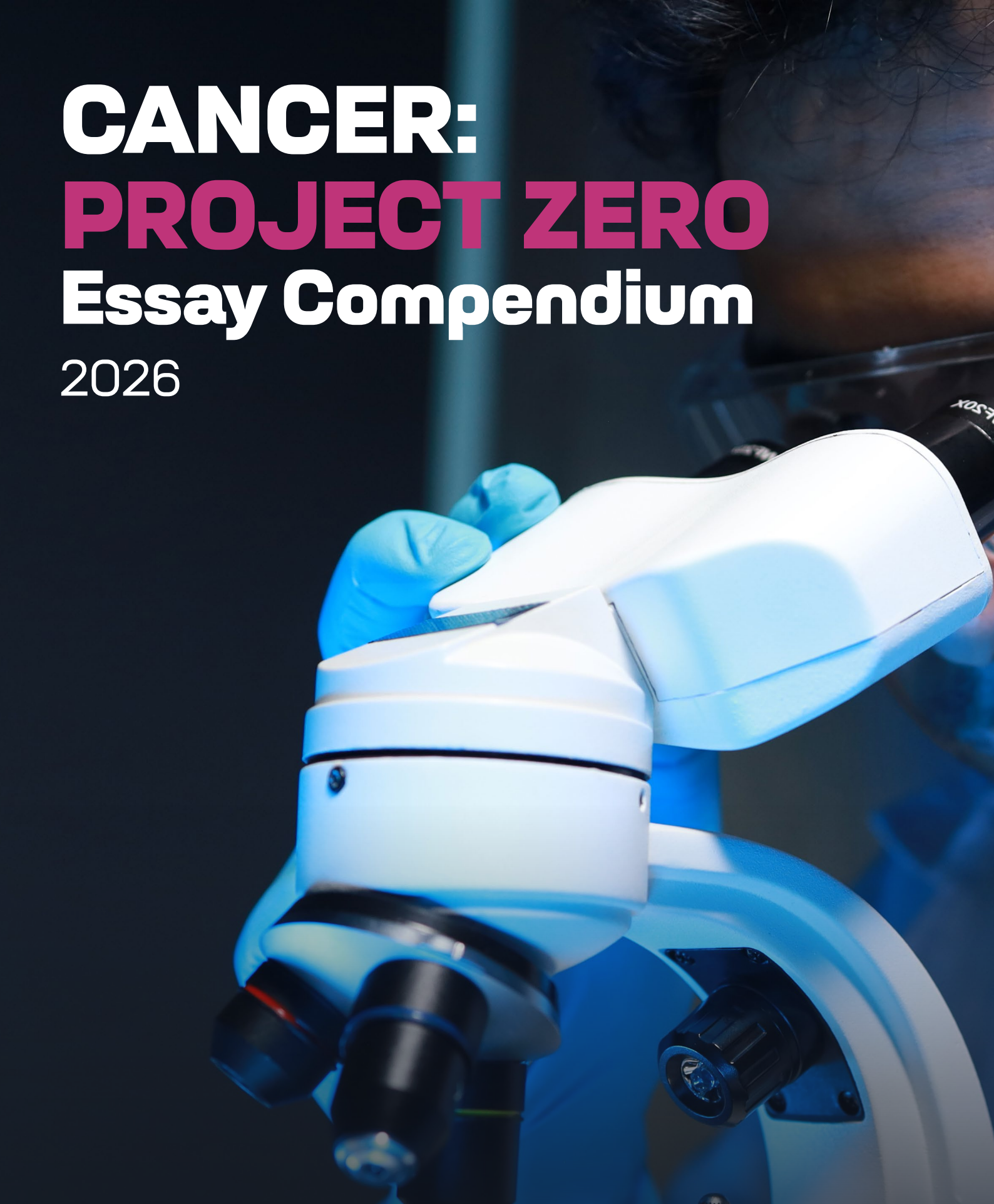
CANCER: PROJECT ZERO Essay Compendium

2026



AstraZeneca

CANCER : PROJECT ZERO

Cancer: Project Zero is a non-promotional campaign funded, initiated and developed by AstraZeneca UK, designed for UK healthcare professionals, health system leaders, patient organisations, government representatives and media.

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CANCER: PROJECT ZERO ESSAY COMPENDIUM FOREWORD

When we launched Cancer: Project Zero, we did so with a bold ambition: to imagine a future where zero people die from cancer and zero families lose someone they love too soon.

At the time, some saw that ambition as aspirational, even provocative. But ambition matters. It sets direction. It creates urgency. It challenges us to think differently about what is possible. With the publication of the National Cancer Plan for England, that ambition feels less provocative and more like a shared commitment across the cancer community – and increasingly, a shared national direction.

In the years since Cancer: Project Zero began, we have seen meaningful progress. Earlier diagnosis rates are improving.[1] Screening programmes are expanding.[1] Scientific innovation is accelerating at an extraordinary pace, from genomics and AI-enabled diagnostics to next-generation immunotherapies and targeted treatments.[2] More people are living longer, better lives after a cancer diagnosis.[3] What once felt like a distant possibility is becoming a clinical reality for many patients.

With the publication of the National Cancer Plan for England, we now have a clear, system-wide framework for delivery. The Plan sets out a bold ambition: that by 2035, three in four people diagnosed with cancer will survive five years or more – representing hundreds of thousands of additional lives saved.[1]

Reading the Plan on World Cancer Day, under the theme United by Unique, felt particularly resonant. Every cancer journey is different. Every person's experience is shaped by their biology, their circumstances and the system that surrounds them. The Plan recognises this. It acknowledges both the progress made and the stark reality that outcomes in the UK still lag behind comparable nations. Now comes the defining chapter: delivery.

Cancer outcomes will not improve because we have another plan. They will improve because we implement it consistently, equitably and at pace. That requires partnership across the entire system. The NHS and government must work alongside researchers, charities, patient organisations and industry. It requires us to modernise pathways, embed innovation, tackle inequalities and ensure that breakthroughs reach patients faster – from prevention and early detection through to diagnosis, treatment and survivorship.

Cancer: Project Zero was always designed to support that kind of collaboration. It was created as a platform to convene diverse perspectives, challenge assumptions and accelerate progress across the cancer pathway. This essay compendium brings together voices from across the oncology community - clinicians, researchers, patient advocates and system leaders - each offering a different perspective on how we close the gap between what is possible and what patients experience today.

This new edition builds on the original Summit collection and strengthens the breadth of insight they represent. The compendium now includes the essay on Delivering the Future of Cancer Nursing, and How CtDNA is Transforming Cancer Care in the NHS in Wales. What unites these contributions is optimism grounded in realism. We are living through a golden age of cancer science. Innovation alone, however, is not enough. Adoption, access, workforce capacity, data integration and equitable delivery will determine whether progress is felt in every community. Breakthroughs must not only be discovered – they must be delivered.

At AstraZeneca, we see ourselves as a long-term partner in that endeavour. We work beyond medicines alone to support earlier diagnosis, biomarker testing, clinical research, pathway redesign and system transformation. We are committed to working with the NHS and the wider cancer community to translate scientific innovation into measurable improvements in survival, experience and equity.

Project Zero remains our North Star, not as a slogan but as a challenge to move faster, to work together more effectively, and to ensure no community is left behind. If we align scientific innovation with system transformation and collective will, we can redefine what a cancer diagnosis means for this generation and the next. The direction is clear. The ambition is shared. The next chapter is delivery - together.

REFERENCES

[1]Department of Health & Social Care and NHS England (2026) The National Cancer Plan for England: Delivering world-class cancer care, p. 2. UK Government. Available at: https://assets.publishing.service.gov.uk/media/699ec931532c9ad91ebbcc64/national-cancer-plan-for-england-delivering-world-class-cancer-care.pdf [Accessed: March 2026]

[2]GOV.UK (2026). AI to be trialled at unprecedented scale across NHS screening. Available at: AI to be trialled at unprecedented scale across NHS screening - GOV.UK [Accessed: March 2026].

[3]Cancer Research UK (2025) Cancer in the UK: Overview 2025, p. 19. Available at: https://www.cancerresearchuk.org/sites/default/files/cancer_in_the_uk_overview_2025.pdf [Accessed: March 2026].

ESSAY AUTHORS & CONTENTS

The Cancer: Project Zero essays have been written by the essay authors in collaboration with AstraZeneca UK. AstraZeneca UK reviewed the essays for medical and factual accuracy, as well as for compliance requirements.

This essay collection was first published in 2024, and some essays reflect the cancer landscapes and discussions of that time. Though contexts may change, the ideas explored here continue to resonate and underscore enduring, important themes.

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CANCER: PROJECT ZERO IS ALL ABOUT THE AMBITION TO ONE DAY ELIMINATE CANCER AS A CAUSE OF DEATH.

A future where zero people die from cancer and zero families lose a loved one too soon from cancer. This is the ultimate ambition.

For some cancer types, zero might sound achievable. Cervical cancer for instance, can already be prevented by available HPV vaccination, or consider breast cancer where the majority of cancers can be diagnosed at an early stage and treated with curative intent. Even so, the reality today for patients with breast and cervical cancers is still very far from Zero with 10-year survival rates of around 80% and 50% respectively.[1,2] For other cancer types, Zero feels like a far-off possibility. This is true for the most common cancer, lung cancer, aggressive cancers with a low five-year survival rate such as pancreatic cancer, as well as rarer cancers. Overall, today's reality is that cancer is still the biggest health burden in the UK. One in two people will get cancer in their lifetime,[3] and cancer has the highest impact on years of healthy life lost to premature mortality or disability of any disease.[4] It is clear there is very much more we need to do to come close to Zero.

The essays in this collection, authored by leaders in the field of oncology, each provide a unique perspective on how close to Zero we truly are. As a collective, they convey our underlying optimism about the potential for substantial progress, while embracing the challenges we must overcome. By sharing their insights, experience and suggestions, each author reflects on what we need to do collectively for the benefit of all those impacted by cancer.

The ambition behind Cancer: Project Zero is not to form unrealistic expectations, but to use an inspirational framework, a 'North star', which enables consideration of the radical changes needed in how we use emerging technologies to diagnose and to treat cancer, in order to advance towards that ultimate ambition.

THE PATH FORWARD

Scientific progress has been rapidly evolving, so we now better understand why and how cancers are formed and how technology can be used to diagnose and treat cancer even more effectively. This has already led to major improvements in cancer outcomes. In the 1970s, only one in four cancer patients survived their disease for 10 years or more. By 2010, this had risen to two in four, and survival continues to improve.[5]

The availability of cancer screening has expanded to cervical, breast, colorectal and recently lung cancer with an estimated potential for over 18,000 lives saved in the UK each year by screening for these cancers. This is matched with public awareness activities such as Detect Cancer Early (Scotland) and Be Clear on Cancer (England) and regional initiatives such as the Leeds Lung Health Check, which aims to improve diagnoses by having screening take place in convenient community locations – such as supermarket carparks.

The pace of drug development for cancer has also increased rapidly - more than 50 new drugs with new mechanisms were approved by the FDA in 2009-2020 vs an average of 2 per year in the 1980s.[6]

We are in a "golden age" of scientific discovery in cancer research – a moment of huge potential to integrate the knowledge of cancer biology, and new data science tools, with better targeted treatments, novel ways to engage the immune system, better ways to combine treatments into effective regimens and better ways to manage side effects of treatment with digital health technology.

This has the potential to benefit more patients than ever before.

At AstraZeneca, we are building on our deep-rooted oncology R&D heritage of nearly one hundred years in the UK, and continue to invest more than $5 billion per year in oncology R&D. Our relentless quest for innovation has led us to invest in a wide range of new potential medicines, novel tools including Artificial Intelligence (AI) for improved diagnostics and novel treatment modalities including antibody drug conjugates, radioconjugates, T cell engagers and cell therapies, – all of which will be required – and more – in order to progress towards our ambition of zero deaths from cancer.

However, despite this golden era, and the great excitement that is offered by the potential of tomorrow's science, there are people living with cancer right now who can only see their lives in increments of just months or weeks.

Unfortunately, the UK continues to lag behind international peers when it comes to cancer outcomes – with our European neighbours as well as countries such as Canada and Australia well ahead in delivering improvements.[7] Five-year survival for lung cancer in the UK was 15% according to the most recent data (2010-2014), outcomes Australia achieved 10 years earlier. Similarly for rectal cancer, five-year survival in England was 62%, approximately 10 years behind Canada. Variations exist across the UK, too. In the UK, more than 30,000 extra cancer cases per year are attributable to socio-economic variation – with outcomes the worst for the most deprived groups.[8] The 'deprivation gap' is greatest for smoking-related cancer sites (lung, laryngeal and oral cavity). For example, research found that lung cancer patients receiving radical radiotherapy – a type of treatment used with intent to cure instead of control – was nearly nine percentage points higher in some regions than others – one of several factors which may explain the regional differences in cancer outcomes.[9]

Poor access to timely diagnosis and treatment, including chemotherapy and radiotherapy, as well as to novel medicines, is likely a key contributor to the worse cancer outcomes seen in the UK compared to other similarly wealthy countries,[10] with the UK spending less per capita on cancer treatment and medicines than most other European countries.[11]

Therefore, to deliver the exciting innovations in cancer care and treatment taking place right here in the UK, our regulatory landscape and access systems must be ready to harness this potential.

With scientific breakthroughs paving the way for a new generation of treatments, we need to ensure innovation is embedded at every stage – from a drug's early development to evaluation of its cost-effectiveness – in order for patients to benefit.

There is a strong case for a shift to a framework where early diagnosis and effective, timely treatment is viewed as a good to be invested in, thereby improving the nation's overall health and productivity, not just as a cost to be managed.

WHERE WE GO FROM HERE

The adoption of groundbreaking therapeutic approaches and technologies could not be more critical if we are to address the mismatch within the UK between the quality of scientific research in oncology and the variable outcomes that so many people are still experiencing. Cancer: Project Zero is not just about celebrating the science that will get us there, but the many people and organisations who will contribute to that process and eventual outcome.

As such, we thank the authors in this essay collection for their invaluable contributions. Each shines a light on some of the most exciting advancements and contributions in cancer care in the UK; helping us better understand collectively how we can get closer to Zero.

As a first step on the road to delivering on these existing possibilities, we, along with many in the cancer community, are calling for a long-term, strategic plan on cancer. Such planning ensures that funding for the much-needed initiatives, tools and technologies as outlined in this collection of essays can be delivered upon to truly transform cancer care. If we act now, we have a real possibility of redefining what it means to be diagnosed with cancer, and creating a future in which cancer has been eliminated as a cause of death.

Cancer: Project Zero is intentionally a positive provocation. There is a huge amount of talent, drive and hope in our community. By harnessing that energy, we have the potential to go further and faster than we might otherwise. We hope this collection of essays helps to reimagine what's possible for cancer as we utilise the breakthrough science that is happening today in pursuit of this goal.

REFERENCES

[1] CRUK (2024) Breast Cancer Statistics. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer (Accessed October 2024)

[2] CRUK (2024) Cervical Cancer Statistics. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/cervical-cancer (Accessed October 2024)

[3] CRUK (2015) 1 in 2 people in the UK will get cancer. Available at: https://news.cancerresearchuk.org/2015/02/04/1-in-2-people-in-the-uk-will-get-cancer/ (Accessed October 2024).

[4] Ahmad, A. S., Offman, J., Delon, C., North, B. V., Shelton, J., & Sasieni, P. D. (2023). Years of life lost due to cancer in the United Kingdom from 1988 to 2017. British journal of cancer, 129(10), 1558–1568. https://doi.org/10.1038/s41416-023-02422-8 (Accessed October 2024)

[5] CRUK (2020). Cancer in the UK 2020: Socio - economic deprivation. Available at: https://bsw.icb.nhs.uk/wp-content/uploads/sites/6/2022/06/cancer_inequalities_in_the_uk-1.pdf (Accessed October 2024)

[6] Olivier, T., Haslam, A., & Prasad, V. (2021) Anticancer Drugs Approved by the US Food and Drug Administration From 2009 to 2020 According to Their Mechanism of Action. JAMA network open, 4(12), e2138793. https://doi.org/10.1001/jamanetworkopen.2021.38793 (Accessed October 2024)

[7] CRUK (2024), Leading on Cancer: Why the next UK Government must set out a new strategy for cancer. Available at: https://news.cancerresearchuk.org/2024/06/19/leading-on-new-strategy-for-cancer/#comments (Accessed October 2024).

[8] CRUK (2020), Cancer in the UK: socio-economic deprivation. Available at: https://bsw.icb.nhs.uk/wp-content/uploads/sites/6/2022/06/cancer_inequalities_in_the_uk-1.pdf. (Accessed October 2024).

[9] H Moller et al (2018), Geographical variations in the use of cancer treatments are associated with survival of lung cancer patients, Thorax 73: 530-537. Available at: https://thorax.bmj.com/content/thoraxjnl/73/6/530.full.pdf (Accessed October 2024).

[10] Smith, J. CRUK (2024), How does cancer treatment in the UK measure up to other countries. Available at: https://news.cancerresearchuk.org/2024/02/27/how-does-cancer-treatment-in-the-uk-measure-up/#:~:text=Overall%2C%20people%20in%20the%20UK%20were%20treated%20with,and%20radiotherapy%20and%20shorter%20waits%20to%20start%20treatment. (Accessed October 2024).

[11] Hofmacher et al (2020), The cost of cancer care in Europe vol 129 p41-49

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MORE RESEARCH, LESS CANCER

Cancer is the defining health issue of our time. It impacts people and their loved ones across the world every day and **nearly 1 in 2 people born in the UK will develop cancer during their lifetimes.**[1] Those are stark statistics, and each cancer case represents a parent, a partner, a sibling, a child, a friend.

Thanks to lifesaving research into cancer prevention, diagnosis and treatment, survival for all cancers combined in the UK has doubled since the early 1970s.[2] In the last 40 years, since the mid-1980s, that equates to more than one million deaths being avoided in the UK[3]. Significant progress has been made possible through investment into cancer research.

However, despite more people surviving their cancer today than ever before and the tireless efforts of hardworking NHS staff, improvements in cancer survival have slowed in recent years. Cancer cases are rising,[4] and patients are waiting too long to be seen and to start treatments across England, Scotland, Wales and Northern Ireland.

There is no quick fix, but improvements can and must be made. We can learn from what has worked before in the UK and around the world. Research and innovation have been the driving force behind the UK doubling cancer survival in the last 50 years – and despite the current outlook faced by cancer patients, **we are at the centre of a golden age of cancer research which, if harnessed, will power economic growth and improve outcomes.**

However, to meet this challenge, we need to be more ambitious.

With the right action and long-term planning, we could reduce the cancer mortality rate in the UK by 15% by 2040 – preventing 20,000 cancer deaths every year.[5]

Cancer Research UK's Leading on Cancer[6] report demonstrates how cancer strategies can save lives from the disease and improve early diagnosis. We've seen the impact of this in comparable countries such as Denmark. A decade ago, England and Denmark were improving cancer outcomes at broadly the same rate. But now, with consistent funding and long-term strategies, Denmark have raced ahead.[7]

It's why Cancer Research UK has called for a dedicated cancer strategy that could pave the way for the UK to be world-leading on cancer again and to enable the UK Government to deliver on three of its most important missions.[8]

BACK RESEARCH AND ACHIEVE ECONOMIC GROWTH

The life sciences sector is a UK success story, but in recent years it has fallen behind its peers. Last year, for the first time since 2012, the UK had no Initial Public Offerings in life sciences[9].

In Longer, Better Lives,[10] Cancer Research UK's manifesto for cancer research and care, we detailed how improvements in cancer research, prevention and care would reduce health, social care and 'informal' care costs. The economic argument for investing in cancer research has been overlooked for too long. **It's estimated that every £1 invested in cancer research generates £2.80 in economic benefits** – leading to improved survival, health benefits for patients, less pressure on the NHS and the creation of more jobs.[11]

SHIFT TO PREVENTION

The UK Government's health mission also emphasises a shift to prevention, with around four in 10 cancer cases being avoidable, such as smoking.[12] Analysis published this year shows that the number of cancer cases caused by smoking in the UK has reached an all-time high.[13] The Tobacco and Vapes Bill, which will introduce legislation to increase the age of sale of cigarettes in the UK,[14] could pave the way for the first UK smokefree generation.

DIAGNOSE EARLIER AND TREAT PEOPLE ON TIME

Since 2015, over 380,000 cancer patients in England haven't been treated on time.[15] In the most recent data from August, only 69.2% of people in England started their treatment within 2 months of an urgent referral, well below the target of 85%.[16] Progress on early diagnosis is also poor, with the NHS unable to meet its target of diagnosing 75% of cancer patients early – at stage 1 or 2. This is a key reason for poorer outcomes in the UK, particularly amongst deprived communities.[17]

We're encouraged by the UK Government's commitment to get back on track and meet all cancer wait time targets by the end of this parliament, and we look forward to working with them to achieve this.

Things can be turned around with innovation and reform. There have been big shifts in how the NHS in England functions, bringing care closer to home through new community diagnostics centres. Initiatives like the use of community pharmacies to support timelier diagnosis, self-referral for specific tests or consultations and innovations like AI tools hold real promise in delivering better care for people with cancer.

The UK needs an ambitious and actionable plan for cancer. The road ahead is not easy. However, if we seize the moment, we can bring about a future where everybody lives longer, better lives, free from the fear of cancer.

REFERENCES

[1] Cancer Research UK. Cancer Statistics for the UK, Risk. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics-for-the-uk. [Last accessed October 2024]

[2] Ibid. Cancer Survival.

[3] Cancer Research UK. Cancer mortality statistics. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/mortality#heading-Zero. [Last accessed October 2024]

[4] Cancer Research UK. Cancer incidence statistics. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/incidence#heading-Zero. [Last accessed October 2024]

[5] Cancer Research UK (2023). Longer, better lives. Available at https://www.cancerresearchuk.org/sites/default/files/cruk_manifesto.pdf . [Last accessed October 2024]

[6] Cancer Research UK (2024). Leading on cancer: The case for a dedicated strategy and political leadership across the UK. Available at https://www.cancerresearchuk.org/sites/default/files/leading_on_cancer_june_2024.pdf . [Last accessed October 2024]

[7] Medlicott, LC. I News (2024). Denmark cancer survival rates were as bad as UK – here's how they improved. Available at https://inews.co.uk/news/world/denmark-cancer-survival-rates-bad-uk-improved-3328812. [Last accessed October 2024]

[8] Cancer Research UK (2024). Leading on cancer: The case for a dedicated strategy and political leadership across the UK. Available at https://www.cancerresearchuk.org/sites/default/files/leading_on_cancer_june_2024.pdf . [Last accessed October 2024]

[9] UK Government (2024). Life Sciences Competitiveness Indicators 2024: Summary. Available at https://www.gov.uk/government/publications/life-sciences-sector-data-2024/life-sciences-competitiveness-indicators-2024-summary#main-points-on-the-uks-performance-in-the-lscis. [Last accessed October 2024]

[10] Cancer Research UK (2023). Longer, better lives. Available at https://www.cancerresearchuk.org/sites/default/files/cruk_manifesto.pdf . [Last accessed October 2024]

[11] Cancer Research UK, PA Consulting (2022). Understanding the Economic Value of Cancer Research. Available at https://www.cancerresearchuk.org/sites/default/files/economic_value_of_cancer_research_-_cruk_full_report_29-06.pdf?_gl=1*mb22ot*_gcl_au*NjU3ODM4NTA5LjE3MjkyNDUyMTY.*_ga*MjgyNzUyNzg0LjE3MjkyNDUyMTY.*_ [Last accessed October 2024]

[12] Cancer Research UK. Cancer Statistics for the UK. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics-for-the-uk . [Last accessed October 2024]

[13] Smith, J. CRUK (2024). Cancers caused by smoking reach all time high. Available at https://news.cancerresearchuk.org/2024/07/09/smoking-cancers-reach-all-time-high/ . [Last accessed October 2024]

[14] UK Parliament (2024). Tobacco and Vapes Bill. Available at https://publications.parliament.uk/pa/bills/cbill/58-04/0220/230220.pdf. [Last accessed October 2024]

[15] Mitchell, M. CRUK (2024). Five priorities for the new Secretary of State for Health and Social Care. Available at https://news.cancerresearchuk.org/2024/07/15/five-priorities-for-the-new-secretary-of-state-for-health-and-social-care/. [Last accessed October 2024]

[16] Lowes S, Sample M. CRUK (2024). Cancer waiting times: Latest Updates and analysis. Available at https://news.cancerresearchuk.org/2024/10/10/cancer-waiting-times-latest-updates-and-analysis/. [Last accessed October 2024]

[17] Triggle N. BBC News (2022). NHS not making progress on early cancer diagnosis. Available at https://www.bbc.co.uk/news/health-60988390. [Last accessed October 2024]

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A RESEARCH DRIVEN HEALTH SERVICE?

RESEARCH HAS MANY BENEFITS TO THE HEALTH SERVICE

Unearthing new ways to save and improve the lives of people affected by cancer is the driving force for many biomedical researchers. Existing care practices can be improved upon with life-changing results if discoveries are translated into new diagnostics and treatments, and with trials to test new drugs and technologies in the health service.

A lack of progress gives an imperative. Lung cancer has seen little improvement in the last 50 years, with only 1 in 10 people surviving the disease for 10 years or more.[1] TRACERx – the TRAcking Cancer Evolution through treatment (Rx) lung study – is designed to understand the driving forces behind cancer evolution, metastases, immune evasion and drug resistance at scale. It has analysed blood and tumour samples from 800 people with non-small cell lung cancer, with 250 investigators based at 13 hospital sites.[2] We can now predict whose lung cancer will return after surgery and who may need additional therapy to help prevent the disease recurrence. The data collected are also driving forward our understanding of how lung cancer develops, and further observational studies are ongoing to lead to more improvements.

As well as leading to future breakthrough and enabling current patients access to the latest innovations through participation in clinical trials, there are other less obvious benefits. **Evidence shows that greater research activity in the health service is associated with an overall higher quality of care, lower levels of patient mortality and improved staff recruitment and retention.**[3,4,5,6] There are also substantial economic gains in contribution to Gross Value Added and job creation.[7,8]

Despite these clear benefits and a welcome focus from the previous government with the Clinical Research Delivery vision[9] and their response to the O'Shaughnessy review,[10] and which the new government have shown signs of continuing, we still don't have a truly research-active health service.

HOW IS RESEARCH PRIORITISED IN THE HEALTH SERVICE?

The context clinical researchers face is a challenging one. In Cancer Research UK's 2023 survey of the UK clinical research workforce, 74% of respondents said it was more difficult to deliver research, and the number of commercial trials initiated in the UK per year fell by 41% between 2017 and 2021.[11,12]

There is not enough capacity for - or prioritisation of - research within the health service. The recent review of the health service stated partnerships with the life sciences industry are 'important but not urgent" for the NHS.[13] Unsurprisingly this is in large part a result of wider pressures facing the health service where research is de-prioritised.

Research can reduce these pressures through improving care, staff retention and bringing in much-needed income. However, 61% of Health Care Professionals that responded to the CRUK survey stated that research and its benefits lacked visibility within the health service. [14] A lack of accountability for research at senior levels was also reported.

There is more to do to ensure research is no longer seen as "nice to have" and instead seen as an essential part for all clinicians to play to improve the lives of their patients. Doing more to prioritise research in the health service will accelerate improvements to care and secure the UK's reputation as a world-leading research base to attract talent and a globally competitive life sciences industry.

OVERCOMING CHALLENGES TO CLINICAL RESEARCH

Clinical research in the UK faces very significant challenges today. Pressure to deliver front-line services, increasing competition in global research, challenges setting up and successfully operating trials and hard choices between investing in current delivery as well as reform to develop better tests, treatment and systems, all add up to the most difficult landscape in a generation.

Ambitious political leadership is needed to drive an integrated approach to clinical research across the NHS. There needs to be clearer points of responsibility for, and better governance of, clinical research in government, with input from key health research stakeholders: government, health service, universities, industry, charities. Clinical research delivery needs to be more closely built into job plans in the NHS so that research output becomes a measured expectation of performance across NHS trusts.

Alongside protecting research time in job plans, measures are needed to cut the time it takes to set up clinical studies, improve the visibility of research and its benefits, strengthen accountability among NHS senior leaders and reduce the wider pressures on the health service. Acute pressures make implementation difficult, but we should be ambitious. **The public agree: polling shows 4 in 5 UK adults believe that healthcare staff should have time dedicated for research, even when the health service is under pressure.**[14]

Due attention should be paid to investigator-led trials which drive progress in addressing unmet need but face specific challenges to initiate and conduct. The falling numbers of clinical academics in the UK is concerning as they provide an important link between academia and the clinic. It's positive a review is underway to help address this decline. We need to protect clinical academics, train more in the best scientific environments and provide integrated and flexible training opportunities across funding agencies.

BARRIERS TO ACCESSING DATA NEED TO BE OVERCOME

Effectively harnessing data has incredible potential to improve our ability to prevent, detect, diagnose and treat cancer. From cutting edge research like AI and genomics, to vital work analysing health systems and prevention, access to high quality data being collected by the health system is central to the future of cancer research and improving patient outcomes.

But currently, there are barriers preventing these data from reaching its lifesaving potential. Despite significant improvements in the quality and volume of cancer data over the last decade, researchers still face complex and uncertain processes when accessing data. Further, the ability to link datasets to generate further insights, for example between primary and secondary care, remains a significant challenge. "Real world" data analysis in routine healthcare is challenging owing to a lack of consistency in the systematic collection of patient data. **The trust of patients and the public is a pre-requisite for meeting the potential of data-driven research and must be at the heart of efforts to tackle these barriers.** CRUK are working with other charities, Government and NHS England to unlock the potential of data as a driver for change within health and research.

A PIPELINE OF DISCOVERIES IS NEEDED

To secure future breakthroughs to translate into innovations to test in the health service, sustained investment is needed including in discovery "blue-skies" science. The TRACERx study was only possible through strategic long-term investment. The programme has unveiled new insights into how lung cancer evolves over time, unlocked potential new ways to diagnose and treat it, fostered a growing lung cancer research community in the UK and generated new areas for commercial science.

Take the discovery of a gene called EGFR, which is found in a defective form in some lung cancer tumours. This gene was first associated with cancer in the 1980s[15] by Cancer Research UK scientists studying the links between viruses and cancer. The drugs developed from this discovery took another 30 years to reach the clinical and approval. These drugs have now transformed survival rates[16] for certain forms of lung cancer.

Sustained investment in the UK's cancer research infrastructure is needed to ensure a pipeline of scientific discoveries to help the patients of tomorrow.

Clinical cancer research is an example of real strength in the UK but there are barriers that are stifling the progress of the development of new innovations that will improve patient outcomes.

The new government should give due attention to the valuable contribution that clinical research can make to their health and growth missions. Greater prioritisation of research in the health service and collaboration across the life sciences sector will lead to improvements in our understanding of cancer and how it develops and better measures to prevent, detect and treat it.

REFERENCES

[1] Cancer Research UK. Lung cancer statistics. Available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/lung-cancer. [Accessed October 2024].

[2] CRUK, Thompson, K. (2022) TRACERx EVO, a new programme to transform lung cancer research. Available at https://news.cancerresearchuk.org/2022/11/09/tracerx-evo-a-new-programme-to-transform-lung-cancer-research/. [Accessed October 2024]

[3] Boaz, A., Hanney, S., Jones, T., & Soper, B. (2015). Does the engagement of clinicians and organisations in research improve healthcare performance: a three-stage review. BMJ open, 5(12), e009415. https://doi.org/10.1136/bmjopen-2015-009415 [Accessed October 2024]

[4] Jonker, L. and Fisher, S.J. (2018) The correlation between National Health Service trusts' clinical trial activity and both mortality rates and care quality commission ratings: a retrospective cross-sectional study. Public Health. 2018; 1–6. ISSN 0033-3506, https://doi.org/10.1016/j.puhe.2017.12.022. [Accessed October 2024]

[5] Harding, K., Lynch, L., Porter, J., & Taylor, N. F. (2017). Organisational benefits of a strong research culture in a health service: a systematic review. Australian health review: a publication of the Australian Hospital Association, 41(1), 45–53. https://doi.org/10.1071/AH15180[6] KPMG. Impact and value of the NIHR Clinical Research Network. 2019. [Accessed October 2024]

[6] Rees, M., Bracewell, M. (2019) On behalf of Medical Academic Staff Committee of the British Medical Association, Academic factors in medical recruitment: evidence to support improvements in medical recruitment and retention by improving the academic content in medical posts, Postgraduate Medical Journal, Volume 95, Issue 1124, June 2019, Pages 323–327, https://doi.org/10.1136/postgradmedj-2019-136501. [Accessed October 2024]

[7] KPMG. (2019) Impact and value of the NIHR Clinical Research Network. Available at bit.ly/NIHR_CRN_Impact_and_Value_Assessment. [Accessed October 2024]

[8] ABPI, Frontier Economics. (2024) The value of industry clinical trials to the UK. Available at https://www.frontier-economics.com/media/qmqhy3m4/the-value-of-industry-clinical-trials-to-the-uk-interim-report.pdf. [Accessed October 2024]

[9] Department of Health & Social Care. (2022) The Future of Clinical Research Delivery: 2022 to 2025 implementation plan. Available at https://www.gov.uk/government/publications/the-future-of-uk-clinical-research-delivery/saving-and-improving-lives-the-future-of-uk-clinical-research-delivery. [Accessed October 2024]

[10] Department of Health & Social Care. (2023) Full government response to the Lord O'Shaughnessy review into commercial clinical trials. Available at https://www.gov.uk/government/publications/government-response-to-the-review-into-commercial-clinical-trials/full-government-response-to-the-lord-oshaughnessy-review-into-commercial-clinical-trials. [Accessed October 2024]

[11] CRUK. (2023) Survey of UK clinical research workforce 2023. Available at https://www.cancerresearchuk.org/sites/default/files/2023_survey_of_the_uk_clinical_research_workforce_-_website_version.pdf. [Accessed October 2024]

[12] The Association of the British Pharmaceutical Industry. (2022) Rescuing patient access to industry clinical trials in the UK. 2022. Available at https://www.abpi.org.uk/publications/rescuing-the-uk-industry-clinical-trials/ [Accessed October 2024]

[13] Lord Darzi, A. (2024) Independent Investigation of the National Health Service of England. Available at https://assets.publishing.service.gov.uk/media/66f42ae630536cb92748271f/Lord-Darzi-Independent-Investigation-of-the-National-Health-Service-in-England-Updated-25-September.pdf. [Accessed October 2024]

[14] CRUK, Kiely, J. (2024) Why the next government needs to support clinical research – for our health and the NHS. Available at https://news.cancerresearchuk.org/2024/02/12/clinical-research-nhs-next-government/. [Accessed October 2024]

[15] Danovi, S. CRUK, EGFR – Wanna be starting something? Available at https://news.cancerresearchuk.org/2011/08/05/high-impact-science-egfr/. [Accessed October 2024]

[16] Scowcroft, A. Cancer Research UK, US Lung cancer data points to the power of cancer research. Available at https://news.cancerresearchuk.org/2020/08/18/us-lung-cancer-data-points-to-the-power-of-cancer-research/. [Accessed October 2024]

PROFESSOR FRANK CHINEGWUNDOH MBE

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CancerBlackCare

EQUITY IN CANCER CARE

THE CURRENT ISSUE IN CANCER CARE

Cancer does not discriminate. It affects anyone, anywhere – but some groups (namely those defined by race, ethnicity and socio-economic deprivation) experience an increased likelihood of being diagnosed with cancer and worse outcomes than others.

In England, for example, lung cancer mortality rates are 170% higher for men and 176% higher for women living in the most deprived areas, compared with the least deprived.[1]

And in breast cancer, Black African women are approximately twice as likely to be diagnosed with late-stage breast cancer compared to white women.[2]

If we are to be ambitious about the future of cancer care, we need to ensure these variations in experience become a thing of the past.

How do we do that?

EQUITY-OVER-EQUALITY

Thinking about diagnosis, different groups require different approaches to place them on a level-playing field so, we need to take an equity rather than equality approach.

Take uptake of breast cancer screening. It is far lower in black women than white women – despite the fact that, from an equality perspective, they all receive the same letters inviting them to a screening.

However, equity is all about understanding why black women are less likely to attend screening appointments - and then taking steps to make it easier for them to do so.

Equity is what will shift the needle for groups who experience worse outcomes. While equality calls for equal treatment for all patients, health equity prioritises treatment and care based on need.

HOW WE'RE APPROACHING EQUITY-OVER-EQUALITY TODAY

There are many instances where we are taking an 'equity-over-equality' approach – and, importantly, seeing positive results.

The targeted lung health check programme (TLHC) is a national scheme that identifies people aged 55-74 at increased risk of lung cancer and invites them for a lung check and chest CT scan – with these checks often taking place in purpose-built centres in community spaces such as pubs, leisure centres and retail parks.[3]

Since the programme's commencement in 2019, the programme has detected over 3,000 lung cancers, with over 74% at an early stage – when lung cancer is more treatable.[3]

In South Yorkshire, the scheme has diagnosed over 300 lung cancers that would have otherwise gone undiagnosed and detected 79 other cancers – including breast, kidney, lymphomas, and skin cancer. [3]

These lung health checks have resulted in, for the first time ever, more than a third of people from the most deprived fifth of England being diagnosed with lung cancer at stage one or two in 2022 (34.5%) – up from 30% in 2019.[4] Though a 4.5% increase may seem small, this is an exciting first step in showing the potential of a national programme to drive improvements in diagnosis for those who need it the most.

Back to breast cancer, as part of Cancer Black Care, I went to so many high-level NHS cancer meetings where, year after year, the uptake of breast cancer screenings in black women was hovering around 30% - and nothing was being done.

I decided to employ two amazing black women to help me get hold of the invitees who had been asked to attend King's College Breast Cancer Screening Centre.

These two women telephoned 600 of the invitees and converted one third of them into attendees whilst also being able to uncover some of the underlying reasons for why appointments were forgone in the first place. These included:

- **The concept that screening means there is something wrong with you**
- **Familial responsibilities and;**
- **Travelling to the Caribbean / Africa.**

We took these learnings to further drive screening attendance for black women in the local community.

There is a similar success story of local community engagement with Prostate Cancer UK in Bristol.[5]

Here, GPs contacted all men in catchment areas where there was a high proportion of black men and invited them to do a blood test.

The invitation removed the reliance on these men to have existing knowledge about their own risk to prostate cancer and led many to book a blood test.

As such, I would like to see a revision to the Prostate Cancer Risk Management Programme, so that all men at the highest risk for prostate cancer are offered immediate PSA screening. Currently, the Programme focuses on providing GPs and primary care professionals with the information to counsel men who ask about PSA testing.[6]

DELIVERING AN EQUITABLE FUTURE

So, if we want to deliver a more equitable future in cancer care, we need to focus on what we know works well: understanding social motivations and behaviour through community engagement.

The Core20PLUS5 Connector Programme funds integrated care systems (ICS) and place-based initiatives to recruit, mobilise and support those with influence in their community to help engage local people with key health services – such as cancer screenings. This is a great initiative, and we need to ensure the continued provision of such services.

Community diagnostic centres will also be key to help fill the gaps where hospitals and GP practices are stretched. The Mile End Early Diagnosis Centre is a first of its kind and provides an extra 16,500 procedures a year across the whole of North East London.[7]

Access to research trials of new cancer drugs will also be fundamental to deliver positive change. Promisingly, there's already an understanding that there needs to be more access equity in trials. Initiatives in East London – such as public engagement days – to improve access to studies and ensure trial results reflect our diverse population.

Ultimately, if we want to get to 'Zero', we need to be proactive in considering the demographics we're trying to reach and tailoring our approach to them, so that reasons like those stopping women from accessing breast cancer screening in London no longer get in the way of timely diagnosis.

The future is bright. It just takes recognition of the issue at hand - and commitment to tackling it - to ensure sustained change for everybody impacted by cancer.

REFERENCES

[1] Cancer Research UK. Lung Cancer Mortality Statistics. Available at: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/lung-cancer/mortality#heading-Four. Last Accessed October 2024.

[2] Cancer Research UK, Black African women almost twice as likely to be diagnosed with late stage breast cancer compared to white women (2016). Available at: https://news.cancerresearchuk.org/2016/11/16/black-african-women-almost-twice-as-likely-to-be-diagnosed-with-late-stage-breast-cancer-compared-to/. Last Accessed October 2024.

[3] Dr Jason Page, NHS England Rolling out targeted lung health checks (2024). Available at: https://www.england.nhs.uk/blog/rolling-out-targeted-lung-health-checks/. Last Accessed October 2024.

[4] NHS England Most deprived communities more likely to receive early lung cancer diagnosis thanks to NHS trucks and lung health checks being offered in the community (2023). Available at https://www.england.nhs.uk/east-of-england/2023/04/28/most-deprived-communities-more-likely-to-receive-early-lung-cancer-diagnosis-thanks-to-nhs-trucks-and-lung-health-checks-being-offered-in-the-community/#:~:text=For%20the%20first%20time%20ever,up%20from%2030%25%20in%202019. Last Accessed October 2024.

[5] Prostate Cancer UK Delivering the PCN Directed Enhanced Service for Prostate Cancer. Available at: https://prostatecanceruk.org/for-health-professionals/resources/pcn-des. Last Accessed October 2024.

[6] Gov.UK, Prostate cancer risk management programme: overview. Available at: https://www.gov.uk/guidance/prostate-cancer-risk-management-programme-overview. Last Accessed October 2024.

[7] NHS North East London Cancer Alliance The Mile End Diagnosis Centre. Available at: https://www.nelcanceralliance.nhs.uk/mile-end-early-diagnosis-centre. Last Accessed October 2024.

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EARLIER DETECTION AND PREVENTION OF CANCER

CHALLENGING THE STATUS QUO

Imagine a future where annual work appraisals in 2034 include personalised health checks. Smartwatches track vital signs, online forms assess risk factors, and convenient workplace testing offers early detection for diseases like cancer. This proactive approach, driven by compelling health economic calculations, prioritises prevention and early intervention, ensuring a healthier workforce and improved quality of life for all.

This utopian vision is fuelled by the stark reality of increasing cancer rates. Statistics show that one in two individuals born in the UK in 1961 will develop cancer during their lifetime.[1] Current reliance on symptom-based diagnosis often leads to late-stage detection, resulting in complex treatments, reduced survival rates, and significant side effects.

Public anxieties surrounding cancer are palpable. A University of Cambridge survey[2] revealed that two-thirds of respondents feared a cancer diagnosis more than any other medical condition. Late detection emerged as the primary concern, with 55% desiring advancements in early diagnosis. Concerns extended beyond survival to encompass the debilitating side effects of treatment, highlighting the need for a paradigm shift in cancer care.

The societal implications of this growing cancer burden are significant. An aging population, a major risk factor for cancer, coupled with increasing life expectancy, translates to more individuals experiencing prolonged periods of ill health. Data indicates that on average, women spend 20.1 years (24%) of their life in poor health, compared to men who spend 16.4 years (21%) in poor health. Geographic variation also presents challenges. In 2020-22, healthy life expectancy in the North East was almost seven years shorter for males and six years shorter for females compared with the South East.[3] Delaying disease onset and extending healthy lifespans are paramount for a sustainable healthcare system. **Remarkably, an estimated 38% of cancer cases are preventable, underscoring the potential of proactive measures.[4]**

HOW EARLY DO WE WANT TO KNOW ABOUT CANCER?

Early cancer detection, ideally at a pre-cancerous stage, offers the best chance for effective treatment with minimal side effects. Pathologists have long recognised pre-cancerous lesions, and advancements in ultra-sensitive sequencing technologies are illuminating the progression from pre-cancer to invasive cancer.[5] Recent breakthroughs have even identified critical mutations in blood cancers years before clinical diagnosis.[6]

However, the challenge lies in distinguishing between indolent pre-cancerous changes that may never progress and those destined to become life-threatening. Overdiagnosis, where a diagnosed disease is unlikely to cause harm, can lead to unnecessary anxiety and potentially harmful treatments. **Striking a balance between early detection and avoiding overdiagnosis is crucial.**

THE TECHNOLOGY REVOLUTION FOR ENHANCED CANCER DETECTION

The convergence of several technological advancements has positioned us at the cusp of a revolution in cancer detection. Affordable and accurate nucleic acid sequencing technologies can detect minute genetic changes, while combining DNA, methylation, and protein analysis amplifies signals for earlier detection.

Tissue-specific blueprints enable tracing the origin of cancerous cells.

This progress has spurred a surge in the development of minimally invasive cancer tests. While promising, current data suggests reduced accuracy in detecting early-stage cancers, raising concerns about lead-time bias – detecting cancer earlier without improving outcomes. Combinatorial methods,[7] serial testing,[8] and sampling closer to the tumour (or precursor) site[9] or utilising bodily fluids like urine, stool, or breath[10] hold potential for enhancing sensitivity.

There has been rapid progress with multi-cancer early detection blood tests, while specificity remains high, confirmation of the tumour site often necessitates whole-body imaging. Cost remains a barrier to equitable access, highlighting the need for affordable solutions. Artificial intelligence applied to medical imaging, such as low-dose CT scans for lung cancer screening or mammograms for breast cancer, and digital pathology images, offers promising avenues for scalable and cost-effective early detection.[11]

Looking ahead, further advancements could include:

- **Immune system readouts:** Leveraging the body's natural defence system to detect cancer cells.[12]
- **Remote sensors:** Home-based sensors detecting changes in appearance and metabolites in bodily fluids.[13]
- **Behavioural data analysis:** Identifying changes in behaviour, such as shopping habits, that could indicate early cancer symptoms.[14]

WHAT ELSE CAN WE DO TO PREVENT CANCER?

Early detection is only meaningful with effective interventions to prevent cancer progression. While prompt access to high-quality healthcare is essential, broader public health measures are equally crucial.

Addressing preventable risk factors like smoking and obesity is paramount and achievable now because it does not require development of new technology. Phased bans on tobacco sales and policies restricting junk food advertising to children, alongside sugar taxes, can significantly reduce cancer incidence.[15]

Developing new medicines, including vaccines, to intercept and prevent cancer is likely to be the new frontier once we can understand the biology of cancer and detect the early signs accurately.

The success of HPV vaccination in preventing cervical cancer highlights this potential. While more complex for non-communicable cancers, vaccines are being explored for advanced cases with defined epitopes. Targeting cells expressing specific risk variants in individuals with high genetic predisposition to cancer is a promising avenue.[16]

Repurposing existing medicines for earlier intervention is another strategy. However, early deployment necessitates impeccable safety profiles and minimal side effects. Adjusting healthcare policies to incentivise and evaluate the cost-effectiveness of cancer prevention medicines, similar to cardiovascular disease prevention, is crucial.[17]

WHY IS A MULTIDISCIPLINARY APPROACH KEY FOR EARLIER DETECTION AND PREVENTION?

Progress hinges on breaking down disciplinary silos and fostering collaboration between mathematicians, AI specialists, biologists, chemical engineers, clinicians, and patients. Creating spaces where these experts can work side-by-side, such as dedicated interdisciplinary research facilities within patient-facing hospitals and integrated early cancer detection and prevention clinics, is essential for translating research into clinical benefits.[18]

The development of non-invasive tests for early oesophageal cancer detection exemplifies the need for practical, community-accessible solutions.[19] Technological advancements alone are insufficient; translating innovation into real-world impact requires a multidisciplinary approach.

CONCLUSION: EMBRACING A FUTURE OF PROACTIVE CANCER CARE

We stand on the precipice of a transformative era in cancer care, shifting from reactive treatment to proactive prevention and early intervention.

Harnessing technological advancements, embracing a multidisciplinary approach, and implementing supportive healthcare policies are crucial for realising this vision.

While the potential benefits are immense, we must proceed thoughtfully, ensuring rigorous evidence generation and equitable access to avoid exacerbating health inequalities. By working together, we can usher in a future where cancer is detected earlier, treated more effectively, and its impact on individuals and society is minimised.

REFERENCES

[1] Cancer Research UK. (2024) Cancer risk statistics. Available at: https://www.cancerresearchuk.org/health-professional/cancer-statistics/risk [last accessed October 2024]

[2] University of Cambridge. (2024). Cancer is the public's biggest health concern. Available at: https://www.cam.ac.uk/stories/2024-cancer-polling [last accessed October 2024]

[3] The King's Fund (2024). What is happening to life expectancy in England? Available at: https://www.kingsfund.org.uk/insight-and-analysis/long-reads/whats-happening-life-expectancy-england#:~:text=For%20the%20three%20aggregated%20years,been%20spent%20in%20poor%20health. [last accessed October 2024]

[4] Cancer Research UK. Statistics on preventable cancers. Available at: https://www.cancerresearchuk.org/health-professional/cancer-statistics/risk/preventable-cancers [last accessed October 2024]

[5] Bowles, A. L., (2022). Leveraging single cell sequencing to unravel intratumour heterogeneity and tumour evolution in human cancers. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9322001/ [last accessed October 2024]

[6] Chen et al., (2020). Non-invasive early detection of cancer four years before conventional diagnosis using a blood test. Available at: https://www.nature.com/articles/s41467-020-17316-z [last accessed October 2024]

[7] Newman et al., (2016). Integrated digital error suppression for improved detection of circulating tumor DNA. Available at: https://www.nature.com/articles/nbt.3520 [last accessed October 2024]

[8] Virdee et al., (2023). BLOod Test Trend for cancEr Detection (BLOTTED): protocol for an observational and prediction model development study using English primary care electronic health record data. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9830700/ [last accessed October 2024]

[9] Shaukat, A., Levin, T.R. (2022). Current and future colorectal cancer screening strategies. Nat Rev Gastroenterol Hepatol 19, 521–531. https://doi.org/10.1038/s41575-022-00612-y [Last accessed October 2024]

[10] Debashish et al., (2020). Identification of Biomarker Hyaluronan on Colon Cancer Extracellular Vesicles Using Correlative AFM and Spectroscopy. Available at: https://pubs.acs.org/doi/10.1021/acs.jpclett.0c01018 [last accessed October 2024]

[11] Chen et al., (2021). Artificial intelligence for assisting cancer diagnosis and treatment in the era of precision medicine. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8626610/ [last accessed October 2024]

[12] Le et al., (2022). Harnessing the Immune System with Cancer Vaccines: From Prevention to Therapeutics. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9146235/ [last accessed October 2024]

[13] Park et al., (2020). A mountable toilet system for personalized health monitoring via the analysis of excreta. Available at: https://www.nature.com/articles/s41551-020-0534-9 [last accessed October 2024]

[14] Flanagan et al., (2019). Self-Care Behaviors of Ovarian Cancer Patients Before Their Diagnosis: Proof-of-Concept Study. Available at: https://cancer.jmir.org/2019/1/e10447 [last accessed October 2024]

[15] Department for Health & Social Care (2023). 10-Year Cancer Plan: call for evidence. Available at: https://www.gov.uk/government/calls-for-evidence/10-year-cancer-plan-call-for-evidence/10-year-cancer-plan-call-for-evidence [last accessed October 2024]

[16] Wang, Q. (2016). Cancer predisposition genes: molecular mechanisms and clinical impact on personalized cancer care: examples of Lynch and HBOC syndromes. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4753377/ [last accessed October 2024]

[17] Andrew Reynolds (2023). Premalignant disease: How could treatment help prevent cancer in the future? Available at: https://www.astrazeneca.com/what-science-can-do/topics/disease-understanding/premalignantdisease.html [last accessed October 2024]

[18] Independent Cancer Taskforce. 2015. Achieving World-Class Cancer Outcomes: A Strategy for England 2015-2020. London: Independent Cancer Taskforce. http://bit.ly/1ldwf5W [last accessed October 2024]

[19] Qu et al., (2024). Esophageal cancer screening, early detection and treatment: Current insights and future directions. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11037049/ [last accessed October 2024]

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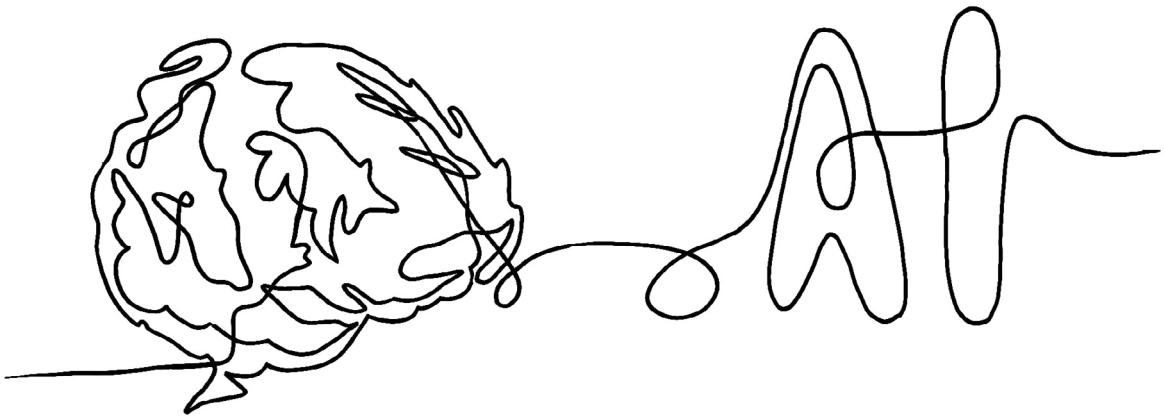

ARTIFICIAL INTELLIGENCE

THE ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN IMPROVING THE UK HEALTHCARE LANDSCAPE

The transformative power of AI in revolutionising the health system is no longer a distant dream—it's a reality that's here to stay. AI is not a cure for cancer but is a catalyst for enhancing the delivery of care and discovering new therapies. AI has the potential to revolutionise the entire cancer care pathway. Its applications are vast and varied, ranging from increasing diagnostic accuracy to enhancing patient communication.[1] AI can analyse large datasets to identify individuals at higher risk of developing cancer, enabling targeted prevention strategies,[2] as well as facilitate remote monitoring of patients through wearable devices and mobile apps, ensuring timely interventions and reducing hospital visits.[3]

AI has already made notable progress in the field of oncology, especially in early detection and reducing patient wait times. An AI pilot implemented by the Mid and South Essex NHS Foundation Trust cut patient appointment 'no-shows' by nearly a third in six months, potentially saving £27.5 million annually if maintained. As a result, the NHS announced in March 2024 that it was expanding the technology to 10 more Trusts.[4] More recently, in May 2024, the Government funded £15.5 million to roll out AI in all radiography departments in England.[5] This AI identifies cancer cells 2.5 times faster than doctors by reviewing CT or MRI scans, distinguishing cancerous cells from healthy organs.

The incorporation of AI into cancer care not only holds immense promise for patient outcomes but offers significant economic advantages, such as reducing false negatives and improving diagnostic accuracy. In October 2023, the NHS invested £21 million in AI tools for lung cancer diagnosis, potentially saving £235 million over five years by reducing false negatives by 10%.[6] The use of AI in cancer care also offers wider economic benefits such as helping people get back to work sooner, minimising the economic burden of prolonged sick leave and healthcare costs.

However, despite these encouraging developments, AI's full potential in cancer care is yet to be fully realised.

WHAT CAN AI ALREADY ACHIEVE?

Five years ago, a study I contributed to showed AI's effectiveness in early cancer diagnosis, particularly in interpreting mammograms.[7] The AI system reduced false negatives (9.4% in the USA, 2.7% in the UK) and false positives (5.7% in the USA, 1.2% in the UK). This is crucial for improving diagnostic accuracy, as undetected cancer can progress and become more challenging to treat when finally discovered.

The NHS is currently grappling with workforce challenges, including a 10-12% vacancy rate for pathologists and a 15% shortage of clinical oncologists, projected to reach 25% within the next three years.[8] The standard approach for breast cancer screening involves double reading, where each mammogram is reviewed by two radiologists to decide whether further follow-up is necessary.[7] **The study revealed that the AI system could reduce the workload of the second reader in the UK's double-reading process by 88%, drastically easing workforce pressure.**

It also found that the AI system outperformed all human readers in an independent evaluation involving six radiologists.[7] Further studies have explored AI's potential in other tumours, accelerating detection, drug discovery, and patient education. For example, Oxford University Hospitals NHS Foundation Trust is developing an AI system to help pathologists detect and grade prostate tumours.[9]

Generative AI, which learns from data to develop new insights, is unlocking new possibilities in medicine. In lung cancer, AI technologies predict patient outcomes reliably. A study by Imperial College London developed a "virtual biopsy" using a deep-learning framework to model the connection between CT imaging features and metabolomic profiles of lung cancers, obtaining critical insights non-invasively.[10]

FUTURE IMPLICATIONS OF AI FOR CANCER CARE

AI, combined with the many other areas contained within this essay collection, is making the vision of no one dying from cancer a tangible reality.

Early detection of disease is going to be a key tenet of any health system that may one day be able to eliminate cancer as a cause of death.

It may be some time off, but it feels eminently possible to, at some point, have a system which uses AI to detect all cancers earlier, leading to less aggressive treatment, fewer side effects and better quality of life.

Once cancer has been detected, you want to make sure the right treatment is used giving the patient the best chance of survival. We can do that now. With AI, we can analyse patient data, including genetics, to tailor treatment plans to suit the individual. Multimodal AI allows for integrating diverse data types, of which we have a plethora of in the NHS. Then, predictive models, as they become more widely adopted, will identify patients who may benefit from specific treatments in routine care and trial settings.

And it's not just the patients who will benefit from AI. **AI can support clinical decision making with real-time, evidence based recommendations that will help to streamline workflows and reduce administrative burdens.**

BALANCING INNOVATION WITH SAFETY

The UK should be ambitious about a future where AI enhances timely cancer detection and treatment for everyone. The NHS has the infrastructure and potential to achieve this. Take the NHS AI Lab aiding in testing and scaling AI technologies for early lung cancer detection and enhancing the Breast Cancer Screening Programme. **But, ambition must be tempered with pragmatism to ensure the system is prepared.**

Regulation is crucial and we need an efficient regulatory framework for AI. **Over-regulation could stifle innovation, while inadequate regulation could allow unsafe technologies to enter the market.** In the US, the FDA has approved many AI devices, but reliable evaluation methods are essential to ensure safety and effectiveness, considering biases and real-time performance. Many FDA approvals rely on the 510(k) pathway (a premarket submission made to FDA to demonstrate that the device to be marketed is safe and effective), requiring substantial post-market efforts to prevent data drift and unintended consequences.[11]

The Regulatory Horizons Council report highlights the need for robust regulatory frameworks to ensure AI safety and efficacy in healthcare while avoiding excessive regulation.[12] Continuous monitoring and validation of AI systems are essential to maintain high standards of care. **By establishing the right regulatory framework, we can harness AI's transformative power in healthcare, ensuring these technologies are safe, effective, and beneficial for all.** The future of healthcare innovation depends on it.

ETHICAL AI

The quality of data is crucial for developing effective precision oncological AI systems. The NHS has access to 65 million data records which can be utilized to create new AI tools. However, safeguarding patient data is critical, especially given recent cybersecurity concerns.

Currently, disparities exist among certain population segments regarding the uptake of cancer screening, delayed diagnosis, and cancer survival. So, it's crucial that data is representative of all demographic groups to avoid perpetuating inequalities. Algorithms should be explainable and interpretable to ensure trust, preservation of patient autonomy, and prevention of unintended consequences.[13,14] AI should be a tool to minimise, not exacerbate, these issues.

CONCLUSION

The journey to harnessing AI's full potential in healthcare is a collaborative effort that requires careful planning, robust regulation, and continuous innovation. As such, it is key the new Government continues to support the rollout of new AI technology in the NHS so that fewer people die because of

REFERENCES

[1] Basu K, Sinha R, Ong A, Basu T (2020). Artificial Intelligence: How is It Changing Medical Sciences and Its Future? Indian J Dermatol. Sep-Oct;65(5):365-370. doi: 10.4103/ijd.IJD_421_20. PMID: 33165420; PMCID: PMC7640807.

[2] Sebastian AM, Peter D (2022). Artificial Intelligence in Cancer Research: Trends, Challenges and Future Directions. Life (Basel). doi: 10.3390/life12121991. PMID: 36556356; PMCID: PMC9786074.

[3] Liao Y et al (2019). The Future of Wearable Technologies and Remote Monitoring in Health Care. Am Soc Clin Oncol Educ Book. doi: 10.1200/EDBK_238919. Epub 2019 May 17. PMID: 31099626; PMCID: PMC8325475.

[4] NHS England (2024). NHS AI expansion to help tackle missed appointments and improve waiting times. Available at: https://www.england.nhs.uk/2024/03/nhs-ai-expansion-to-help-tackle-missed-appointments-and-improve-waiting-times/ [last accessed October 2024]

[5] UK Government (2024). AI technology to help cut cancer waiting lists. Available at: https://www.gov.uk/government/news/ai-technology-to-help-cut-cancer-waiting-lists#:~:text=It%20works%20by%20automatically%20reviewing,being%20damaged%20during%20radiation%20treatment [last accessed October 2024]

[6] Woolley (2024). The NHS has spent £21m on AI tools. Will they be worth it? Available at: https://www.frontier-economics.com/uk/en/news-and-insights/news/news-article-i20547-the-nhs-has-spent-21m-on-ai-tools-will-they-be-worth-it/ [last accessed October 2024]

[7] McKinney et al. (2020). International Evaluation of an AI system for breast cancer screening. https://doi.org/10.1038/s41586-019-1799-6 [last accessed October 2024]

[8] European Cancer Organisation (2024). A Cancer Workforce in Crisis. Available at: https://www.europeancancer.org/resources/407:press-release-a-cancer-workforce-in-crisis.html#:~:text=In%20the%20UK%2C%20where%20cancer,within%20the%20next%203%20years [last accessed October 2024]

[9] The University of Oxford (2023). Prostate cancer AI diagnosis tool begins evaluation in Oxford. Available at: https://www.ox.ac.uk/news/2023-03-10-prostate-cancer-ai-diagnosis-tool-begins-evaluation-oxford [last accessed October 2024]

[10] Boubnovski Martell, M., Linton-Reid, K., Hindocha, S. et al (2024). Deep representation learning of tissue metabolome and computed tomography annotates NSCLC classification and prognosis. npj Precis. Onc. 8, 28. https://doi.org/10.1038/s41698-024-00502-3 [Last accessed October 2024]

[11] Guni, A. et al (2024). The Lancet. The next generation of evidence synthesis for diagnostic accuracy studies in artificial intelligence. DOI: https://doi.org/10.1016/S2589-7500(24)00115-8 [last accessed October 2024]

[12] Regulatory Horizons Council (2022). The Regulation of Artificial Intelligence as a Medical Device. Available at: https://assets.publishing.service.gov.uk/media/6384bf98e90e0778a46ce99f/RHC_regulation_of_AI_as_a_Medical_Device_report.pdf [last accessed October 2024]

[13] Farasati Far B. Artificial intelligence ethics in precision oncology: balancing advancements in technology with patient privacy and autonomy. Explor Target Antitumor Ther. 2023;4(4):685-689. doi: 10.37349/etat.2023.00160. Epub 2023 Aug 31. PMID: 37720345; PMCID: PMC10501889.

[14] Hantel A, Walsh TP, Marron JM, et al. Perspectives of Oncologists on the Ethical Implications of Using Artificial Intelligence for Cancer Care. JAMA Netw Open. 2024;7(3):e244077. doi:10.1001/jamanetworkopen.2024.4077

PROFESSOR RICHARD SIMCOCK

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LONGER, BETTER LIVES

Macmillan is the UK's largest cancer support charity, founded over 100 years ago by Douglas Macmillan, who stated that we stand for "betterness". Making lives better is central to what we want to achieve, as people with cancer have told us that life is not simply about duration - but is also about contentment.

A life of quantity without quality might feel more like prison than paradise.

When we at Macmillan recently spoke with people with lived experience of cancer about their hopes and fears around the future of cancer care, many told us that some things are as likely to remain as true in the future as they are now. Most people want improved navigation across the cancer pathway, enabling person-centred care tailored to meet individual needs, and more support during diagnosis, treatment and beyond. They want to live well after treatment for cancer, get reassurance if needed, and receive increased communication about signs and symptoms of progression or recurrence. People want confidence that they will have rapid access to specialist care if they need it.

Being able to navigate the cancer pathway is essential, particularly as treatments become more complex. Now, there is more information than ever, with numerous healthcare professionals involved at each treatment stage. Not every person navigating cancer care wants or needs a medical companion every step of their journey, but everyone, at the very least, needs the best map we can provide and the tools to read it. After all, information is empowerment.

PERSONALISED CARE VS 'FIT-FOR-ALL'

There will not be a single route to achieving the ambition behind Cancer: Project Zero - no-one dying of cancer. However, an important engine of change will be precision medicine, which continues to unpick cancer's defences.[1]

However, the trap in precision medicine lies in its tendency to reduce a patient solely to the 'codes' of their cancer, allowing the complexity and chaos of molecular alterations to distract us from the person and their needs.

A possible first definition of person-centred care is attributed to Hippocrates from 450 BC;

> **It is far more important to know what person the disease has than what disease the person has.**
>
> **- Hippocrates, 450 BC**

Precision medicine's promises have started to deliver over recent decades[2], but the truths of personalised care have held for millennia. As such, precision medicine and personalised care require equal commitment.

In other words, working towards better lives needs focused attention on what matters most to people. Understanding this requires cultural competency, care, and dedicated time for comprehensive enquiry. One tool to help provide this is the Holistic Needs Assessment (HNA) – and the context in which it is offered, delivered and supported needs to be flexible for cancer populations with varying needs.

At Macmillan, we have supported projects where HNA is introduced at tertiary specialist clinics all the way through to place-based community models. Single models will never be a 'fit-for-all' - and nor should we look for one.

A SHIFT IN THE SYSTEM

Similarly, better cancer care requires a shift in approach where shared decision making and system co-design are the norm. A likely reality of Cancer: Project Zero is that many treatment paradigms will convert to chronic therapies. The lived experience of chronic therapy, particularly for those with treatable but not curable cancers, can be a 'tyranny' of treatment[3] - or else committing to continual surveillance. People tell us of the constant 'scanxiety' that precedes results and the fear of recurrence that shadows a well-treated cancer. To make these lives better, we will need systems that allow people to access their results quickly and easily. For example, **artificial intelligence solutions may soon be able to decode the jargon of a pathology or radiology report[4] for people as easily as our smartphones can unlock a food menu in a foreign language.** However, we need professional communities to chaperone these evolutions and more openly welcome efforts to improve patient autonomy.

THE GROWING PATIENT POPULATION: "A GOOD PROBLEM"

Progress towards the ambition of Cancer: Project Zero is already marked by cancer's 'good problem'. That is, the growing patient populations that need monitoring and therapies, due to successful treatments. However, this requires real estate and staffing. Many centres have already changed models of care to accommodate snowballing treatments - but with consequences. If treatment visits are reduced to transactional administration, then the opportunity to make that visit a touchpoint of care is lost. **One vision of better lives sees care relocated closer to home or, even better, designed for self-administration – helping restore agency.** Thus, providing options becomes important; ranging from self-care autonomy all the way through to professionally delivered care.

The shape of healthcare teams will inevitably change based on evolving treatment paradigms and well-documented pressures of recruitment and retention. New members of our workforce will need core universal skills of compassionate care and communication, as well as education on new developments, when they arrive in clinic. Patients and professionals alike will need readily accessible and understandable information about new treatments.

Furthermore, longer lives will also result in the cancer population aging and accumulating additional illnesses. The problems of multimorbidity are well described but not yet fully addressed in the evidence that is already available. In this changed paradigm, primary care will need support, education and investment to meet the challenges of supporting people with cancer.

If we sincerely want to understand what facilitates better living with and after cancer, then we need some shift towards understanding of what makes better lives.

Research is fundamental to the aspiration of Cancer: Project Zero, but it is impossible to ignore that the vast majority of current research is centred around drug development.[5]

Work on living with and beyond cancer has always been a 'poor relation' within research funding. Measuring quality of life is harder to do than the hard endpoints of survival – with the former more difficult to understand and too often, ignored. A movement towards parity of esteem in the research of living well compared to living longer is required; research that speaks to human experience.

In the UK, the NHS alone will not be able to meet all these needs. Government co-operation across health and social care and a 'coalition of the willing' in charity and community sectors will all be required.

As an oncologist who is able to offer incrementally superior treatments for cancer, I am naturally excited by the prospect of Cancer: Project Zero. As part of an organisation that is committed to doing whatever it takes to ensure every person has the best support today, whilst also sparking a revolution in cancer care for the future, we, the cancer community, and the government have much work to do to ensure that longer lives are manifestly better.

REFERENCES

[1] 20 years of precision medicine in oncology (2021). The Lancet, Volume 397, Issue 10287, 1781. doi: 10.1016/s0140-6736(21)01099-0.

[2] Johnson KB, Wei WQ, Weeraratne D, Frisse ME, Misulis K, Rhee K, Zhao J, Snowdon JL (2021). Precision Medicine, AI, and the Future of Personalized Health Care. Clin Transl Sci. 2021 Jan;14(1):86-93. doi: 10.1111/cts.12884.

[3] Macmillian Cancer Support (2020). Treatable but not curable cancer. Available at: https://www.macmillan.org.uk/_images/tbcn-research-summary-march-2020_tcm9-355791.pdf [Last Accessed October 2024]

[4] Tepe M, Emekli E (2024). Decoding medical jargon: The use of AI language models (ChatGPT-4, BARD, microsoft copilot) in radiology reports. Patient Educ Couns. doi: 10.1016/j.pec.2024.108307.

[5] IQVIA. Global Oncology Trends 2024: Outlook to 2028. Available at: https://www.iqvia.com/insights/the-iqvia-institute/reports-and-publications/reports/global-oncology-trends-2024 [Last Accessed October 2024]

PROFESSOR ALASTAIR GREYSTOKE

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PRECISION MEDICINE TO TREAT CANCER

Until two decades ago, cancer treatment was anything but precise, relying on the uncontrolled replication of cancer cells.

Treatments were given based on the site of cancer origin with little or no recognition of the underlying biology. This meant that cures in advanced settings were hardly seen and limited to rare tumour types with exquisite tumour sensitivity. Radiotherapy was common but restricted in dose because of the significant side effects due to damage to surrounding healthy tissues, leading both to acute and long-term side effects.

Since then, the progress that has been made has been nothing short of remarkable. The key to success in the development of precision medicines has been an improved understanding of the biology of cancer and metastasis – the spread of cancer cells from the place where they first formed to another part of the body.[1]

As these therapies become more targeted, a crucial hurdle to overcome will be global access to genomic testing. The most up-to-date genomic testing must not be limited to a few patients in research settings but broadly applied across the population to provide the best treatments for all.

EARLY INSIGHTS INTO TARGETED TREATMENTS AND THEIR IMPACT

One of the early insights into tumour biology was the understanding that cancer cells hijack normal growth signals to survive and spread. As such, these growth signals became obvious targets for new treatments. For example, in breast cancer, the HER2 protein, and in lung cancer, the EGFR protein, were identified as key targets. Treatments that block such signals can lead to longer survival and better quality of life compared to standard chemotherapy. These advances in treatments mean survival rates for breast cancer have doubled in the past 50 years.[2] However, these treatments are rarely curative because some cancer cells are resistant from the start and can grow despite treatment.

Treatment resistance can present significant challenges, as cancers that used to respond to a therapy start to spread or grow again.[3] Therefore, newer treatments often aim to prevent or target the most common mechanisms by which cancer cells develop resistance. However, this has led to even more complex forms of resistance that are harder to target.

In the NHS, decisions on availability of treatments are often made for groups of patients rather than tailored to individuals, making it difficult to adjust treatment combinations to address the emerging resistance in an individual effectively.

Nevertheless, significant progress has been made in identifying new growth factors, which could be amenable to targeting, and in designing drugs using computers to block previously un-targetable growth signals. Understanding other key elements of tumour biology, such as DNA damage repair pathways, has also led to further treatment advances.

EXPANDING THE USE OF IMMUNOLOGY IN CANCER CARE

The biggest shift in cancer treatment over the last 10-15 years has been recognising the role of the immune system in the development and treatment of cancer.[4]

Cancer cells can evade the immune system by hijacking the body's checkpoints that prevent overactivity of the immune system and attack of our own bodies. Given the adaptability of the immune system and its ability to mount a long term coordinated attack against the cancer, these agents can lead to cure even in the metastatic setting.

Efforts are ongoing to expand the use of immune-targeting treatments. Expanding the patients who may benefit from using agents targeting the immune system has been a key thrust of drug development. There are a range of promising new treatments coming through that use the immune system in new and novel ways, including genetically modified T cells designed to attack cancer cells,[5] vaccine therapies building on some of the new technologies that came to the fore in the

COVID-19 pandemic,[6] and antibodies designed to bind and engage killer T cells on to cancer cells.[7]

However, many of these treatments are still often used in a similar way to chemotherapy - based on the cancer's tissue of origin or the presence of a single protein taken at the time of diagnosis - which may not be the most effective approach. Tailoring these treatments appropriately based on the cancer and patient factors will be necessary to unleash the full benefits these treatments could provide to patients.

Additionally, harnessing the immune system unfortunately has its own issues which must be considered for each patient. When activating the immune system to target cancer cells, there is a risk that the immune system could respond more aggressively than it should. This can result in anything from mild to severe, life-threatening symptoms and must be addressed urgently.

COMBINING TREATMENTS FOR BETTER OUTCOMES

Given the complex and evolving landscape of cancer, it is clear that, if we are to hit the Cancer: Project Zero target, we need to combine our treatments in a more rational and precise way, whilst ensuring access to genomic testing for all patients. Every patient will respond differently to combined treatment approaches, given the importance of biological targets not only to cancer, but the rest of the body. This, therefore, needs to be considered on an individual basis, particularly in older patients, who are making up an increasing number of people with cancer.[8]

In many types of cancer, we are seeing better control when immunotherapy is combined with chemotherapy.[9] By combining treatments, we can improve their effectiveness and hopefully reduce side effects. For instance, radiotherapy causes DNA damage in cancer cells. If we simultaneously target the cancer's ability to repair this damage, we can increase the effectiveness of the treatment. Similarly, we can attach chemotherapy drugs to antibodies to target cancer cells more precisely based on the expression of key proteins.

Additionally, we can now design antibodies to target multiple proteins. This helps avoid side effects by ensuring the antibodies only target proteins present on cancer cells or within the tumour environment, rather than on normal cells. These advances in combination will allow for a more precise and targeted approach to treatment, aiming to improve efficacy and reduce side-effects to allow broader use across the whole patient population.

PRECISION THERAPY ALREADY IN USE AND LOOKING TO THE FUTURE

Some of the answers for this are already in our grasp. We know that cure rates are significantly higher when cancer is detected at an early stage.[10]

Cancer diagnosed at stage 1 versus stage 4 have 5-year survival rates of 80% and 20%, respectively. [11]

Precision therapies, such as growth factor inhibitors and immunotherapies, are more effective in treating low-volume disease. This increased effectiveness may be due to a lower likelihood of resistant clones being present, the body's better overall condition to handle both the cancer and the treatment, or a combination of both factors.

Screening programs, like the lung cancer screening program in the UK, can help shift the stage of detection to earlier phases. Additionally, emerging technologies, such as multi-cancer detection blood tests, hold great potential for early diagnosis and fostering improved treatment outcomes.

The last decade has seen a revolution in cancer treatment, where in 2019, over one-third of surviving cancer patients received state-of-the-art targeted drug treatment or immunotherapy.[12]

And the future is bright – there are an increasing number of targeted treatments in late-stage development, at over 700 molecules by the end of 2017, an increase of 64% since 2007. [13] However, choosing the best treatments (or combinations of treatments) for patients will rely on the simultaneous development and access to novel diagnostics.

In order to truly harness the potential of progress in personalised treatment, the NHS must be open to collaborative approaches with universities, academics and the pharmaceutical industry to support the research and development of these innovations in the UK. This will lead to benefits for all, with improved treatment for patients and a better understanding of which should be prioritised for implementation. There then needs to be a clear and accelerated pathway to ensure that these innovations can reach patients as quickly as possible.

This will include implementing biomarker testing across the population. **It is crucial that the UK builds on its leading scientific advancements, the experience from the 100,000 Genomes Project, and the establishment of genomic laboratories to ensure speedy and comprehensive genomic testing for all cancer patients.**

This collaboration and commitment to research, development and equitable access, is essential if we are to truly achieve Cancer: Project Zero.

REFERENCES

[1] National Cancer Institute. NCI Dictionary of Cancer Terms: Metastasis. Available at: https://www.cancer.gov/publications/dictionaries/cancer-terms/def/metastasis. [Accessed October 2024].

[2] Breast Cancer Now. (2024). Breast cancer facts and statistics. Available at: https://breastcancernow.org/about-us/why-we-do-it/breast-cancer-facts-and-statistics/?gad_source=1&gclid=CjwKCAjw0aS3BhA3EiwAKaD2ZbnkeCMVozlijzN4CA872r_NdRz-XRzhWoeoQrqJ7gKSj400MgFZqRoCW9QQAvD_BwE [Accessed October 2024]

[3] National Cancer Institute. Why Do Cancer Treatments Stop Working? Overcoming Treatment Resistance. Available at: https://www.cancer.gov/about-cancer/treatment/research/drug-combo-resistance#:~:text=When%20cancer%20cells%20resist%20the,%2C%20or%20even%20years%2C%20later. [Accessed October 2024]

[4] Kciuk M, et al (2023). Recent Advances in Molecular Mechanisms of Cancer Immunotherapy. doi: 10.3390/cancers15102721. [Accessed October 2024].

[5] Cancer Research UK. (2024). CAR T-cell therapy. Available at : https://www.cancerresearchuk.org/about-cancer/treatment/immunotherapy/types/CAR-T-cell-therapy#:~:text=With%20this%20treatment%2C%20a%20specialist,and%20attack%20the%20cancer%20cells. [Accessed October 2024].

[6] GOV.UK. (2024). What are mRNA vaccines and how do they work? Available at: https://ukhsa.blog.gov.uk/2024/03/11/what-are-mrna-vaccines-and-how-do-they-work/ [Accessed October 2024].

[7] Eltarhoni et la. (2022). Therapeutic Antibodies in Cancer Treatment in the UK. Available at: https://doi.org/10.3390%2Fijms232314589 [Accessed October 2024].

[8] Cancer Research UK. (2024). Cancer incidence statistics. Available at: https://www.cancerresearchuk.org/health-professional/cancer-statistics/incidence [Accessed October 2024].

[9] Cancer Research UK. (2024). Immunotherapy: puzzles and promise. Available at: https://news.cancerresearchuk.org/2024/01/25/immunotherapy-puzzles-and-promise/ [Accessed October 2024].

[10] Office for National Statistics. (2019). Cancer survival in England: adult, stage at diagnosis and childhood - patients followed up to 2018. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/cancersurvivalinengland/stageatdiagnosisandchildhoodpatientsfollowedupto2018 [Accessed October 2024].

[11] RM Partners. (2024). Improving early cancer diagnosis – evidence-based interventions for primary care. Available at: https://rmpartners.nhs.uk/wp-content/uploads/2024/07/RMP-Early-Diagnosis-Part-1-Detection-rate-and-practice-behaviour.pdf [Accessed October 2024].

[12] The Institute of Cancer Research. (2019). UK cancer treatment 'revolution' as survey finds third of patients receiving modern precision treatments. Available at: https://www.icr.ac.uk/news-archive/uk-cancer-treatment-revolution-as-survey-finds-third-of-patients-receiving-modern-precision-treatments [Accessed October 2024].

[13] Macmillan (2018). Impact of new personalised cancer treatments. Available at: https://www.macmillan.org.uk/_images/impact-of-new-personalised-cancer-treatments_tcm9-342003.pdf [Accessed October 2024].

ANNA JEWELL

Chair of Less Survivable Cancers Taskforce

MAKING ALL CANCERS SURVIVABLE

When we think about cancer in 2024, we usually think of a health condition in which science has made huge advances, where survival rates have dramatically improved, and new exciting treatments are regularly announced. From this viewpoint it feels possible to envisage a world in which cancer can be cured.

But unfortunately, if we take a closer look at the different cancer types, we see that this progress is unequal. There are a group of cancers that have been left behind where, staggeringly, five-year survival remains at less than 20%.[1]

These are the less survivable cancers, which include those of the brain, lung, stomach, oesophagus and pancreas. It is even more shocking that, for the deadliest of these cancers, pancreatic cancer, half of those diagnosed will die within just three months.[2] Looking at cancer from this viewpoint, it is much harder to envisage a world in which all cancers are curable.

Is the challenge of zero deaths from cancer an impossible one? Can these cancer types catch up and - most urgently - can we envisage a future where there are no longer less survivable cancers? Yes, we can. We already have a roadmap for progress laid out for us by other cancer types, like breast and prostate cancer, where survival rates have substantially increased over recent decades.[3,4] When we invest in the research infrastructure and funding required, and our governments develop and commit to a clear plan of action, change is possible. However, the challenge lies in overcoming the decades of neglect of these cancers.

So, if we're going to close the deadly cancer gap, then we need to focus on three key areas.

EARLIER DIAGNOSIS

Firstly, earlier diagnosis is key. **Many patients with a less survivable cancer will only be diagnosed after an emergency admission to hospital or an emergency GP referral after symptoms have become severe.**[5] For other common cancers, the proportion diagnosed at such a late stage is far lower, and the average five-year survival rate is markedly higher at 69%.[6]

Less survivable cancers often have vague symptoms that only appear once the cancer is already advanced. Therefore, we need to accelerate research into finding tests that can pick up these cancer types at a much earlier stage, ideally when they are presymptomatic.

For cancers where incidence is lower than the most common cancers, it may not be practical to have individual screening programmes. Instead, we need to identify biomarker tests that are easy to administer in primary care and cover multiple cancer types which can be used in high-risk groups or in those with vague symptoms. Alongside this we need to harness the power of AI to help find and monitor at-risk individuals. One example is a promising triage test – Dxcover - a low-cost blood test which, in trial, was able to detect 96% of patients with brain tumours.[7]

PERSONALISED AND EFFECTIVE TREATMENT

Secondly, we need better treatments for the less survivable cancers that are more effective, less toxic and personalised to

tumour types.

For some of the less survivable cancers like pancreatic, there are no existing treatments, beyond surgery, that have been developed specifically for these cancers - and we need urgent action to change this. We know that immunotherapies, gene therapy and proton therapy, among others, show promise for our cancer types, but the research isn't moving fast enough.

We will only get new treatments in place if we have more clinical trials - which relies on having a patient population that is well enough to take part. At present, too many people are living with a less survivable cancer, including 40% of people with lung cancer, who are not fit enough for treatment.[8] Previous research by the Less Survivable Cancers Taskforce has also shown lower levels of participation in trials by people with a less survivable cancer - 4.6%, compared to 7.5% of cancer patients overall.[9]

IMPROVING CARE PATHWAYS

Therefore, our third area of focus is on improving care pathways for these aggressive cancer types. To ensure people are well enough for treatment, we need to both reduce waiting times and facilitate better access to supportive care - including prehabilitation and rehabilitation.

> Currently in the UK, seven in ten patients receive no treatment at all for pancreatic cancer and, of the 10,000 people diagnosed annually, just 10% receive surgery – the only potentially curative treatment.[10]

Similarly, in England, only 65% of people with a cancerous brain tumour are treated by surgery, radiotherapy and/or chemotherapy (the main potential treatments) in comparison to 85% of breast cancer patients.[5]

The key to achieving progress in these areas is the need for a much more concerted research effort for the less survivable cancers.[11]

We need to invest in both basic and translational science and build larger, more dynamic research communities with strong infrastructure - as less survivable cancers are trapped in a vicious cycle of research underfunding. Poor survival outcomes result in fewer patients taking part in research studies, which in turn contributes to fewer positive breakthroughs and less research investment. This perpetuates low survival rates - and the cycle continues. Despite their prevalence, the less survivable cancers receive a fraction (16.6%) of research funding of more survivable cancers.

We also need to build new collaborations that bring in knowledge, skills and innovations from other cancers and wider scientific fields. We need visionary research strategies for these cancer types, involving global collaboration to accelerate progress and reduce duplication. This collaboration must unite the patient, research, clinical, pharmaceutical and funder communities under shared goals.

All of this requires national coordination, with less survivable cancers prioritised in national cancer strategies. Previously, when new ideas for improving cancer care were introduced, these cancers were at the back of the queue, with innovation expected to filter down to them. However, this has often not been the case, and they remain in the 'too difficult box'.

We need to turn this thinking on its head. If we can make new initiatives and innovations work for these harder to treat cancers, then they can be rolled out afterwards to a broader range of cancers. In the US, they have taken the bold step of putting in place the Recalcitrant Cancer Act[12] to require the government to coordinate and ensure funding for research into the cancers with the lowest survival rates. We need to see the UK take similar bold action - and must work to ensure that the new government does just that.

REFERENCES

[1] Cancer Research UK, 'Cancer survival for common cancers'. Available here: https://www.cancerresearchuk.org/health-professional/cancer-statistics/survival/common-cancers-compared#heading-Zero [Accessed October 2024]

[2] Pancreatic Cancer UK. Thousands of people with pancreatic cancer could live longer if shockingly low treatment rates are reversed. Available at: https://www.pancreaticcancer.org.uk/news-and-blogs/thousands-of-people-with-pancreatic-cancer-could-live-longer-if-shockingly-low-treatment-rates-are-reversed/ [Accessed October 2024]

[3] Cancer Research UK, 'Breast cancer statistics'. Available here: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer#heading-Three [Accessed October 2024].

[4] Cancer Research UK, 'Prostate cancer survival statistics'. Available here: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/prostate-cancer/survival#:~:text=Ten%2Dyear%20survival%20has%20increased,for%20at%20least%20ten%20years [Accessed October 2024].

[5] Less Survivable Cancers Taskforce (2024) 'UK survival ranks among the worst in the world for deadliest cancers'. Available at: https://lesssurvivablecancers.org.uk/uk-survival-ranks-among-the-worst-in-the-world-for-deadliest-cancers/ [Accessed October 2024]

[6] Less Survivable Cancers Taskforce (2021). Symptom awareness of deadliest cancers is as low as 4% in the UK. available at: https://lesssurvivablecancers.org.uk/symptom-awareness-of-deadliest-cancers-is-as-low-as-4-in-the-uk/ [Accessed October 2024]

[7] Dxcover, 'Dxcover advances fast-track cancer diagnosis' (2022). Available at: https://www.dxcover.com/post/dxcover-advances-fast-track-cancer-diagnosis [Accessed October 2024]

[8] Roy Castle Lung Cancer Foundation (2023) 'A framework for achieving earlier diagnosis in symptomatic lung cancer' Available at: https://roycastle.org/campaigns/a-framework-for-improving-early-diagnosis-in-symptomatic-lung-cancer/ [Accessed October 2024]

[9] Less Survivable Cancers Taskforce (2019) 'Less Survivable Cancer: 'The next research priority'. Available at: https://lesssurvivablecancers.org.uk/wp-content/uploads/2019/11/LSCT-Barriers-to-Research-report.pdf [Accessed October 2024]

[10] Pancreatic Cancer UK, 'Thousands of people with pancreatic cancer could live longer if shockingly low treatment rates are reversed'. Available at: https://www.pancreaticcancer.org.uk/news-and-blogs/thousands-of-people-with-pancreatic-cancer-could-live-longer-if-shockingly-low-treatment-rates-are-reversed/ [Accessed October 2024].

[11] Less Survivable Cancers Taskforce (2024) 'The Less Survivable Cancers' Available at: https://lesssurvivablecancers.org.uk/the-less-survivable-cancers/ [Accessed October 2024]

[12] H.R.733 - Recalcitrant Cancer Research Act of 2012. Available at: https://www.congress.gov/bill/112th-congress/house-bill/733 [Accessed October 2024]

DR KAREN CAMPBELL

President of UKONS

FROM CAPACITY CRISIS TO CARE CATALYST: DELIVERING THE FUTURE OF CANCER NURSING

As President of UKONS, I see every day how cancer nurses are both the frontline and the future of care. Our teams span the full spectrum of cancer nursing. We include nurses supporting people with cancer in primary care, on hospital wards and in outpatient departments, as well as Advanced Practitioners (APs), Clinical Nurse Specialists (CNSs), nurse consultants, researchers and educators. Together, we deliver care and treatments – including systemic anti-cancer therapy (SACT), radiation and surgery – across community, secondary, and specialist settings. Yet in policy conversations about what drives outcomes, the breadth of the nurses' contribution is often overlooked.

Cancer nursing is explicitly multidimensional: we weave physical, psychological, social and spiritual needs into care planning, offering support, preventing avoidable harm and enabling earlier intervention for the people we serve.

That is why any credible route towards Project Zero must put nursing at its core.

THE VITAL ROLE OF CANCER NURSES IN PROVIDING MULTIDIMENSIONAL CARE

In practice, we are clinicians, educators, researchers, advocates and connectors across pathways. We keep people as safe as possible on treatment and help them to navigate the moments which matter; diagnosis, dealing with treatment toxicities and symptoms of disease, supporting families, transitioning to follow-up, facing relapse and advancing disease, life beyond cancer, and end of life support. Better access to specialist nursing, including APs and CNSs, is associated with improved overall survival across common cancers in England, underlining that our roles can be a determinant of outcomes.[1] We also know that personalised, stratified follow-up (PSFU) improves patient experience and service efficiency when implemented well, with nursing leadership vital to making these models work.[2]

While these specialist roles, APs and CNSs are just one of the key nursing roles supporting people with cancer, cancer nurses are also the backbone of treatment delivery. However, **cancer nurses are experiencing increasing workload demands driven by rising patient numbers and the rapid pace of innovation in cancer care and treatment.[3] Recognition must match responsibility.** Cancer nursing is a specialist field and must be formally acknowledged and protected, with proactive measures to sustain staff health, wellbeing and career development, so we can retain and grow the skilled workforce on which cancer services depend.

Without sustained recognition, investment and support, the full potential of this workforce risks being constrained, just when the system needs us most.

A DYNAMIC WORKFORCE AT A CROSSROADS

Recruitment and retention remain challenging, yet roles are evolving dynamically as technology advances. Across the country, nurse-led primary-care cancer reviews, advanced practice in every tumour site, remote monitoring, supported self-management and innovative approaches to supporting those with advancing cancer are reshaping care for the better. These nurse-led innovations are already delivering on the ambitions of the 10-Year Health Plan in prevention, population health and community-based support.[4]

While precision medicine and digital pathways matter, our profession is rooted in connection. Recruitment and retention

are not only about filling vacancies but about shaping roles that align with what nurses and patients value: continuity, rapid escalation routes and time for personalised conversations.

Growing and retaining cancer nurses and modernising practice requires funded training places, protected supervision and digital tools that enhance, not erode, the relationships at the heart of nursing. This is exactly the kind of clinically led innovation the 10-Year Health Plan envisages: aligning new tools with compassionate, preventative, community-anchored care.

THE MISSED OPPORTUNITY IN CANCER REFORM

Cancer reform rightly invests in diagnostics, drugs and data, but without the human infrastructure to deliver them, they cannot succeed. Nurses are practical enablers of earlier diagnosis through primary-care engagement, safety-netting and screening advocacy, directly supporting the Faster Diagnosis Standard. The pilot for the Lung Cancer Screening Programme in Wales shows what's possible. Under standard care, around 70% of people with lung cancer in Wales are diagnosed at a late stage (stage 3 or 4). However, in the screening pilot, two-thirds of people diagnosed with lung cancer were identified at an early stage (stage 1 or 2), when a wider range of treatment options are available and the likelihood of long-term survival is higher.[5] Nurses are pivotal to the success of such screening programmes. As trusted patient advocates for detection, they play a vital role in promoting early detection, educating people about the benefits of screening, and raising symptom awareness within their communities.[6]

Cancer nurses are already delivering equity strategies on the ground by working with users, carers and others to reduce barriers for underserved communities and adapting care to cultural and practical needs, aligning with wider NHS efforts to narrow unwarranted variation.

Cancer nurses are also at the heart of personalised care pathways – leading holistic needs assessment, supporting shared decision-making, and ensuring people can rapidly access services when they need them, in line with national commitments to personalised care.[7]

A DYNAMIC WORKFORCE AT A CROSSROADS

Cancer nurses are already catalysts of change – delivering earlier diagnosis, personalised care and support, and improved outcomes.[8,9,10] The specialist nature of cancer nursing equips them to lead innovation – developing new models of care, driving research, and improving patient experience through creative problem-solving and evidence-based practice.

If we are serious about achieving the Project Zero ambition of eliminating deaths from cancer, cancer nurses must be seen as strategic leaders of transformation and this must be matched with recognition and investment. We call on policy makers, system leaders and Integrated Care Systems to:

1. Invest in the oncology nursing workforce growth across the spectrum – including nurses working on medical wards, day and treatment units, surgical and radiation services, APs, CNSs, and community-based cancer nurses. These roles are already critical to delivering high-quality care and will be central to reform.

2. Embed oncology nursing leadership in prevention, early diagnosis, support in advanced cancer, genomics and population health pilots. Nurses are often the first to engage with people with cancer: they must be at the forefront of new models.

3. Support nurse-led models that integrate primary and secondary care, improve continuity and expand access. These models are not about substitution, but about advancing nursing practice and improving patient outcomes.

The tone of Project Zero is rightly ambitious and positive. Progress in science and system reform is real – and cancer nurses are ready to turn that progress into practice. As the UK charts the path toward reimagined cancer care, cancer nurses must be positioned as core architects of a future where cancer is no longer a cause of death.

REFERENCES

[1]Alessy SA, Davies E, Rawlinson J, et al. Clinical nurse specialists and survival in patients with cancer: the UK National Cancer Experience Survey. BMJ Supportive & Palliative Care 2024;14:e1208-e1224.

[2]NHS England (2020) Implementing Personal Stratified Follow Up Pathways: A handbook for local health and care systems. Available at: https://www.england.nhs.uk/wp-content/uploads/2020/04/cancer-stratified-follow-up-handbook-v1-march-2020.pdf [Accessed: October 2025]

[3]Zhuming Bao, Jenny Harris, Verna Lavender, et al. Understanding Nurses' Role in Systemic Anti-cancer Therapy Day Unit: A Qualitative Study. Seminars in Oncology Nursing, Volume 41, Issue 2, 2025, 151720, ISSN 0749-2081, https://doi.org/10.1016/j.soncn.2024.151720

[4]NHS England (2025) Fit for the Future. 10 Year Health Plan for England. Available at: https://www.gov.uk/government/publications/10-year-health-plan-for-england-fit-for-the-future [Accessed: October 2025]

[5]Cancer Research UK (2025) A National Lung Screening Programme for Wales. Available at: https://news.cancerresearchuk.org/2025/07/15/a-national-lung-screening-programme-for-wales/ [Accessed: October 2025]

[6]D. Freeman (2024). Supporting lung cancer screening in the community. Available at: https://www.nursinginpractice.com/clinical/supporting-lung-cancer-screening-in-the-community/ [Accessed: October 2025]

[7]NHS England (2020) Implementing Personal Stratified Follow Up Pathways: A handbook for local health and care systems. Available at: https://www.england.nhs.uk/wp-content/uploads/2020/04/cancer-stratified-follow-up-handbook-v1-march-2020.pdf [Accessed: October 2025]

[8]Alessy SA, Davies E, Rawlinson J, et al. Clinical nurse specialists and survival in patients with cancer: the UK National Cancer Experience Survey. BMJ Supportive & Palliative Care 2024;14:e1208-e1224.

[9]Caixia Li, Yunhong Liu, Dandan Xue, et al. Effects of nurse-led interventions on early detection of cancer: A systematic review and meta-analysis, International Journal of Nursing Studies, Volume 110,2020, 103684, ISSN 0020-7489, https://doi.org/10.1016/j.ijnurstu.2020.103684.

[10]Jandaghian-Bidgoli M, Jamalnia S, Pashmforosh M, Shaterian N, Darabiyan P, Rafi A. Personalized nursing as the missing link of providing care: A systematic review. BMC Nurs. 2025 Mar 3;24(1):239. doi: 10.1186/s12912-025-02855-x. PMID: 40033310; PMCID: PMC11877740.

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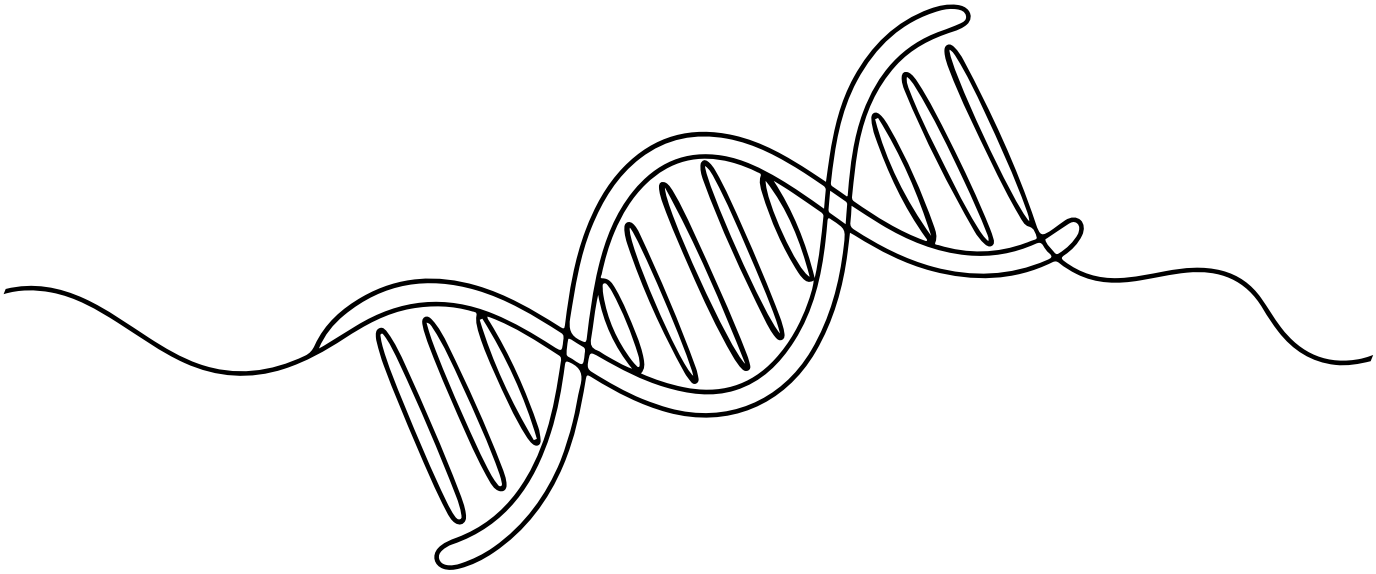

HOW CTDNA IS TRANSFORMING CANCER CARE

The ability to detect and analyse circulating tumour DNA (ctDNA) represents an exciting advancement with the potential to transform cancer care. ctDNA are tiny fragments of DNA, shed into the bloodstream by malignant cells, offering non-invasive insights into cancer biology and treatment strategies.[1] As cancer cases grow over time,[2] the role of ctDNA will become ever more crucial.

With potential applications ranging from early detection and personalised therapy plans to real-time monitoring and beyond, ctDNA is at the forefront of a new era in precision medicine.

Importantly, ctDNA can and should be used today given its many benefits, which include helping to alleviate capacity challenges by significantly reducing testing turnaround times, meaning that healthcare professionals can make timely decisions about personalised therapy plans for patients.

By integrating these capabilities into routine clinical practice, ctDNA can significantly contribute to better patient outcomes through enabling more effective screening strategies, tailored treatments, and continuous monitoring[3]—all essential components in achieving the ultimate goal of eliminating cancer as a cause of death.

TISSUE BIOPSY COMPARED TO USE OF CTDNA

Tumours are complex structures composed of multiple subclones with varying mutations; this diversity within tumours is referred to as heterogeneity.[4] This heterogeneity can often be missed with a standard tissue biopsy, which samples only one region of the tumour and may not capture the full spectrum of genetic variations.[5] CtDNA, collected from a simple blood test called a "liquid biopsy," provides DNA from all tumour sites in the body, offering a more comprehensive picture of tumour biology.[6] CtDNA form the ubiquitous blood sample which helps researchers and clinicians understand how these diverse cell groups contribute to disease progression and aids in planning treatments that target multiple resistance pathways within the tumour.

Tissue biopsies remain the gold standard for cancer diagnosis. However, these can be time-consuming to arrange and are time-intensive processes requiring specialist staff. Tissue biopsies may pose challenges due to the tumour's location, are painful and invasive for the patient, with associated risks including pneumothorax (collapsed lung), haemothorax (blood accumulation in pleural cavity), and infections, and sometimes fail if the biopsy taken does not contain enough cancer cells. Patients are frequently asked for repeat procedures (~11% lung biopsies fail). These delays can impact patient care by postponing diagnosis and treatment, potentially leading to worsened health outcomes. Patients also decline having the procedure done. In our resource constrained and under stress health system, a major advantage of ctDNA is that its collection of this key genomic data is simpler (a blood test) and bypasses some of the complex processing required in cell pathology and the invasive discomfort experienced by patients.[7]

KEY APPLICATIONS OF CTDNA IN CANCER CARE

CtDNA are increasingly being evaluated within the NHS diagnostic pathways today to improve care and treatment for those with cancer. Examples are the recent studies in England and Wales where early ctDNA testing has been shown to be a reliable and rapid method that significantly shortens time to genomic results and treatment in advanced lung cancer. CtDNA analysis provides detailed insights into specific genetic mutations present within tumours, which are critical for developing personalised therapy plans.[8]

Oncologists can use this information to identify precise targets within a patient's unique tumour profile and select appropriate drugs designed specifically against those targets—known as targeted therapies. These personalised treatments are often more effective because they directly address the underlying genetic drivers of an individual's cancer rather than employing one-size-fits-all approaches.[3]

THE FOOTHILLS OF CTDNA

As well as the applications of ctDNA which are being used today, ctDNA holds immense promise in the future for the early detection and diagnosis of cancer.[9] In terms of screening, ctDNA can be utilised to identify cancer at an early stage, even before symptoms manifest.[10] This is particularly beneficial for individuals in high-risk populations who may have a predisposition to certain types of cancer due to genetic factors or family history. By detecting tumour-specific genetic alterations in ctDNA, clinicians can gain valuable insights that may suggest the presence of cancer.[11] While this capability can aid in diagnosing cancers earlier and potentially enhance treatment outcomes, it is important to note that the same genetic alteration can occur in multiple tumour types and does not always confirm cancer presence on its own. **Therefore, ctDNA analysis should be used alongside traditional methods for a more comprehensive assessment.**

There are some applications of ctDNA which are already being used in research and which could potentially have significant benefit if applied in clinical practice. One such application, due to ease of sampling, is the role of ctDNA in monitoring how patients respond to treatment in real-time.[9] By measuring changes in ctDNA levels during chemotherapy or targeted therapy, healthcare professionals can assess whether a patient's condition is improving or if adjustments are needed. If ctDNA levels do not decrease as expected, it may indicate that the current treatment regimen is ineffective against the tumour's specific genetic makeup. This insight allows clinicians to promptly modify treatment plans, potentially switching therapies to better target the cancer cells.

Another example of where ctDNA is being applied in clinical trials but not yet routine clinical practice is monitoring ctDNA levels to predict reoccurrence. After radical treatment for localised disease, such as surgery (with or without chemotherapy) or radical radiotherapy, have been completed, there remains a risk that small numbers of cancer cells could persist and lead to recurrence—this state is known as minimal residual disease (MRD).[9] CtDNA plays a crucial role here by detecting these residual cells through regular blood tests post-treatment. Monitoring ctDNA levels enables oncologists to predict if and when a recurrence might occur, allowing for earlier intervention strategies that could prevent full-blown relapse and improve long-term patient outcomes.[12]

CHALLENGES

The analysis and interpretation of ctDNA requires sophisticated technology and specialised expertise. Techniques such as next-generation sequencing (NGS) or droplet digital PCR (ddPCR) are often employed to analyse ctDNA due to their high sensitivity and specificity[9]; however, these methods involve complex processes that demand state-of-the-art laboratory equipment and highly trained personnel. Additionally, interpreting the results from these analyses involves intricate bioinformatics tools capable of distinguishing between clinically relevant mutations linked with cancer progression versus benign variations found within an individual's genetic makeup.

More broadly, integrating new technologies such as ctDNA into healthcare systems like the NHS can present challenges. This is particularly true given the rate and pace of innovation in oncology and precision medicine.

Not all NHS healthcare genomic facilities have the necessary infrastructure or expertise to conduct ctDNA testing, which can limit patient access to these tests in certain areas.

For example, the integration of bioinformatic specialist staff and tools to allow for ctDNA implementation into routine NHS clinical practice necessitates substantial investment. The technical challenges in genomics labs, which involve a different workflow and equipment compared to traditional tissue analysis, also necessitate specialised workforce expertise and infrastructure. Navigating regulatory pathways and securing funding for widespread implementation into the NHS is a huge consideration for policy makers.

The upskilling and education needs of our wider NHS healthcare professionals on the latest advancements and interpretation of genomic profiles also needs to be highlighted as a barrier and requires considerable investment.[11]

Despite these hurdles, the potential benefits of incorporating ctDNA into routine clinical practice are substantial. ctDNA should be seen as complementary, but in the future, may replace tissue testing to target precision medicine. However, at this time, both methods are essential components of a comprehensive diagnostic pathway strategy, with healthcare professionals working together to provide maximum diagnostic information for optimal patient care.

INTEGRATING CTDNA INNOVATIONS INTO ROUTINE PRACTICE

The advanced NHS genomic laboratory services and electronic healthcare record linkage capabilities in Wales are unique and have supported the QuicDNA study. This prospective real-world adoption study has sought to enhance the lung cancer diagnostic care pathway in Wales by integrating ctDNA testing (liquid biopsies) earlier in the pathway, before tissue testing.

Early data from the QuicDNA has shown that early ctDNA testing is a reliable and rapid method that significantly shortens time to genomic results and treatment in advanced lung cancer. Launched in April 2023, the project has achieved significant advancements for lung cancer diagnostics, with QuicDNA now active across all Health Boards in Wales. The QuicDNA project has yielded early data from 113 patients, already demonstrating that it improves detection of actionable variants and identifies additional patients eligible for targeted therapy, particularly those unable to undergo biopsy.[15] This demonstrates its impact for both patients and the health service.

This approach puts NHS Wales at the forefront when it comes to implementing a high-profile flagship, government-backed life science collaborative programme, QuicDNA. The NHS genomics service in Wales have validated a non-commercial, large-gene panel, and this approach ensures a cost-effective and scalable adoption, the only UK genomics laboratory to achieve this. The reporting of these results are uploaded to a national NHS patient clinical portal, enhancing the quality and accessibility of evidence available.

This evaluation of clinical outcomes taking place in Wales not only highlights its leadership but also has the potential to simplify routine commissioning decisions. Those leading on this project engaged with commissioners during the project's design phase to ensure they had gathered relevant data needed to inform funding decisions effectively.[16] By building on the success seen in Wales, we can work towards broader implementation of ctDNA testing that benefits patients across various tumour types. Other regions in the UK have also started to roll out the use of ctDNA testing, with ctDNA testing for suspected lung cancer added to the National Test Directory in England.[17] The increased use of ctDNA testing could lead to significant improvements in patient care by ensuring timely interventions that enhance both PFS and OS metrics.

FUTURE DIRECTION - QUICDNA MAX, WALES

QuicDNA is now being expanded to other cancer types under the new programme 'QuicDNA Max'.[15] 15 Building on the success of the QuicDNA lung cancer project, QuicDNA Max aims to integrate the application of liquid biopsy to other solid tumour types, making liquid biopsies a standard part of the clinical tool kit. As part of its aims, QuicDNA Max will help prepare the system for a larger-scale roll out by fostering education and collaboration, whilst also developing an AI-driven genomic database, to enhance patient outcomes and drive future innovation and research in NHS Wales.

QuicDNA Max is a pivotal innovation in Wales's healthcare landscape. It aligns closely with key initiatives such as the Welsh Government's Tackling Cancer Initiative, which emphasises ministerial leadership aimed at fostering innovation, research and practical implementation within oncology care. QuicDNA Max also aligns with the Welsh Genomics Implementation Plan and both the Advanced Therapies in Wales Delivery Plan and National Diagnostic Strategy. As a flagship project within the Tackling Cancer Initiative, QuicDNA Max not only exemplifies cutting-edge scientific progress but also embodies Wales's commitment to transforming cancer diagnostics and treatment through strategic collaboration and advanced genomic technologies.

CONCLUSION

Overall, the use of ctDNA represents an exciting advancement towards more personalised and precise management of cancer patients by providing critical information throughout their care journey without the need of invasive procedures like traditional biopsies. The ability to detect cancer early, tailor therapies to individual genetic profiles, and monitor treatment efficacy in real-time underscores its potential to significantly improve patient outcomes. The case study of QuicDNA Max in Wales exemplifies how ctDNA can be effectively implemented within healthcare systems to enhance diagnostic accuracy and therapeutic decision-making.

As we continue to advance our understanding and application of ctDNA technologies, it is crucial that investments are made not only in cutting-edge laboratory equipment and workforce but also in education and training for healthcare professionals. Ensuring that clinicians are equipped with the knowledge and tools necessary to interpret complex genomic data will be essential for maximising the impact of these innovations on patient care.

Ultimately, as ctDNA becomes more integrated into routine clinical practice worldwide, it holds promise not just as a tool for managing existing cancers but as a cornerstone technology capable of reducing deaths from cancer through earlier detection and more effective interventions. To realise this potential ctDNA should be rolled out at pace and scale across healthcare systems. This will require coordinated efforts to overcome logistical challenges, invest in necessary infrastructure and training, and ensure equitable access to this transformative technology. By doing so, we can significantly enhance our ability to detect cancer early and intervene more effectively, ultimately helping to eliminate cancer as a cause of death.

REFERENCES

[1]NHS. Circulating tumour DNA for cancer patients. Available at: https://www.genomicseducation.hee.nhs.uk/genotes/knowledge-hub/circulating-tumour-dna-for-cancer-patients/ . [last accessed May 2025]

[2]The Lancet Oncology. The future of cancer care in the UK – time for a radical and sustainable National Cancer Plan. Available at: https://www.thelancet.com/pb/assets/raw/Lancet/infographics/the-future-of-cancer-care-in-uk-radical-and-sustainable-national-cancer-plan/future-of-cancer.pdf#:~:text=The%20complexity%20of%20cancer%20care%20has%20grown%20exponentially,information%20asymmetry%20across%20all%20aspects%20of%20cancer%20care. [last accessed May 2025]

[3]Krzyszczyk et al. The growing role of precision and personalized medicine for cancer treatment. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6352312/. [last accessed May 2025]

[4]Ottaiano et al. From Chaos to Opportunity: Decoding Cancer Heterogeneity for Enhanced Treatment Strategies. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10525472/#:~:text=Intra%2Dtumoral%20heterogeneity%20refers%20to,the%20development%20of%20drug%20resistance. [last accessed May 2025]

[5]Gilson P., et al. (2022). Deciphering Tumour Heterogeneity: From Tissue to Liquid Biopsy. National Library of Medicine. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC8946040/#:~:text=The%20clinical%20evaluation%20of%20tumour,bulk%20tumour%20and%20its%20heterogeneity. [last accessed May 2025]

[6]Elazezy M, Joosse S. Techniques of using circulating tumor DNA as a liquid biopsy component in cancer management. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6197739/#:~:text=Liquid%20biopsy%20can%20provide%20valuable,response%20and%2For%20therapy%20resistance. [last accessed May 2025]

[7]Ma, L., Guo, H., Zhao, Y. et al. (2024). Liquid biopsy in cancer: current status, challenges and future prospects. Sig Transduct Target Ther 9, 336. https://doi.org/10.1038/s41392-024-02021-w

[8]Khatami F, Tavangar SM. Circulating tumor DNA (ctDNA) in the era of personalized cancer therapy. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6154523/. [last accessed May 2025]

[9]Oncology Nursing News, Childers. How ctDNA Testing Is Being Used To Diagnose And Monitor Cancer Available at: https://www.oncnursingnews.com/view/how-ctdna-testing-is-being-used-to-diagnose-and-monitor-cancer. [last accessed May 2025]

[10]Bittla P et al. Exploring Circulating Tumor DNA (CtDNA) and Its Role in Early Detection of Cancer: A Systematic Review. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10516512/. [last accessed May 2025]

[11]Campos-Carrillo et al. Circulating tumor DNA as an early cancer detection tool. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6957244/ [last accessed May 2025]

[12]Bartolomucci et al. Circulating tumor DNA to monitor treatment response in solid tumors and advance precision oncology. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC11930993/. [last accessed May 2025]

[13]Dodds R et al. Transforming the lung cancer diagnostic pathway with liquid biopsy: Early genomic results from the QuicDNA biomarker study in wales. Available at: https://www.journalofliquidbiopsy.com/article/S2950-1954(24)00065-1/fulltext. [last accessed May 2025]

[14]Life Sciences Hub Wales (2024). QuicDNA project rolls out nationwide in Wales: Transforming lung cancer diagnosis. Available at: https://lshubwales.com/news/quicdna-project-rolls-out-nationwide-wales-transforming-lung-cancer-diagnosis. [last accessed May 2025]

[15]Life Sciences Hub Wales (2024). QuicDNA Max: Expansion Opportunities for Liquid Biopsy Testing in Wales. Available at: https://lshubwales.com/news/quicdna-max-expansion-opportunities-liquid-biopsy-testing-wales. [last accessed May 2025]

[16]Integration of Liquid Biopsy into Lung Cancer Diagnostic Pathway. Operational Business Case. (2022).

[17]NHS England (2024). Available at: NHS England » Thousands more lung cancer patients to get innovative blood test as part of NHS pilot [last accessed May 2025]

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