specific radiopharmaceutical.

Up the dose and you can use the same strategy to deliver radiation directly to treat the disease. Scientists pair isotopes (radioactivity) with a protein or antibody that specifically targets cancer cells. The treatment works by breaking bonds in cancer cell DNA (instructions for developing and function of the cell), killing them from the inside out; this is called systemic radiation therapy.

The good thing is that the image derived from the diagnostic phase can now be used as a biomarker to identify the patients who may benefit most from treatment. Systemic radiation therapy is therefore the first and best example we have of personalised medicine.

This is considered the Holy Grail of medicine whereby targeted treatments are based on the unique characteristics of each patient's disease, rather than a one-size-fits-all approach. Labelled theranostics, it's about providing the right treatment for the right patient at the right time, where the right dose is the goal; it's the reason why radiopharmaceuticals have been called smart drugs.

It also helps that there's a growing acceptance of this type of nuclear medicine globally. This is because of the greater burden of new cases of cancer, as we live longer, and that there are more drugs available. Radiopharmaceutical treatments are also increasingly accepted and tolerated by patients, as well as their families. Toxicity is generally low in many patients. They can also be used in combination with other drugs.

The number of cancers that could be treated this way is potentially significant. In the process, the normally devastating side effects of chemotherapy and radiation may be drastically reduced.

Radiopharmaceuticals have moved beyond just treating thyroid cancer, they're now used for cancers of the neuro endocrine system, prostrate and bone. Systemic radiation therapy is a platform technology that can be applied to many different types of tumour.


Caiaimage/Robert Daly/GettyImages

> **It's difficult to imagine a world without cancer, but new radiopharmaceuticals could help in this journey**

Pancreatic cancer is a major focus, since there are few treatments that bring more than short-term benefits to patients. At Ipsen we believe that radiopharmaceuticals have immense potential to significantly improve the lives of patients with rare and difficult-to-treat cancers. There are still many people with cancer who have a poor prognosis and lack of treatment options.

Recently there's been a stronger commitment by big pharma to nuclear medicine and a greater recognition that radiopharmaceuticals are real cancer drugs, no different in efficacy or development complexity, which is in fact greater than many of the modern generation of anti-cancer agents.

Developing this class of drugs is no small feat; they require complex manufacturing and supply chains. Because of their radioactive nature, they have a short shelf live and have to be handled carefully; shipments are regulated and staff have to be trained.

We're also getting better at developing drugs that can target particular cancer cells more precisely. That's because there's increasing realisation that receptor-binding molecules can be exquisitely designed. There are also more therapeutic radioactive elements now available.

Therefore, radiopharmaceuticals appear to have a great future, especially targeting diseases where outcomes have not improved significantly in the last 20 years, such as biliary and pancreatic cancer, as well as glioblastoma, a cancer of the brain.

These drugs have to be seen in a wider context. The development of the field of nuclear oncology, where medical specialists are trained in the use of systemic radiation therapies and learn how to care for their patients with this exciting technology is crucial. There are currently initiatives underway to help bolster this discipline.

It's difficult to imagine a world without cancer, but new radiopharmaceuticals could help in this journey. These are exciting times.

For more information please visit www.ipsen.com/uk

IPSEN
Innovation for patient care

Patient perspective

For many patients and their families living with neuroendocrine tumours (NETs), there can be a long road to diagnosis, and then a complex, diverse and uncertain path ahead, says **Catherine Bouvier**, chief executive of the NET Patient Foundation.

Referral to an expert team at the earliest stage is paramount to ensure access to all relevant treatment options and clinical trials, but also to ensure the support structure required is available.

For many, a multiple treatment trajectory will be the normal experience over the time living with this disease. If found in the early stages, there is potential for curative surgery, but for many the prospect of cure is unlikely.

The impact of living with an incurable cancer can be very profound, isolating and challenging. Working to improve and promote quality of life is a key aim of any therapy. Use of nuclear medicine treatments for this patient community has provided hope and improved quality of life for many.

We have been using nuclear medicine treatments in neuroendocrine tumours (NETs) since 1996, so can now boast a true expertise in this area. NETs really are the showcase for personalised medicine, and the more we understand the different cell types and understand the drivers for development of these cancers, the more personalised our approached will be.

This will have an impact far wider than the neuroendocrine cancer community. Having said that, there are a number of patients with the right disease profile, across multiple NETs primary sites, for which access to this treatment is refused.

We need to raise awareness of NETs and promote true understanding about this group of cancers to the policymakers, commissioners and decision-makers. We need to ensure adequate hospital and technical capability continues to exist, and ultimately integrate nuclear medicine therapies into standard care.

NET Patient Foundation

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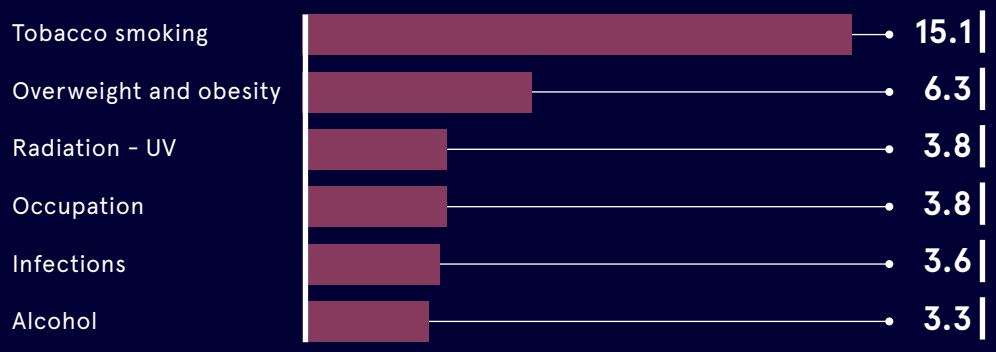
THE LINK BETWEEN RISING RATES OF OBESITY & CANCER

Obesity is the second biggest cause of cancer in the UK and has become one of the most pressing healthcare issues worldwide. As the number of people with a body mass index (BMI) over 30 – classed as 'obese' – continues to skyrocket, what will this mean for cancer diagnoses globally?

TOP LIFESTYLE FACTORS THAT CAN CAUSE CANCER IN THE UK

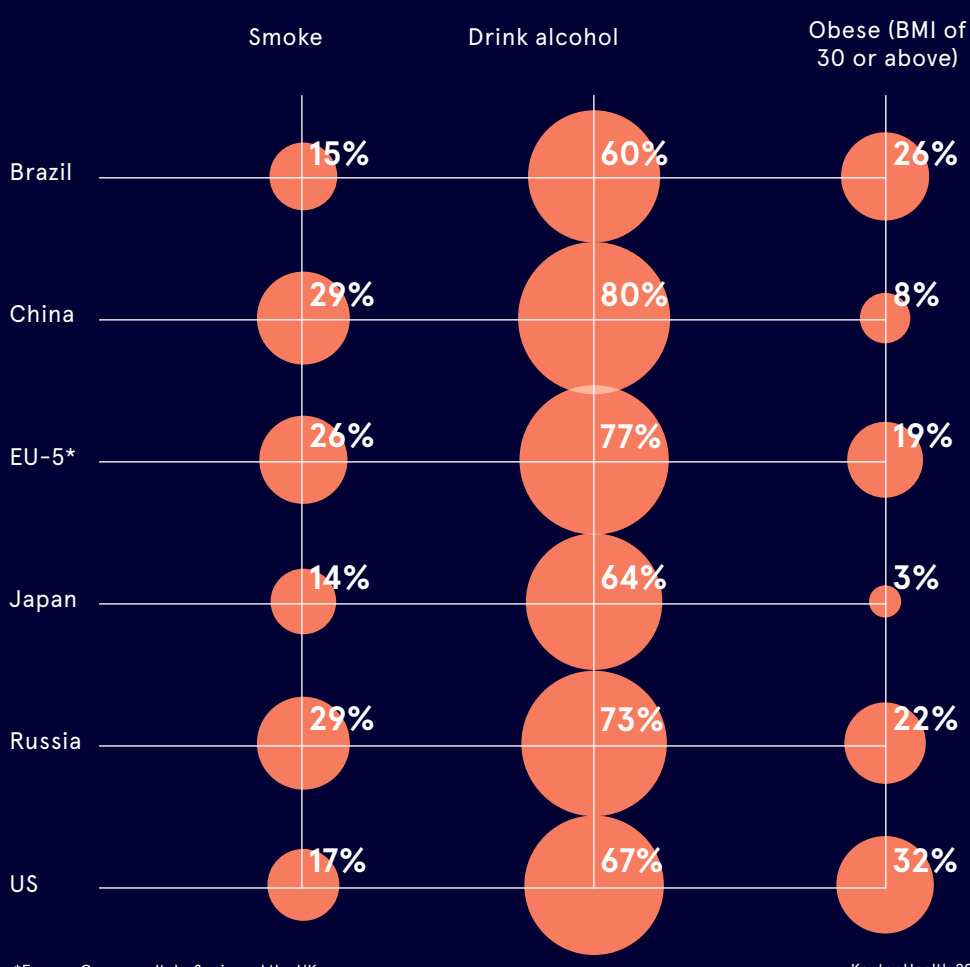
The fraction of cancer attributable to modifiable risk factors in the UK



British Journal of Cancer 2018

LIFESTYLES AMONG PATIENTS WITH CANCER

In selected countries as of 2018



*France, Germany, Italy, Spain and the UK

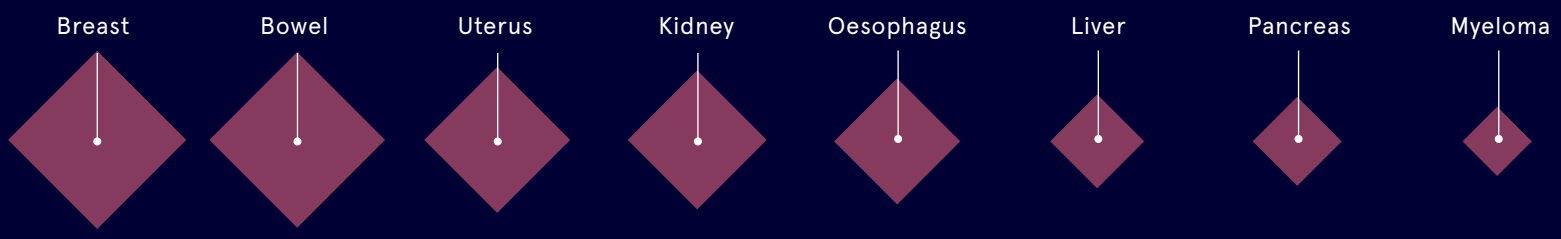
Kantar Health 2018

OBESITY AND CANCER RATES AROUND THE WORLD

Percentage of population with obesity and cancer in 2016

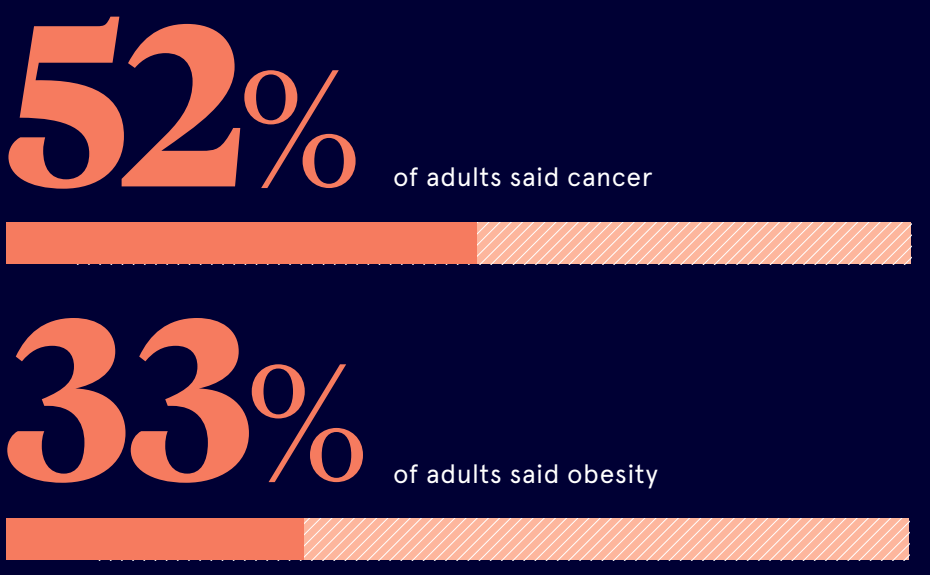
MOST COMMON CANCERS CAUSED BY OBESITY IN THE UK

Being overweight or obese are the biggest causes of cancer after smoking



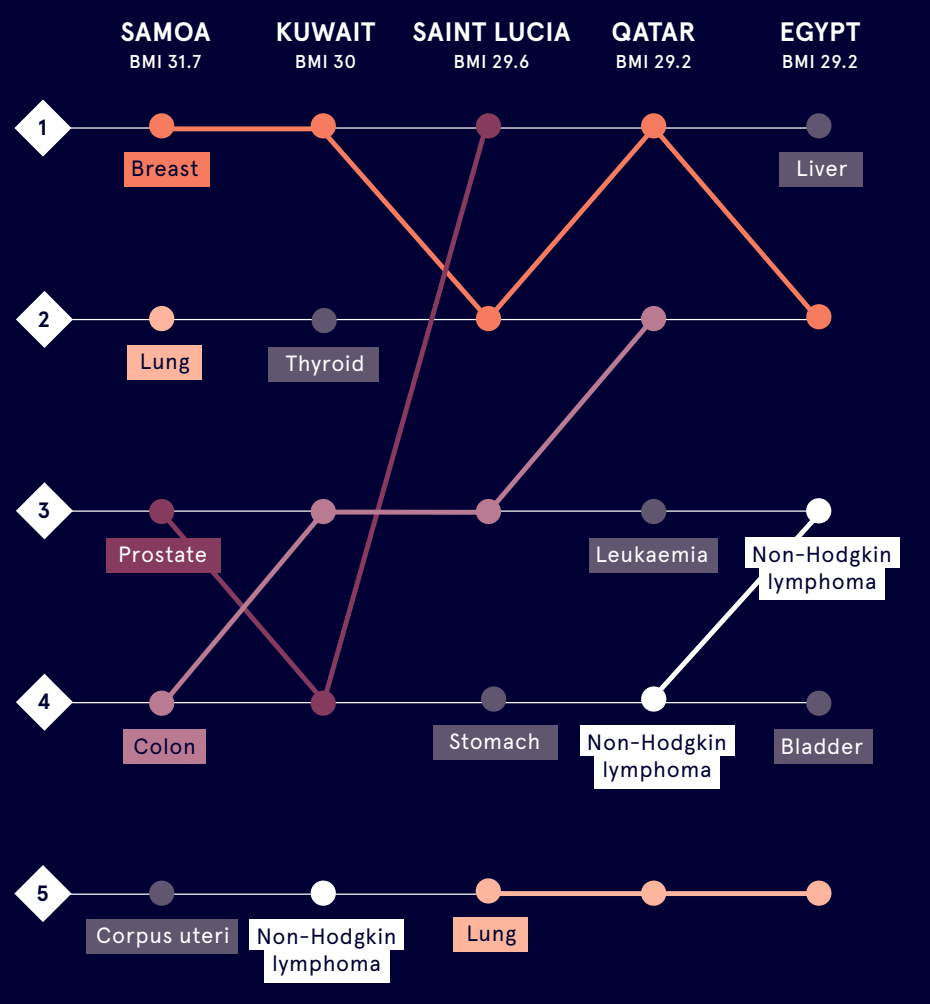
Institute for Health Metrics and Evaluation/World Health Organization 2017/2018

WHEN ASKED WHAT THE BIGGEST HEALTH PROBLEM FACING THEIR COUNTRY WAS...



Ipsos 2018

TOP FIVE CANCERS BY COUNTRIES WITH HIGHEST BMI



World Health Organization/International Agency for Research on Cancer 2019

WORKPLACE

Dealing with cancer in the workplace

Living with cancer brings significant challenges for both patients and their support system. It is imperative that workplaces do not add to these burdens

Nick Easen

It's one thing to announce to your family and friends, "I have cancer"; it's another to stand up in an open-plan office and tell your work colleagues and bosses. Some people worry their employer will discriminate against them or even sack them, others are concerned cancer will damage their career.

"Cancer isn't fair, but your boss has to be," says Liz Egan, programme manager at Macmillan Cancer Support. "We're all guilty of certain perceptions. The fact is there is still a lot of stigma attached to cancer; it's why employees face a lot of issues when it comes to workplace attitudes."

This is also of mounting concern as we live and work longer. There are now more than 890,000 people living with cancer in the UK workforce, set to rise to almost 1.2 million by 2030, according to the charity. Survival rates have climbed over recent decades, but a record number are suffering discrimination at work, according to a YouGov poll last year, with one in five employees facing issues.

"We've heard of bullying, people losing their jobs and harassment at work because of peoples' cancer diagnoses, even though it's against the law. Only half the workers we surveyed realise they actually have any rights at all," says Ms Egan.

Under the Equality Act 2010, employers have a legal duty to make "reasonable adjustments" to help those diagnosed with cancer remain in or return to work when they're able. Failure to do so is discrimination. Those who have cancer are technically classed as disabled in the eyes of the law. It is, therefore, illegal to treat an employee less favourably because they have this condition.

But what is reasonable for one employer or employee may not be for another. Reasonable adjustments can also apply for someone's entire working lifetime; there is no time limit.

"An open dialogue with an employer throughout the different stages of the employee's diagnosis, treatment and post-treatment is essential. An employer is not expected to make reasonable adjustments if they are not aware of the diagnosis and if they could not reasonably have been expected to know of it," says Stephen Wallwork, vocational rehabilitation manager at Maggie's Manchester.

With roughly 200 different types of cancer, myriad treatments, and countless attitudes and abilities in terms of whether people need, want or are able to work, the variables seem endless. This is certainly not a cookie-cutter disease. How to make support bespoke is a big question, which is why Macmillan has an eight-person telephone support line.

"People with cancer don't always know at the outset what their diagnosis and treatment will mean for them, and they don't know what they should ask for in the way of support," says Barbara Wilson, founder of Working with Cancer.

"Good communication is absolutely vital. It's an employer's job to take the time to understand each individual's situation. Sadly, an inclusive and supportive working environment is still a work in progress and many line managers have never managed anyone with cancer."

There are now a lot of resources online via Macmillan Cancer Support and the charity runs workshops to help human resources and line managers, so far training 13,000 employers in the process. "Assistance for cancer patients also works best when it's driven from the top, the CEO, and where executive teams make this a priority, offering flexible policies that are supportive not punitive," says Ms Egan.

There are other schemes to help support cancer in the workplace. Some companies have their own networks or cancer buddies, where staff are trained to assist employees through their treatment; others have detailed intranet systems offering full support. Flexible hours are also crucial for cancer patients.

It is important to consider cancer and other conditions in the light of a wider diversity and inclusion agenda.

"We often think about this in terms of gender, race or socio-economic background. Neurodiversity is a developing area for many companies that value different ideas, such as people who have diagnosed conditions such as autism. The experience of having cancer should also be in this mix," says Dr Andrew Parsons from the Fountain Centre, a cancer charity.

In spite of raised levels of awareness and support, there are still many challenges, especially for those in physical or manual labour. "We expect large companies to do more, that's for sure. Yes, small to medium enterprises find cancer challenging, but they tend to do it well because smaller companies act more like families with the support they provide," says Ms Egan.

One group that is often forgotten in this discussion is carers of cancer patients. There are almost 1.5 million of them in the UK. A good number of these have full-time jobs. Under the Equalities Act, they also cannot be discriminated against by their employer. If they have to look after a loved one with cancer, they are protected in law, by association.

"This group has the right to request flexible working. But some employers provide better rights than others," says Ms Egan. "For many carers, their lives can be very stressful, many fall out of work because they cannot manage employment and caring for loved ones. It's a hidden issue, and it's not discussed much, and can be a real struggle for some."

Interestingly, during this highly stressful time, especially at home, the office comes into its own for cancer patients, providing normality and routine. That pat on the back from the boss, the laugh at the water cooler with colleagues can make all the difference. Those workplaces that realise this, as cancer numbers grow in the future, will thrive. ●

125k
people of working age are diagnosed with cancer in the UK each year

890k
are living with cancer; many will continue to work after, or even through, their treatment

340
are diagnosed with cancer every day

Macmillan 2019

How business leaders can support cancer patients

Let's not forget there's a legal mandate for supporting cancer in the workplace. This is not a nice-to-have, fuzzy human resources policy, it's a legal requirement.

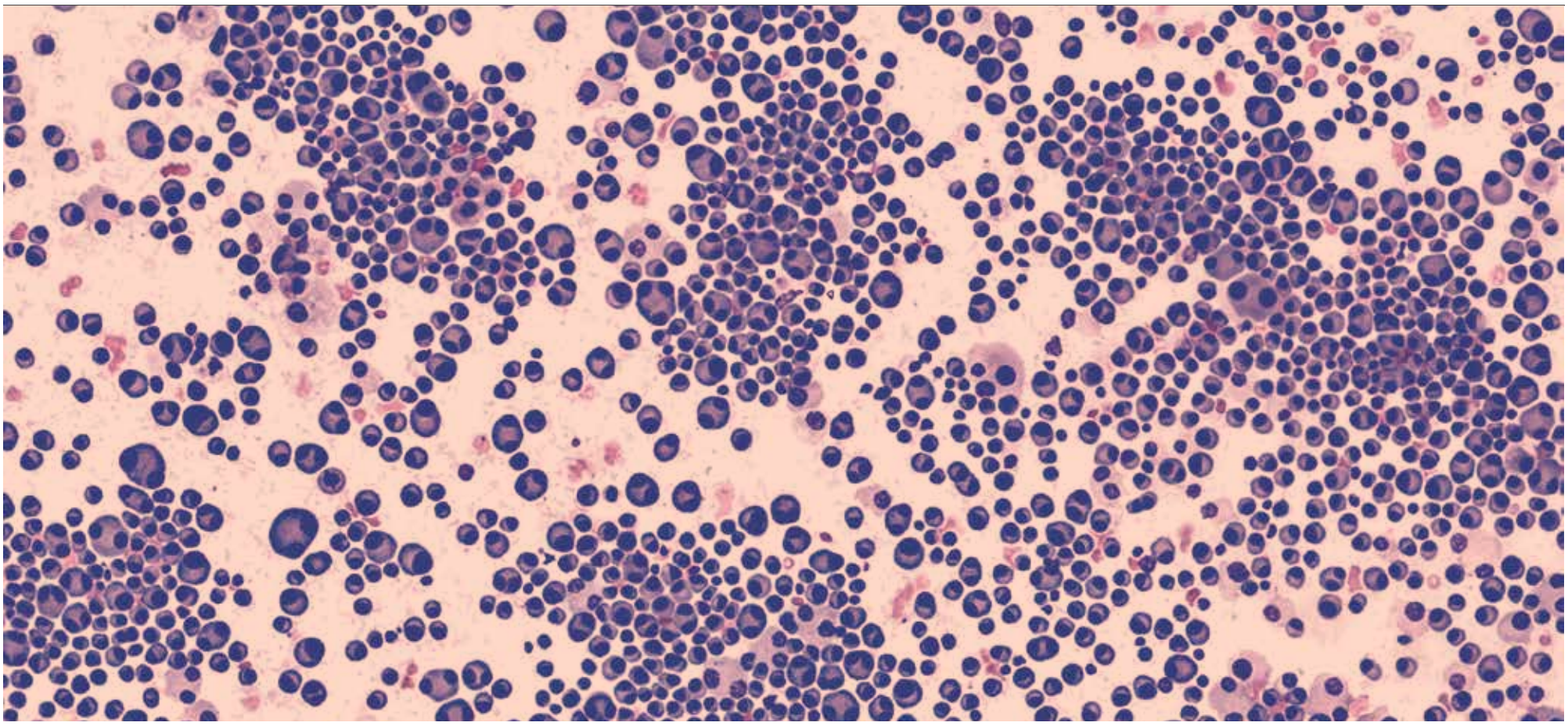
"Leading by example is crucial; it's essential that business leaders understand how to help employees. Not just because getting it wrong can have significant financial and legal consequences, but because it's the right thing to do," says Barbara Wilson at Working with Cancer.

Good support from an employer makes a huge difference. For the bosses it also makes clear financial sense to help someone to stay at work during and after an illness, fostering goodwill throughout an organisation.

Flexitime, remote working, job-share schemes and compressed hours can all help cancer patients juggle treatments, hospital appointments and work. The importance of on-site counselling, as well as regular and meaningful communication, cannot be stressed enough.

It's good practice to set up a long-term communication plan before a cancer patient stops working. Everyone then agrees when employers will keep in touch, as well as what information on work matters will be shared. This way they still feel part of the business.

"The level of support employees receive directly correlates to the loyalty or disloyalty they feel towards their employer," says Liz Walker, human resources director at Unum UK.



Pushing the boundaries of drug discovery for myeloma patients

Consultant Haematologist **Dr Rakesh Popat** reviews 30 years' progress in treating myeloma and sees a promising future

We have made huge progress in finding and delivering treatments for multiple myeloma – a blood cancer generated by faulty plasma cells in bone marrow – and a disease with a very poor prognosis has become a manageable, chronic condition.

It is still incurable, but the average patient can now expect survival of around ten years compared to three years thanks to effective treatments. Our continuing challenge is to find better therapies for a condition which, although classed as a rare cancer, affects around 17,500 people in the UK.

Dr Rakesh Popat
Consultant Haematologist, University College Hospital, London and HCA Healthcare UK

Myeloma is a relapsing and remitting condition that causes renal failure, anaemia, fatigue, hypercalcaemia and destructive bone lesions. It is different for each patient, making diagnosis difficult, and therapy regimes need to be tuned to keeping the disease at bay and providing good quality of life for patients.

Treatment has evolved from a single chemotherapy drug with poor outcomes and high toxicity through the use of the drug thalidomide around 15 years ago, which was the first of a new class of immunomodulatory drugs (IMiDs). We now have two more in that class and proteasome inhibitors, which came along more than ten years ago, help us better manage patients and improve survival.

These drugs are well tolerated and many patients enjoy a good quality of life, rarely being admitted to hospital. More than 60 percent of younger patients have a ten-year survival profile, but older patients can be more frail at diagnosis and we need to understand how best to treat them.

The medical and scientific community has made significant advances in decoding myeloma and laboratory tests have allowed us to identify the genetic markers in the myeloma cells so we can choose the appropriate treatment in each case. We expect to derive even further understanding from gene-expression profiling and next-generation sequencing platforms.

But, unlike with many solid tumours, we have been unable to find a specific driver or mutation which we can then hit. For instance, in lung cancer you can identify a mutation and use an inhibitor which works very effectively, but this simply doesn't exist in myeloma.

It is a complex condition, but there is much hope in a series of clinical trials being undertaken globally and at University College Hospital, London. It has been discovered that the drug Venetoclax, which is funded and licensed for chronic lymphocytic leukaemia, is effective on a sub-group of myeloma patients and we are currently engaged in a clinical trial on its use.

> **There is promise for myeloma patients, but this is a complex condition and our efforts must not, and will not, relax**

We also have two brand-new IMiDs designed to improve on current therapies, which are looking promising in phase-1 trials and we would hope they could come through for patients next year.

The big challenge we face is that myeloma causes profound immune deregulation, which confers resistance on these myeloma cells. They are able to mutate and modify and, despite using established drugs, resistant clones keep appearing. So we are coming to the view that the only way to achieve long-term control is to invoke the body's own immune system because it is the only element that has the ability to adapt and change to cure the cancer.

At a recent conference, someone framed the difficulty succinctly by stating that plasma cells are designed to stay in your body for 80 years producing antibodies, so it is not surprising it is difficult to kill them. Other cancer cells have a quicker turnover and die, but there are a multitude of ways myeloma manages to survive from genetic abnormalities to interactions within the bone marrow micro-environment.

Huge promise is coming from the rapidly emerging approach of engineering a patient's immune cells to attack the cancer, known as CAR T-cell therapy. It has worked well in leukaemia and lymphoma, but the story doesn't seem to be as exciting in myeloma as with other cancers, which is disappointing. But there is a lot to learn and over the next five years we will be using a combination of CAR T-cells and drugs we know to leverage long-lasting impacts.

Worryingly, the incidence of myeloma is climbing. It has doubled to 2 percent of all cancers recently and, although better diagnosis is a factor, we are not completely sure why. This makes our research and quest for better therapies, and ultimately a cure, all the more critical.

We know the causes of myeloma are a combination of genetic and environmental influences. Population research shows a clustering of myeloma in families, while an interesting piece of data has emerged recently that the firefighters who attended the 9/11 World Trade Center disaster in New York have a higher risk of developing the pre-cancerous condition known as MGUS, which shows there is an environmental element.

In the near future, our aim is to continue to develop immunotherapies to see the next step change in survival for our patients who can look forward to new agents coming from clinical trials over the next few years.

Our aim is to provide a good quality of life with well-tolerated drugs, so people can continue working or, if they are retired, have the freedom to travel and not be stuck in hospital.

Myeloma is classified as a rare cancer and, consequently, does not get the profile of some more emotive cancers. But, even though incidence is low, survival has improved, so the number of people living with myeloma on treatment is equally as high as the more common cancers.

Patients are still primarily diagnosed when they attend A&E units and it can take months for a patient to see a haematologist. Therefore, we need to energise education as well as having more investment into research so the UK can lead the way to bring new treatments to patients.

There is promise for myeloma patients, but this is a complex condition and our efforts must not, and will not, relax.

Dr Popat is a Consultant Haematologist at University College Hospital, London and HCA Healthcare UK. He is Honorary Clinical Senior Lecturer at the UCL Cancer Institute, a member of the National Cancer Research Institute myeloma sub-group and North Thames Clinical Research Network Speciality Lead for haematology in the cancer division.

HCAHealthcare UK

Jeff Sheldon/Unsplash

MEDIA

A question of representation

Cancer is a disease which hits the oldest hardest, so why are all the headlines about youthful victims?

Martin Barrow

Cancer is primarily a disease of ageing and is one of the main health concerns for the elderly. The older you are, the higher your risk. Every year, around 130,000 people aged 75 and over in the UK are told they have cancer, and this is set to rise. In just under 20 years, almost half (46 per cent) of people diagnosed with cancer each year in the UK will be over 75 and cancer will be a leading cause of death.

Not that you would appreciate this from reading the news every day. Media reports on cancer care and treatment focus heavily on younger people. Older adults are largely absent from media coverage of cancer, even though it is a significant health concern in an ageing population.

A report by the University of Glasgow, funded by Cancer Research UK, found that older adults were effectively airbrushed out of media representation of cancer and cancer experience. Analysis of 800 articles in UK national newspapers revealed that just 15 per cent featured a personal narrative of adults over the age of 60. Age was mentioned as a risk factor in only 12 per cent of the articles, less frequently than other risk factors such as family history and genetics.

Dr Sara Macdonald, senior lecturer in primary care at the University of Glasgow's Institute of Health and Wellbeing, and one of the report's authors, warns the distorted media coverage of the cancer risk of older age could have an adverse impact on cancer awareness in an ageing population.

She says: "Older adults should be vigilant about cancer, yet this is not reflected in the news media coverage of cancer risk. Taken together invisibility, inaccuracy and information overload build a skewed picture that cancer is a disease which affects younger people.

"Older adults experience poorer cancer outcomes, have lower awareness of risk and symptoms, and are more likely to experience late-stage diagnosis. Studies have shown that older adults often attribute symptoms to natural consequences of ageing and therefore tend to seek help less promptly.

"Encouraging older adults to consider cancer risk, and therefore appraise symptoms and bodily sensations in that context, may prompt earlier presentation and consequently impact on early detection."

As well as raising awareness of the risks and symptoms of illness, media coverage can play a significant role in shaping public services such as the NHS. If older people are invisible, or if older people feel their case is less urgent, there is a danger investment will be skewed towards other groups, neglecting elderly health concerns.

Evidence already shows that UK cancer services are not doing as much as they should for older people. Cancer survival is generally lower for older people, even after taking into account other conditions they may have. The cancer survival gap between the UK and other similar countries is worse for older patients than it is for younger patients.

Rose Gray, policy manager at Cancer Research UK, says one explanation is older patients are less likely to have several types of treatment that could help them live longer. "Some patients might choose not to have intensive treatment, either because they are not well enough or because they prioritise independence and quality of life rather than trying to extend their lives at any cost. The decision is up to each patient and their loved ones," she says.

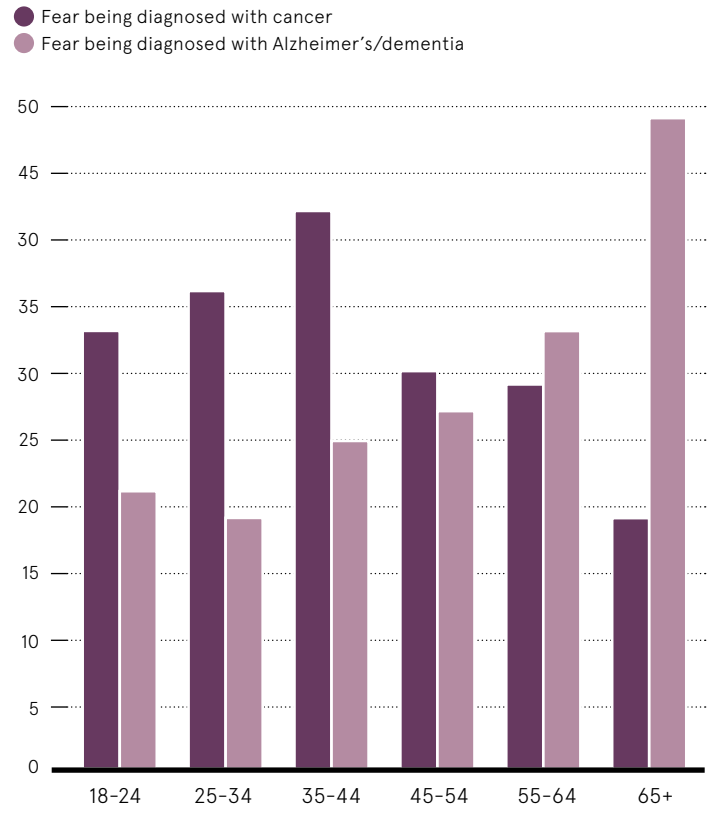
"But sometimes the treatment being offered is not based on a full assessment of how fit they are, how much support they need or how well they will be able to cope with treatment. This means that sometimes older patients are not given the best possible treatment for them."

It is critical to raise cancer awareness among older people, but the NHS also needs to adapt now to respond to elderly health concerns. Informed discussion in the media, with accurate risk messages for all groups, has a vital role to play in ensuring equitable access to cancer care. ●

> **Older adults should be vigilant about cancer, yet this is not reflected in the news media coverage of cancer risk**

GENERATIONAL ATTITUDES

Fear of cancer compared with another age-related condition (such as Alzheimer's or dementia) actually decreases with age



Lenus Health 2019

OPINION

‘Cancer detection will not improve without investment in the vital ingredient: imaging staff’

As a lung oncologist, without diagnostic imaging I would have no idea of the stage of my patients’ cancer or be able to manage and tailor their care.

Radiology is fundamental to how we detect and stage cancer, and techniques are constantly advancing. Examples include multi-parametric MRI (mpMRI) scanning, which is revolutionising the detection of prostate cancer, and the use of whole-body MRI scanning to identify and treat multiple myeloma (bone marrow cancer).

Despite technical innovations, the UK as a whole lags behind European countries on cancer survival rates and patients are not being diagnosed early enough to get the best treatment.

However, politicians are starting to act. The UK government has made a commitment to diagnosing three quarters of cancers at an early stage by 2028 and next year hospitals in England will have a new target to ensure patients have a cancer diagnosis within 28 days of referral.

NHS England is in the process of scoping the rollout of rapid diagnostic centres, with pilot centres already up and running, which would see patients with vague cancer symptoms scanned quickly after a GP referral. Welsh pilot centres have shown these clinics can detect three times as many cancers as usual diagnostic pathways.

Excitingly for my area of practice, England is piloting targeted lung cancer screening, where patients at risk are called directly for chest CT scans to flag disease. Meanwhile, existing cancer screening programmes are under review, with recommendations to boost services and increase uptake expected imminently at the time of print.

Attempts to better connect hospitals so scans can be read by available staff are also ongoing, and there are a number of pioneering imaging networks in England and Scotland. However, the implementation of new radiology IT solutions is currently piecemeal and dependent on local hospital impetus.

Government is investing heavily in the commercial development of artificial intelligence (AI) to detect cancer. Research has shown AI has significant promise in spotting lung and breast cancer on scans. When this technology is proven reliable, it will be rapidly rolled out to help patients by prioritising urgent cancer scan results and supporting radiologists as a second pair of eyes.

We also need scanning equipment that is fit for purpose. Older machines break down more frequently and cannot perform modern scans such as prostate mpMRI. Last month, imaging equipment received a welcome boost when the prime minister announced £200 million for new CT, MRI and mammography scanners in England.

But despite topical funding for equipment and innovative pilots, cancer detection will not improve without investment in the vital ingredient: imaging staff.

Complex hospital imaging is increasing in volume by 10 per cent every year, but annual studies by the Royal College of Radiologists show the UK radiologist workforce is expanding at less than half that. Meanwhile, patients are waiting for scan results and hospitals are spending millions outsourcing scans.

Unless we get more expert imaging doctors in the system, by 2023 the NHS will be missing a third of the diagnostic radiologists it needs to detect cancer. There simply won’t be the doctors needed to look at mpMRI scans and spot prostate cancer or staff rapid diagnostic centres and new lung screening services.

There is genuine progress in cancer imaging, from better networked expertise and new centres to fast-track referrals, to the promise of intelligent diagnosis by computer. These innovations are fantastic, but they will only take us so far without the basics. For UK cancer patients to receive the speedy diagnosis and treatment they deserve, we must see sustainable investment in networked hospital imaging and, fundamentally, more radiologists. ●

Dr Jeanette Dickson
President
Royal College of Radiologists

‘Do I need chemotherapy?’

Ground-breaking test can prevent breast cancer patients from undergoing unnecessary chemotherapy

When given a breast cancer diagnosis, the first question in many patients’ minds is: “Will I need chemotherapy?” The treatment can be debilitating, causing emotional strain and increasing economic costs for many patients. Chemotherapy is an important option for some patients, but for the majority, it provides little or no clinical benefit.

The Oncotype DX Breast Recurrence Score® test is available and can identify which patients will benefit from chemotherapy, potentially sparing thousands from unnecessary treatment.

Advances in the understanding of cancer mean clinicians can offer increasingly personalised treatment to patients. Genomics harnesses information about a patient’s tumour biology enabling treatments to be tailored to the individual patient.

The Oncotype DX test predicts how likely it is that breast cancer may come back after surgery and the likely benefits of having chemotherapy. It was developed by Genomic Health, the world’s leading provider of genomic-based diagnostic tests that address the overtreatment and optimal treatment of early-stage cancer, one of the greatest issues in healthcare today.

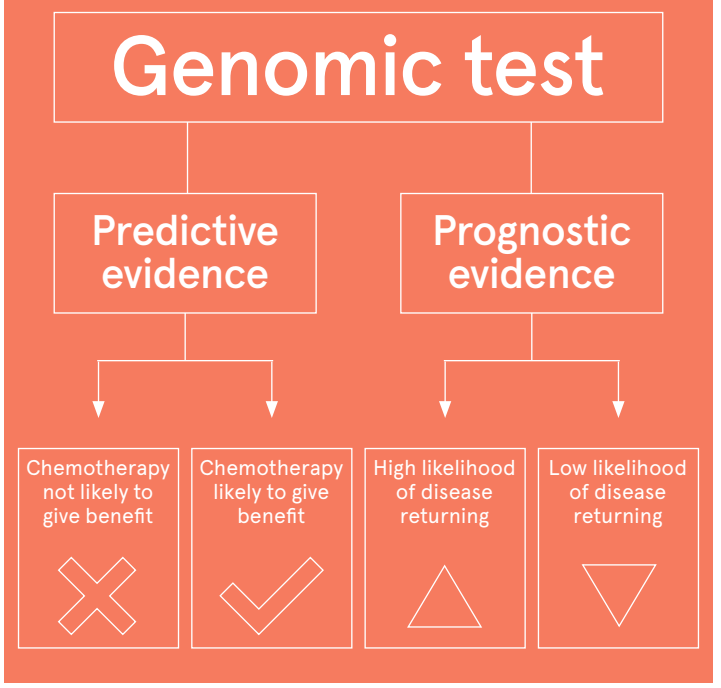
In the UK, the test has been approved by the National Institute for Health and Care Excellence, the health and care regulator, and is available on the NHS. Cancer specialists say it is making a profound difference to patients and their families.

Marianne Dillon, consultant oncoplastic breast surgeon at Swansea Bay Health Board, who has been using the test for five years, says: “One of the first questions people ask after a breast cancer diagnosis is whether they will need chemotherapy. It is frightening for them and for their families.”

One patient told Miss Dillon she was so happy she would not need chemotherapy because of the impact it would have had on her family, rather than because she had been spared the treatment.

> **Oncotype DX® gives greater certainty about the benefit to patients of undergoing chemotherapy**

A genomic test that is both predictive of treatment benefit and prognostic provides more information and leads to better treatment individualisation



“Oncotype DX gives greater certainty about the benefit to patients of undergoing chemotherapy. It means we can minimise treatment and consider other options when chemotherapy is not needed,” says Miss Dillon.

“The test result is not determined by the grade or size of the tumour and we have had unexpected results in many cases, which have confounded the anticipated treatment plan and informed a change of course. This shows the real value of the test.”

The Oncotype DX test gives a score, known as the Recurrence Score® result, from 0 to 100. The higher the score, the more likely breast cancer is to come back and the more likely patients will benefit from having chemotherapy as well as hormone therapy.

Last year, the TAILORx trial, the largest randomised adjuvant breast cancer trial ever conducted, found that 73 per cent of patients with high clinical risk had recurrence scores of 0-25 and may have been overtreated without the Recurrence Score.

Some 43 per cent of patients with a Recurrence Score of 26-100 had low clinical risk and may have been undertreated without the Recurrence Score result. The trial involved more than 10,000 patients in six countries.

The Oncotype DX test analyses the individual biology of a breast cancer tumour by examining the activity of 21 genes in the tumour tissue. The test is performed on a small amount of the tissue removed during the original surgery, so the patient does not need to undergo any additional surgical procedures. The tissue is sent to a central laboratory and the results are sent back to the clinician within seven to ten days.

Studies suggest that the results change breast cancer treatment decisions in between 30 to 60 per cent of cases. The test is suitable for some people recently diagnosed with early-stage breast cancer who are oestrogen receptor positive and HER2 negative. It can be used in either cancers that have or have not spread to the lymph nodes under the arm.

Worldwide, more than 19,000 doctors have ordered the Oncotype DX assay in more than 90 countries and almost one million patients have received the information provided by the Oncotype DX test.

Marianne Dillon is a consultant oncoplastic breast surgeon at Swansea Bay Health Board

For more information please visit www.genomichealth.com/en-GB/ www.oncotypeiq.com/en-GB

Genomic Health
LIFE. CHANGING.

TREATMENT

Cutting risk for life-saving treatment

Proton beam therapy is bringing new hope to patients with hard-to-treat cancers

Danny Buckland

The sight of a 90-tonne piece of equipment being craned into a Manchester hospital represented a landmark moment for cancer treatment in the UK.

It took another 18 months before it became operational, but the cyclotron – the functional heart of proton beam therapy – has now helped cure more than 100 patients who had faced uncertain futures.

The £125-million unit at The Christie Hospital, which offers precision treatment for a range of rare cancers, is a major advance for patients who faced a bleak future or had to seek treatment abroad.

The cyclotron is a particle accelerator. It powers a high-energy beam of protons that target tumours to sub-milimetre accuracy, which allows clinicians to tackle growths in the brain, head and neck, spine and pelvis that were previously difficult to approach.

The beam delivers its curative dose to the tumour alone, sparing some of the flesh that might be impacted by standard x-ray radiotherapy, which tracks through healthy tissue as well as the target site.

The Christie is aiming to treat 650 to 750 patients a year and this capacity will be doubled when a mirror unit is opened at University College Hospital, London next year.

"Since 2008, the UK has been sending patients abroad. There was a recognition that this was expensive and some patients couldn't access services abroad because they were unwell, the timings were very tight or circumstances, such as with work and visa requirements, meant they couldn't travel. Having this service in the UK is excellent news for patients," says Dr Ed Smith, clinical director of proton beam therapy in Manchester.

Radiotherapy, along with chemotherapy and surgery, is a standard and effective approach to cancer treatment, deploying x-rays to destroy tumours. But the x-rays have to pass through the body and can impact healthy tissue as they exit while proton beams are more active when they reach the tumour site.

"Proton beam therapy means we can reach previously hard-to-treat tumours near the brainstem or spinal cord, as well as reducing side effects in the short and long term," says Dr Smith.

The cyclotron works by spinning hydrogen protons at up to two thirds the speed of light before siphoning them off into an invisible beam, which is directed by sophisticated magnets. The beam is manipulated via a gantry that can wheel 360 degrees around a patient on a table, to treat the exact shape and depth of the tumour, which has been previously measured and defined by MRI and CT scans.

The excitement of successful treatments, which take a similar time to radiotherapy, resonates around grateful families, but the unit is also playing a crucial role in gathering outcomes from treatment and research into extending its application to other tumour profiles.

Cyclotron particle accelerator at The Christie Hospital

> **We can reach previously hard-to-treat tumours near the brainstem or spinal cord**

"The performance and results so far have been excellent, but we want to go further," says Dr Smith, a clinical oncologist. "Around 40 per cent of our capacity is dedicated to clinical trials when we can explore its potential impact on other cancers where the evidence is not that robust at the moment.

"There are a number of exciting trials coming over the next five years that will look at the role of protons in certain cancers."

A team from the University of Manchester is also based at The Christie pursuing pre-clinical research on imaging and how protons react with the body to look at ways of improving therapy delivery.

The landmark TORPEdO trial, which examines its potential for oropharyngeal cancer patients, is due to start in December. Funded by Cancer Research UK and the Taylor Family Foundation, it will look at patient-reported toxicities, quality of life and cost effectiveness of proton beam therapy compared with standard treatment. ●

90k

cancer patients treated with radical radiotherapy every year

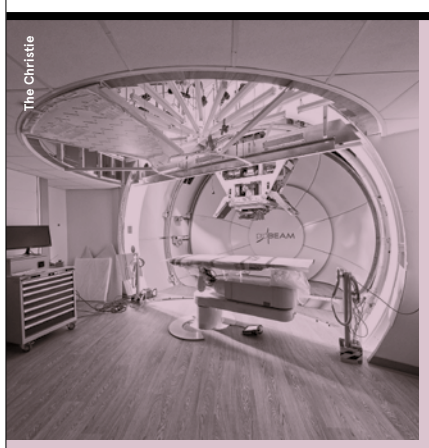
10%

of these could be better treated with proton beam therapy

25

people treated with proton beam therapy in the UK in 2018

Rutherford Health 2019



Proton beam therapy's prime targets

Standard radiation procedures have evolved over the years, but proton beam therapy offers greater precision and fewer potential side effects in some cancers. Currently, it is mainly used for childhood cancers and tumours that develop in the head and neck or close to the spinal column and in other sensitive organs.

An NHS policy document on proton beam therapy underscored its benefit: "One third of survivors of childhood cancer report severe or life-threatening complications up to 30 years after the diagnosis of cancer. This can be due to side effects of cancer treatment and radiotherapy is a significant contributing factor."

Proton beam therapy is particularly effective in treating children and teenagers where any residual damage from radiotherapy could lead to developmental delays, hormonal deficiencies, and issues with bone and muscle growth.

The precision control of proton beams means healthy tissue is spared any contact with x-rays, which helps minimise short-term and long-term side effects.

Treating head and neck carcinomas requires high doses of radiotherapy to sensitive areas such as the front of the brain, base of the skull, mouth and facial bones, and research has shown patients experience less exposure to radiation with proton beam therapy compared with standard radiotherapy.

Tumours that develop close to the spinal cord are difficult to reach, but proton beam therapy is extending clinicians' ability to treat these accurately, reducing the jeopardy of secondary tissue damage.

By the end of 2020, the need to send patients abroad will have ceased and experts believe research will extend the treatment to other cancers over the next decade.

We're here – right where you need us.

Supporting patients on their cancer journey, from diagnosis through to treatment and recovery, we provide access to the latest treatments, including proton beam therapy.

Across our UK network of centres, our consultants, specialists and staff provide an all-encompassing cancer care service. Treatments and services include imaging, chemotherapy, immunotherapy, radiotherapy, proton beam therapy and ongoing supportive care.

Rutherford Cancer Centres

0800 210 0402

therutherford.com

All our registered centres undergo a registration inspection by the independent healthcare regulators of each country (Healthcare Inspectorate Wales, Care Quality Commission) to ensure that the quality and safety of services meet the required standards of care. In addition, ongoing inspections are undertaken, and where these have taken place, full reports are made available on our website.

1 in 2 of us will get Cancer. It's a scary headline.

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