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INSIGHTS

The UK's challenge for precision medicine: *The case for cancer vaccines*

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IQVIA

About this report

ABOUT THE CANCER CARE DELIVERY PLAN

This programme build on the goals and strategies of the NHS Long Term Plan, the Life Sciences Vision, and the National Genomics Strategy to discuss the implementation of policies that support the prevention and survival of cancer across the UK. The NHS Long Term Plan set out ambitious targets, that the NHS must strive to reach by 2028. These targets aim for 55,000 more people each year to survive their cancer for five years or more, and for 75 per cent of people with cancer to be diagnosed at an early stage (stage one or two). Achieving these goals in a healthcare system that is struggling with workforce shortages requires innovative solutions that pertain to the following themes:

- Prevention and screening
- Inequalities
- Precision medicine
- Technology and data
- Specific pathways and treatment
- Workforce

By gathering industry experts from across the public and private sectors, academics, researchers, policy professionals and other key stakeholders, PPP aims to contribute delivery-specific insights regarding these themes over the course of this programme. This paper is based off the findings of a roundtable chaired by Dr Lennard Lee and Dr Joanne Hackett, sponsored by IQVIA.

ABOUT PUBLIC POLICY PROJECTS

PPP is an organisation offering practical analysis and development across health and life sciences. PPP is independent and cross-party, bringing together public and private sector leaders, investors, policy makers, academics and commentators with a common interest in the future of public policy.

Through roundtables, conferences and research, PPP brings together national and regional governments, the NHS, integrated care system leaders, and private, public, and third sector organisations. The resulting policy papers, insights, and publications provide practical analysis and recommendations to drive transformational change in health and life sciences.

ABOUT IQVIA

IQVIA is a Human Data Science company formed through the 2016 merger of IMS Health and Quintiles. We offer a broad range of solutions that harness advances in clinical research, healthcare information, technology, analytics and human ingenuity to improve patient outcomes. We are the UK's fourth largest life sciences employer, with a team of 4,500 people working across the UK. We conduct 20 per cent of all commercial clinical trials in the NHS, including most recently the COVID-19 ACCORD treatment study.

Our London office employs over 270 Real World Evidence and artificial intelligence scientists and is a global hub for Real World Evidence and healthcare analytics, with over one billion de-identified patient transactions a year globally. Connecting datasets is the key to harnessing and unlocking the potential of healthcare data, as well as providing insights into how treatments are performing in the real world.

Using technology to advance human health is at the heart of what we do. We use this knowledge and expertise to support the whole healthcare ecosystem in realising the potential of Real World Evidence to improve outcomes for patients and enable the UK to become a world leader in its capture, analysis and use.

Never has this been more necessary than in the era of COVID-19. IQVIA is proud to be part of the global effort against COVID-19. We have mobilised our people, capabilities and resources to understand the disease, accelerate treatment discovery, and help communities and stakeholders address the impact of the virus. In this unprecedented moment of crisis, we are committed to working with the healthcare community to treat, protect and support those affected by the virus. We are committed to bringing the full power of Human Data Science to the fight against COVID -19, helping healthcare continue, and thrive.

Foreword

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The last few years have tested the capabilities of our people and systems. It has challenged our public institutions. It has stretched our resources. It has affected the lives of everyone, not least those affected by a diagnosis of cancer. However, it has also unveiled our hidden strengths as a country. The United Kingdom is now widely regarded as the best place in the world for vaccine development, research and deployment.

Across our pandemic programmes, I was honoured to witness so many successes. Vaccines may be conceived by the best institutions, implemented across fast recruiting research programmes, approved for use safely yet prudently, and benefit millions of lives globally.

Out of every adversity known to humankind there has been the opportunity for growth, learning and to unleash previously inconceivable levels of innovation. The power of vaccine technologies is now evident for all to witness. This is additionally accompanied by the deep experience and confidence to implement the most efficient route for patient benefit.

We are now all at the cusp of a potential revolution in cancer care, with the development of vaccines for cancer. Vaccines can be rapidly repurposed, switching in new modules that can deliver the blueprint to target cancer. These modules may be individualised to the very genomic changes that caused the cancer in the first place.

The stimulus for this report is that if we, in 2023, build and address the issues that hold us back, we can deliver the silver lining of the pandemic. Many may choose to forget the challenges that we have faced together, and our lessons hard won, however, hopefully others will respond to the call for more pioneering endeavours that will deliver a national advance for cancer vaccines.

Standing together, using our collective strength, we can test cancer vaccines, we can aspire to reduce the chance of cancer returning, we can create new opportunities to participate in clinical trials and one day can hopefully reduce the chances of cancer happening in its entirety.

Key Insights

- Personalised neoantigen cancer vaccines potentially represent the next paradigm shift in precision treatment for cancer patients.
- Given that research into cancer vaccines is at an early stage, the UK is well-placed to utilise its competitive advantage to attract investment. This includes the experience of running some of the fastest recruiting pandemic vaccines studies, its outstanding genomic capabilities and research talent and experience.
- The partnership agreement signed between the UK government and BioNTech in January 2023 means that cancer patients in the UK will have access to trials exploring personalised mRNA therapies, including cancer vaccines, as early as autumn 2023.[1]
- Concerns exist about the sustainability of running clinical trials in the UK, due to current NHS pressures, such as Covid-19 backlogs, workforce challenges and increasing demand for services.
- The number of clinical trials taking place in the UK has declined since 2017, resulting in less revenue for the NHS. Cancer vaccine trials offer an opportunity to reverse this trend, increase investment, and give the earliest access to potentially transformative treatment to patients.
- The MHRA can play a key regulatory role in speeding-up clinical trial processes for cancer vaccines.
- In order that cancer vaccine development does not exacerbate existing health inequalities, equity of access to trials must be ensured at every stage of trial development.
- Given this a still a novel therapeutic, public trust and support is essential for the future success of cancer vaccine development.
- If delivered successfully, the UK will deliver the silver lining of the pandemic, whereby technology for coronavirus vaccines is successfully repurposed to make cancer vaccines, and this achievement would reinforce its reputation as a ‘life sciences superpower’.

Recommendations

1. The government should publish a fully funded workforce strategy, with practical plans for reducing vacancies and better supporting cancer care and research professionals. As part of the strategy, opportunities to pursue innovative clinical trials must be harnessed as a tool for driving workforce engagement.

2. NHS England and DHSC should review the progress of their funded plan to tackle backlogs due to the pandemic and talking waiting lists for elective care, given that targets for oncology services, and other elective care services, are continually unmet. The success of cancer vaccine trials will be dependent on investment that factors in the costs incurred in the clinical settings in which they are taking place.

3. Multidisciplinary teams should be formed during cancer vaccine trials so that pressures on frontline medical staff and overloaded clinical settings are reduced, lightening the burden of clinical trials overall.

4. As part of the overhaul of regulatory processes, the MHRA should consider ethical fast-tracking as part of their review.

5. Clinical trials should be required by the MHRA to adhere to diversity standards, which are reflective of the UK's demographic diversity.

6. To assist in meeting demographic diversity objectives, clinicians with research backgrounds should be incentivised to work in trusts that typically do not undertake clinical research, to encourage trialling in all areas of the UK.

7. New incentives should be developed to encourage trial participation from underserved groups with lower socioeconomic status, this would serve to overcome historical barriers to trial participation that often limit the diversity of trial participants. Hospital trusts should mobilise trusted community leaders to encourage those who may be vaccine hesitant to engage with clinical trials, if appropriate.

8. The UK government should engage in positive communication and advertising campaigns, including informative documentaries, to inform the public about the potential personal and social benefits of cancer vaccines.

9. Cross-sector collaboration should be incentivised and supported to reduce the burden of trials on nurses and clinicians. All clinical trial associates, notably biobank tissue collectors and pharmacists, could play a key role in reducing unnecessary duplication of work within research environments.

Introduction

On the 27th March 2023, Public Policy Projects (PPP) convened senior sector stakeholders for a roundtable entitled The UK's Challenges for Precision Medicine: the Case of Cancer Vaccines. Chaired by Dr Lennard Lee, University of Oxford, and Joanne Hackett, Vice President, Genomic and Precision Medicine, EMEA, IQVIA, the roundtable set out to explore the challenges that the UK will need to address as it endeavours to make cancer prevention and treatment by vaccination a reality. Some progress towards this reality is being made. According to the latest partnership between the UK government and BioNTech, cancer patients in the UK will get access to trials exploring personalised mRNA therapies, including cancer vaccines, which patients will be able to access via the Cancer Vaccine Launch Pad.[2]

The world-leading success of the UK's Covid-19 vaccine development and its outstanding genomic analysis capabilities make the UK an attractive place to set up and roll out cancer vaccine trials.[3] The UK played a pivotal role in the development and distribution of Covid vaccines across the globe, having developed and delivered the Oxford/AstraZeneca ChAdOx1-S vaccine created by Oxford's Jenner Institute and Oxford Vaccine Group.[4] The research team worked at an unprecedented speed, regulatory red tape was cut, and adequate funding was provided from the UK government to allow the rapid development of the vaccine.[5] Vaccine trials were successful, recruiting 30,000 individuals in less than a year, and the Medicines and Healthcare products Regulatory Agency (MHRA) approved the vaccine quickly, ahead of both the Europeans Medicines Agency (EMA) and the US Food and Drug Administration (FDA).[6]

Following the success of the UK's Covid vaccine efforts, researchers are now exploring mRNA technology for its potential in vaccines to combat an array of different diseases.[7] The use of mRNA in vaccination has shortened the typical length of time it takes to develop a vaccine, making the process faster and more effective.[8] In June 2021, then Prime Minister Boris Johnson asked then Chief Scientific Officer, Sir Patrick Vallance, to harness the success of the UK's vaccine rollout to help fight cancer, in doing so it would help to "reinforce the UK's position as a science superpower".[9] The UK now has a unique window of opportunity to harness and direct the enthusiasm and expertise of researchers, health professionals and the public developed through the Covid vaccine efforts toward cancer vaccines.

The development of personalised neoantigen vaccines and any derivative treatments have the potential to transform the treatment and survival of cancer patients in the UK and around the world. The potential to lead on cancer vaccine development also presents significant scope for UK life sciences to bolster its position. However, undertaking these vaccine trials and development will require significant investment and fundamental infrastructural change. There are concerns that the NHS is ill-equipped to undertake such extensive research, due to extraordinary pressures on the health system including Covid-19 backlogs, long waiting lists, workforce issues and shortages, and high service demand.[10]

The recommendations put forward within this document were developed from the insights of contributors to the first roundtable of PPP's Cancer Care Delivery Plan series, which brought together oncology experts to discuss the future of cancer services in the NHS. The first roundtable explored key challenges to be tackled as the UK attempts to trial cancer vaccines, and how these challenges may be overcome.

WHAT ARE CANCER VACCINES?

There are three broad types of cancer vaccines:[11]

Preventative cancer vaccines: preventative cancer vaccines protect against infection by pathogens responsible for the development of some cancers. For example, vaccines against Human Papillomavirus (HPV) protect against cervical cancer, and head and neck cancer, and vaccines preventing hepatitis B protect against liver cancer. Preventative cancer vaccines have been available for many years. In the UK, HPV vaccines have reduced cervical cancer occurrence in the UK by 90 per cent since their introduction in 2006, and vaccination against hepatitis B has reduced the incidence of liver cancer by up to 75 per cent since it became available in the late 1980s.[12, 13]

Therapeutic cancer vaccines: therapeutic cancer vaccines stimulate the body's immune system to respond to tumour cells, by identifying targets on patients' tumours which help to distinguish cancerous cells from normal cells and priming the immune system to attack the cancer.

Personalised neoantigen vaccines: personalised neoantigen vaccines are a newly emerging treatment and function using unique targets on tumour cells which arise because of mutations, called 'neoantigens'. These treatments are bespoke, tailored to both the specific genetic code of an individual's tumour, and their human leukocyte antigen (HLA) DNA sequence to determine a tumour neoantigen based on what the individual's immune system is most likely to recognise and respond to. Personalised cancer vaccines differ from more traditional cancer vaccines in their ability to target tumour cells while unharming healthy tissues.

At the time of writing, there were 16 pharmaceutical companies engaged in clinical trials for personalised neoantigen vaccines, most of which are at Phase I or II.[14] Researchers around the world are exploring different types of cancer vaccines, including: protein or peptide vaccines; DNA and RNA vaccines; whole cell vaccines; dendritic cell vaccines; and virus vaccines.[15]

Personalised cancer vaccines developed using mRNA technology are particularly exciting for researchers. Covid vaccines developed by Moderna and Pfizer-BioNTech during Covid-19 were the first mRNA vaccines to be successfully rolled out. Unlike traditional vaccines, which utilise dead or inactive virus vectors to stimulate the immune system, mRNA vaccines can theoretically be sequenced to produce any protein to stimulate an immune response, making them incredibly versatile.[16] With recent advances in molecular technology and precision medicine, mRNA therapies promise to be more effective, faster to design and produce, as well as being flexible and more cost effective than conventional therapy approaches.[17]

The development of effective, personalised neoantigen vaccines offers significant benefits for cancer patients. The specificity of the vaccine could mean more effective treatment and lengthen the lives of cancer patients. Cancer vaccines also promise a safer therapy route, as the specificity of the vaccine avoids off-target effects, as well as improving patient experience by reducing unpleasant side effects associated with traditional chemotherapies.[18]

MRNA VACCINES: AN OPPORTUNITY FOR THE UK AS A 'LIFE SCIENCES SUPERPOWER'

There is currently considerable interest in the development of mRNA cancer vaccines. Recently, pharmaceutical companies Moderna and Merck & Co. had success evaluating the effectiveness of an mRNA cancer vaccine (mRNA-4157) in adults with high-risk melanoma, used in combination with approved immunotherapy treatment pembrolizumab.[19]

Each vaccine is unique to each patient, identifying up to 34 mutations specific to their melanoma, and uses mRNA to inform the immune system to attack and destroy the tumour. The trial has delivered clinical evidence that the vaccine and pembrolizumab combination is successful against high-risk melanoma, reducing the risk of recurrence or death by 44 per cent.[20] This trial, taking place in Massachusetts, USA, is the first demonstration of efficacy in mRNA cancer vaccines in the world.[21]

With growing evidence supporting the potential benefits of precision cancer vaccines, the NHS and its patients could benefit greatly from running cancer vaccine trials. In January 2023, the UK government announced its deal with BioNTech, in which they are partnering to trial personalised mRNA cancer vaccines in the UK beginning as early as autumn 2023.[22] The partnership aims to deliver 10,000 personalised therapies to UK patients by 2030 and will help to accelerate clinical trials for personalised immunotherapies for cancer and other infectious disease vaccines.[23]

This partnership presents an excellent opportunity for the NHS to prove itself as a productive and desirable place for medical innovation and clinical trials, and for the UK to elevate its life sciences sector to 'superpower' status. In early May 2023, it was announced that University Hospital Birmingham NHS Foundation Trust will be the first site to launch the BioNTech mRNA colorectal cancer vaccine trial among those with high-risk stage II and III colorectal cancer.[24] These trials will expand to recruit 10,000 participants from across the UK.

DELIVERING SERVICES IN PARTNERSHIP

The development of cancer vaccines will likely require significant investment, given the technology resources required to facilitate the sequencing of vast amounts of genomic data, alongside manufacturing and infrastructure costs, and other costs associated with the running of trials. The message must be sent to investors that the UK has the capability for cancer vaccine trials, and that the time is right to invest in clinical trials, clinical academics, and graduates.

A 2022 policy paper on clinical research delivery establishes the government's ambition to make the UK a world-leading hub for the life sciences that delivers improved health outcomes for its citizens and attracts investment from all over the world.[25] Clinical trials are essential for R&D of new medicines and treatments, and to bring their benefits to the NHS, its patients, and the economy. Clinical research and industry partnership confers significant economic benefit on the NHS, generating an estimated investment of £355 million in 2018-19 in England alone.[26]

With increasing attention on the development of cancer vaccines, there is a growing opportunity for UK life sciences to attract new investment. The government's partnership with BioNTech for the exploration of mRNA technologies is one such significant investment and provides an opportunity for the UK to showcase its research capabilities in this area. This partnership could drive further investment, research, and new discoveries around cancer vaccines, improving oncology research and care.

Currently though, the number of clinical trials taking place in the UK is declining. A report from the Association of British Pharmaceutical Industry (ABPI) shows that the number of commercial clinical trials initiated in the UK declined by 41 per cent between 2017 and 2021, with particular losses of commercial research in oncology during the first wave of the pandemic due to the prioritisation of Covid-focused research.[27] This is resulting in less revenue for the NHS: in 2020/21 the loss of industry research due to the pandemic is estimated to have generated an NHS deficit of up to £447 million.[28] As one roundtable participant emphasised:

"Post-covid and post-Brexit, it has been difficult to attract pharma back in, and get clinical trials operating again in the NHS. New headlines about cancer vaccines are incredible and provide a real opportunity to attract new investment and lead on this research… the world will be watching to see how we deal with this, how we catch this ball."

CORE INFRASTRUCTURAL CHALLENGES

While clinical trials can bring new investment into hospitals and can encourage the workforce to engage with innovative and compelling research work, trials can add further pressure upon struggling services. Treatments which may result from these trials have the potential to better treat patients and save lives, but in in the short term, the UK's clinical research environment are routinely limited by personnel and infrastructure capacity restraints.

The NHS is currently under immense pressure between elective care waiting lists, backlogs exacerbated by Covid-19, and a dissatisfied workforce.[29] Some roundtable participants observed that with current pressures and backlogs, it may be risky to undertake extensive research in the NHS: "we are not at 80 per cent of recovery yet, so the concept that we take on big national trial programmes just feels like a really big hurdle." The government has attempted to address this though additional investments. However in March 2023, the British Medical Association reported that more patients than ever are waiting for consultant-led elective care, that 7.33 million people were waiting for treatment, and that the NHS was consistently missing performance targets for cancer diagnosis and treatment.[30]

Pressure on oncology services is particularly striking, and cancer treatment waiting times are high.[31] Analysis from Cancer Research UK explains four key targets which indicate how well cancer services are doing:

- Urgent suspected cancer referrals standard
- The Faster Diagnosis Standard
- The 62-day standard
- The 31-day standard

Their analysis shows that in March 2023 all four targets were missed in England, meaning that patients are starting treatment at later stages of cancer, leading to poorer outcomes.[32] With diagnostic and treatment capacity currently low across the NHS, guidance suggests that current growth will require a 25 per cent increase in cancer diagnostic capacity and a 13 per cent increase in treatment capacity during the 2023/24 period.[33, 34]

These delays in treatment are reflective of the mounting pressure on the oncology workforce. For example, current specialist nursing vacancies in cancer care are only set to rise, as demand for cancer services is set to increase over the next 10 years.[35] According to a 2022 report from the UK Parliament's Health and Social Care Committee, the NHS is set to be short of 2,271 specialist cancer nurses by 2030.[36] Furthermore, the number of consultant clinical academics is predicted to decline in the coming years unless urgent action is taken, meaning that the workforce available for oncology research is shrinking.[37]

The roundtable expressed concerns around capacity issues, with one participant saying that:

"Innovation feels especially hard when services is being squeezed, squeezed, squeezed – of course, as clinicians, we want to run these trials. Any hesitancy or reluctance is just us wondering how on earth we are going to do this with current constraints."

Exploring infrastructural concerns reveals that they are particularly prevalent for cancer vaccine trials in the perioperative/adjuvant setting, in which the majority of cancer vaccines would be delivered (perhaps with the

exception of particularly immunogenic cancers, like melanoma, for example).[38] According to the roundtable participants, infrastructural challenges already exist in the post-surgery setting, where clinicians are often unable to see patients quickly enough after surgery to have the opportunity to implement the findings from studies.

Using the BioNTech study of mRNA-based vaccines for colorectal cancer as an example, a participant emphasised that patients must have an initial screening to determine eligibility for the trial within four weeks of their surgery, and therapy must start within eight weeks. The participant stated that:

> *"You might think that starting adjuvant therapy in eight weeks should be an absolutely straightforward thing to do in colorectal cancer... I can tell you since the pandemic, starting chemotherapy within eight weeks? We are lucky to even see the patient within eight weeks."*

With key cancer treatment targets being routinely missed, the ability of NHS services to meet the extra demands and constraints of clinical trials has understandably come under question. Without sufficient capacity and resource, clinical trials present added infrastructural ask and a competing priority for already overstretched clinicians and nurses. Considering this, and as the number of research clinicians is set to fall in coming years, there are growing concerns about the future of the NHS as a successful research environment.[39] To help ensure trials do not place additional burden on overstretched services, investment must factor in the costs incurred in the clinical settings in which they are taking place. Additional attention should be paid to ensuring that clinical and trial work are streamlined to both maximise value for money and workload on staff.

Cross-sector collaboration will be essential to reducing the trial burden on nurses and clinicians. Clinical trial associates, biobank tissue collectors, and pharmacists, could help reduce duplication of work and the burden of research in clinical settings. There were pleas at the roundtable for researchers to recognise role that pharmacy plays in the clinical trial process, and the need for pharmacy to be properly supported in the execution of clinical trials in the NHS.

Additionally, the decentralisation of trials can aid in easing the capacity challenges. Removing parts of the trial process from central clinical settings can make trials easier to attend, thereby encouraging greater and more diverse patient participation.[40] Often, decentralised trials use a hybrid approach of clinical trial design, using technology and other solutions to enable trials to take place outside of a specific site, which can improve convenience and cost-efficiency for patients.[41] Trial pathways can also be made more efficient through digitisation and automation, as has been demonstrated in lung cancer pathway optimisation.[42] During this optimisation, it was found that automation of clinical processes such as the manual collection and collation of relevant patient information needed along the patient referral to treatment pathway can lead to increased efficiency, reduced staff workload and overall better patient experience.[43]

It should also be noted that while trials present challenges for the workforce, they can also offer exciting and fulfilling opportunities for frontline medical staff in the NHS. Involvement in innovative clinical trials can boost morale, job satisfaction, and make the NHS a more attractive place in which to work. The House of Lords Science and Technology Committee recently found that active engagement with NHS research environments is likely lead to a greater sense of fulfilment among participating clinicians, which will in turn increase recruitment and retention.[44] One participant of the roundtable noted that:

"if you asked oncologists to just concentrate on the backlog, I think a lot of people would leave – if you stop them doing this research, you stop [them] being able to push the boundaries and doing what they love."

This issue has also recently been identified in the most comprehensive review into commercial clinical trials in the UK, led by Lord James O'Shaughnessy.[45] Amongst the 27 recommendations, there was a call to establish a clinical trials careers path for training critical roles in research.

As was noted throughout the roundtable, the ability for the NHS workforce to fully embed clinical trials and cancer vaccines will be largely reliant on a comprehensive and fully funded workforce plan from the government, with specific focus on the cancer care and research workforce. In the Chancellor's Autumn Statement in November 2022, the delivery of an assessment of workforce needs across the NHS was promised, however such a plan is long overdue, and current reports suggest its publication is being held up by government.[46, 47] High vacancies, as well as issues around pay and working conditions must be addressed for cancer vaccine trials to run effectively and successfully alongside timely diagnosis and treatment for cancer patients.

DEVELOPING THE ROLE OF THE REGULATOR

The role of the regulator is significant in the clinical trial process, and participants were quick to emphasise that the UK regulator, the MHRA, is struggling to approve new medicines and technologies in a timely manner. This can lead to more costly research, that patients miss opportunities to access new treatments and can make the UK uncompetitive and unattractive for investment. Regulatory timelines can also impact investment. The ABPI reported that consistently slow and variable study set up and recruitment times in the NHS have forced pharmaceutical companies to place trials in other countries.[48]

At the height of the Covid-19 pandemic, regulatory barriers were lifted and red tape was cut to streamline the clinical trial process. The MHRA quickly approved safe vaccines, faster than both the FDA and the ERA with swift but thorough review. The pace, agility, and flexibility of the MHRA during the pandemic should be adopted long term if the UK is to efficiently conduct trials, including those for cancer vaccines. That will drive oncology innovation and progress and strengthen the UK's research base. The MHRA recently announced the biggest overhaul of trial regulation in 20 years.[49] New measures will make it faster and easier for trials to gain approval and be carried out in the UK, and the trials application process is to become "more proportionate, streamlined and flexible, without compromising on safety", which will help consolidate the UK as an attractive location for trials. The proposed timelines to be introduced by the MHRA include: a 30-day maximum to complete a trial's application review; and a commitment to make a final decision on a trial within 10 days of the regulator has receiving final information.[50]

In the Spring Budget 2023, it was announced that the MHRA will receive £10 million of extra funding over the next two years to accelerate patient access to treatment, and that the regulator is exploring partnerships with international agencies to provide simple, rapid approvals for medicines and technologies receiving their approval from 2024.[51] Regulators must be appropriately resourced to focus on new innovations like cancer vaccines. If the affordable development of cancer vaccines is to be prioritised in the UK, the government will need to support the MHRA to boost their approvals capacity and capability. New resource in the MHRA will allow

the quicker reviewing of documents and data leading to faster approval times. Reducing issues and delays at the point of regulation will also contribute to increasing investment in UK clinical trials, as according to participants,

> *"placing trials in the UK generally is less attractive for pharma, where we know there will be delays with the MHRA."*

EQUITY OF ACCESS

For cancer vaccine trials to be a success, it is important that there is equity of access in terms of geography, socioeconomic status, gender, and ethnicity. This is not only so that all can benefit from potentially successful trials, but also so that the data collected during the trials is truly representative of everyone in the UK. Failure to do so may exacerbate levels of inequalities across the UK.

When setting up clinical trials and engaging patients, medical professionals should consider the use of NHSE's Core20PLUS5 approach for reducing health inequalities, to target those at highest risk of poor health. This means targeting the most deprived 20 per cent of the population, as well as "plus" populations on a local level, including:

- Ethnic minority communities;
- People with a learning disability and autistic people;
- People with multiple long-term health conditions;
- Other groups that share protected characteristics as defined by the Equality Act 2010 and;
- Groups experiencing social exclusion.[52]

Key to ensuring that these groups can be reached is the creation of a comprehensive registry of longitudinal health data, linked to community pharmacy data, which should be led by NHS Digital for easier access for those involved in the set-up of trials.
Socio-economic status can often impact participation in clinical trials. This can be due to travel costs or the inaccessibility of trials, or lifestyles and professions which can make engaging with trials difficult. To help overcome these barriers, potential participants should be incentivised to encourage involvement, these incentives should vary depending on financial status. New guidance from the NHS Health Research Authority (HRA), in collaboration with the National Institute for Health and Care Research (NIHR) and Health and Care Research Wales, has been issued for paying public contributors for their involvement in clinical trials.[53] Roundtable participants expressed the importance of the use of data to identify socioeconomically deprived groups, to monitor their involvement in trials and target engagement strategies to ensure involvement from underrepresented groups.

To ensure equity of access to trials, trial organisers must take lessons the Covid vaccination programme. The strategy for vaccinating typically underserved groups for Covid used a bottom-up approach, empowering community leaders and influencers to reach those hesitant and encourage them to be vaccinated.[54] Engaging with trusted community leaders ensures that these communities are not treated as a homogenous group. Rather, each community can be approached and informed about the cancer vaccine trial process by someone who knows their circumstances and lifestyle intimately. Gaps in knowledge can be addressed more easily, and the benefits of participating in clinical trials can be communicated more effectively.

There may be significant geographical barriers for many people in accessing cancer vaccine trials. If trials are not taking place

near to where a potential patient lives, they are less likely to be able to access the trial or be offered the opportunity at all. Roundtable participants noted that a substantial proportion of clinical research occurs in the "Golden Triangle" – between the research hubs of London, Oxford, and Cambridge. Also, certain NHS trusts tend to pursue trials more than others, and particular research hospitals will be more engaged with cancer vaccine trials than others. This tends to mean that patients living near research hospitals in these cities are more likely to benefit from innovative medicines and treatments in the trial stage. Roundtable participants also emphasised that, accordingly, the number of consultants with a research background are not evenly spread across the UK, which can be a barrier for research in certain parts of the country.

The decentralisation of cancer vaccine trials, where appropriate, is likely to reduce geographic inequalities in trial uptake. Decentralised trials aim to make clinical trials easier for patients to access by reducing the need to travel to clinical sites.[55] As suggested at the roundtable, the newly-established community diagnostic centres and pop-up community research centres could play a role in the decentralisation of some aspects of the trial process.[56] Given their accessible locations, CDCs or pop up community research centres could take a coordinating role in locating suitable trial participants from within their catchment area and identifying suitable local clinical settings for trial participation to take place. For example, CDCs could partner with research facilities to further open access to trials.

BRINGING THE PUBLIC ALONG ON THE CANCER VACCINE JOURNEY

While medical professionals are interested in, and support, the potential of cancer vaccines and the trials to come, roundtable participants expressed a view that for the wider public, the potential benefits of cancer vaccines are less well known. Some participants observed that, for such trials to gain momentum and support, education will be the key. It was suggested that developing a community understanding of the relationships between cancer, trials, and vaccines will be key to getting non-medical professionals engaged and supportive.

It has previously been demonstrated that public awareness campaigns regarding cancer and vaccines can be effective tools in promoting community understanding and support for health programmes. The "Be Clear on Cancer" campaign is one such example of how targeted information directed through appropriate channels can increase public awareness of the signs and symptoms of certain cancers while encouraging early diagnosis by seeing their GP.[57] Also, research conducted following the Covid-19 vaccination roll-out shows that public acceptance rates for vaccination are not static and are responsive to information and prevailing sentiment.[58] Authors found that public inclination towards taking a Covid-19 vaccine declined between three and six per cent when exposed to misinformation.[59] Further, public explanations of the regulatory and approvals process for vaccines should be developed when approvals processes appear to diverge from previous processes or international equivalents.[60]

What this research on cancer and vaccination campaigns shows is that the medical community will need to actively consider information campaigning as part of the cancer vaccine development process. By targeting misinformation and promoting vaccine benefits, patients can understand and will be more likely to be involved with data collection exercises, and clinical trials to support the development of the vaccines.

The cancer vaccine agenda is more likely to succeed if there is public backing, and therefore communication campaigns and documentaries centring on cancer vaccines should be produced by the NHS to engage those currently unaware. Education regarding cancer vaccines will also go a long way to engaging people in clinical trials, particularly those at higher risk of missing out on trial benefits. More information and signposting will help people to find out about trials near them, and what they can do to take part.

Vaccine hesitancy may be a point of resistance when gaining public support for cancer vaccines. A roundtable participant suggested that "this could be a really exciting space, but one with the potential to generate fear and resistance, given the debate around the covid vaccine." For all to benefit from cancer vaccines, NHS should engage communities specifically impacted by vaccine hesitancy during the pandemic, to educate and spread awareness of the potential benefits of such trials. NHS should partner with trusted charities to engage with people on the benefits of trial participation, as well as on misconceptions around the word "vaccine". This will also help to ensure that individuals can engage with clinical trials that they may be eligible for and understand why they are taking place.

Conclusion

The development of cancer vaccines is an incredibly exciting opportunity for the UK, with the potential to deliver on the silver lining of the pandemic by using the technology and trial acceleration learnings from Covid-19 vaccines and utilise them against cancer. If delivered, it will transform cancer treatment and save lives. At the same time, the successful development of personalised antigen cancer vaccines could transform the struggling NHS. It could attract significant investment and inspire a stretched workforce, as well as consolidate the UK as a 'Life Sciences Superpower'. However, for the trials to be a success, cancer services and the oncology workforce must be fully supported to recover from backlogs, reduce waiting lists, keep up with rising demand and to fill workforce vacancies.

In addition, for the UK to continue to be viewed as an attractive location to place trials, the MHRA must be supported and adequately resourced to review and approve trials swiftly, to speed up the trial process and ensure efficiency.

In order that cancer vaccine development and trials do not contribute to existing health inequalities in the UK, equity of access to trials must be ensured, so that potential benefits are felt by all. The recommendations of this report, if implemented correctly, will help the UK to seize the opportunity presented by cancer vaccine technology.

The successful rollout and undertaking of cancer vaccine trials, and the implementation of the recommendations of this report, will require increased collaboration between all involved stakeholder groups: including healthcare professionals, regulatory bodies, investors, government, academia and the general public. All groups must be aligned around the same goals of bettering the infrastructure of research environments, optimising regulatory processes, ensuring equity of access and educating the public about cancer vaccines to attract further investment, for the success of cancer vaccine trials, and the benefit of the NHS overall.

Recommendation Summary

1. The government should publish a fully funded workforce strategy, with practical plans for reducing vacancies and better supporting cancer care and research professionals. As part of the strategy, opportunities to pursue innovative clinical trials must be harnessed as a tool for driving workforce engagement.

2. NHS England and DHSC should review the progress of their funded plan to tackle backlogs due to the pandemic and talking waiting lists for elective care, given that targets for oncology services, and other elective care services, are continually unmet. The success of cancer vaccine trials will be dependent on investment that factors in the costs incurred in the clinical settings in which they are taking place.

3. Multidisciplinary teams should be formed during cancer vaccine trials so that pressures on frontline medical staff and overloaded clinical settings are reduced, lightening the burden of clinical trials overall.

4. As part of the overhaul of regulatory processes, the MHRA should consider ethical fast-tracking as part of their review.

5. Clinical trials should be required by the MHRA to adhere to diversity standards, which are reflective of the UK's demographic diversity.

6. To assist in meeting demographic diversity objectives, clinicians with research backgrounds should be incentivised to work in trusts that typically do not undertake clinical research, to encourage trialling in all areas of the UK.

7. New incentives should be developed to encourage trial participation from underserved groups with lower socioeconomic status, this would serve to overcome historical barriers to trial participation that often limit the diversity of trial participants. Hospital trusts should engage with trusted community leaders to encourage those who may be vaccine hesitant to engage with clinical trials, if appropriate.

8. The UK government should engage in positive communication and advertising campaigns, including informative documentaries, to inform the public about the potential personal and social benefits of cancer vaccines.

9. Cross-sector collaboration should be incentivised and supported to reduce the burden of trials on nurses and clinicians. All clinical trial associates, notably biobank tissue collectors and pharmacists, could play a key role in reducing unnecessary duplication of work within research environments.

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