HM Government

European Union
European Regional Development Fund

Health Tech Enterprise

ACCELERATING MEDICAL TECHNOLOGY THROUGH INNOVATION

JOOP TANIS
EMA DAUKSAITE
NOVEMBER 2022

Contents

1. The Covid-19 Impact 4
2. Current Issues 5
3. Target areas of technological intervention 6
4. Some successful Cases 8
5. Key concerns 9
6. Future Developments 10
7. Lasting change? 10
8. References 12

Medtech Navigator

The Medtech Navigator (www.medtechnavigator.co.uk), part-funded by the European Regional Development Fund (ERDF), is a three-year programme, delivered by Health Enterprise East Ltd., to facilitate knowledge exchange between the medtech industry, many of whom are small and medium sized enterprises (SMEs), the NHS, and academia. The programme seeks to enable companies to identify potential market opportunities in a variety of specific disease areas and apply for Innovation Grant funding through the programme, thereby engaging SMEs in new R&D projects that are both customer-focussed and collaborative in nature. This will allow the creation of partnerships between clinicians, academics, and industry to develop novel medical technologies which will improve healthcare and quality of life for patients and the healthcare market of the future.

Health Tech Enterprise

At Health Tech Enterprise, we believe in improving healthcare through technology and innovation. We work with the NHS, medical technology industry and government organisations to help turn innovative ideas into products and services that will benefit patients.

Our experienced team offers clients a diverse range of business and innovation management services. Our strengths include IP management, technology commercialisation, health economics and strategic market access advice.

Based in Cambridge, we work with over 20 NHS organisations nationally and medtech companies globally. Our aim is to help our clients address the challenges faced along the product development pathway, connecting them with relevant healthcare experts and funding opportunities.

1. The Covid-19 Impact

The COVID-19 pandemic provided the unexpected conditions for an unprecedented natural experiment in the healthcare sector. A substantial increase in healthcare demand was combined with mandatory distancing measures. This prevented patients from accessing, and clinicians from providing, healthcare by traditional routes. The result was a rapid development and acceleration of the implementation of technology in the healthcare market. Large-scale adoption of technological innovations produced efficient and cost-effective solutions which helped to mitigate the effect of the Covid-19 pandemic, but also may help to address growing unmet needs in the NHS.

Although the development and application of technology in the medical and social care field have been encouraged before the Covid-19 pandemic, routes to mass adoption and integration were slow and turbulent. Whereas the willingness to explore technological innovations in the healthcare sector was widely shared amongst clinicians, scientists and healthcare providers, the integration and adoption were impeded by systemic barriers, including regulatory complexities, devolution, and bureaucracy. This posed a significant constraint to utilising healthcare resources more efficiently.

So how did the COVID-19 pandemic disrupt the status quo and helped overcome institutional inertia[i], triggering the rapid adoption of digital solutions in the healthcare system?

Firstly, the COVID-19 crisis facilitated a shift in staff attitudes and a larger engagement with digital technologies. An increase in digital work profiles in the healthcare sector led to a growth in the quantity and quality of people applying for IT jobs in the healthcare sector[i]. This spurred the digital transformation and maintenance in the field. Furthermore, the pandemic catalysed collaboration with partners thus far external to the NHS, which acted as an additional driver for the adoption of technological innovations[i].

Similarly, patients, many of whom until now believed that the only way to get medical help was to go and see a clinician in a healthcare setting, realised that methods such as telephone or video consultations, technologies with which they were very familiar outside the clinical setting, could also be highly effective in getting medical support.

Not surprisingly, the digital revolution also had a cost. The negative consequences of unprecedented technological advances included extra data traffic, additional data-

management work for already strained staff, extra licenses and equipment purchases, and exacerbated healthcare inequalities as the digitisation process was not easily accessible by all. Moreover, some innovations were not fully functioning ('not good enough') when launched[i] due to lack of integration with existing systems.

As we are moving forwards, COVID-19 has shifted from pandemic towards a more manageable endemic status. Most of the emergency measures were called off, and the unlocked pathways of technological transformation are scaled back[ii]. However, the current economic and demographic situation leads to growing pressures on the national health system (NHS) in desperate need of innovative approaches.

2. Current Issues

As we enter a new post-pandemic normal, the UK economy faces powerful headwinds. The aftermath of successive lockdowns has created significant patient backlogs, the spike in energy prices triggered by the Russian invasion of Ukraine is adding to inflationary pressures. Furthermore, the persistent political turmoil is impacting investor trust and Brexit-induced hurdles are impeding cross-border trade as well as worsening workforce shortages.

Whilst the pandemic and other events have clearly impacted on the current pressures, some of the issues were present before the pandemic. The UK, similar to other developed nations, is facing a demographic tsunami. In the next decade, the percentage of the UK population aged 65 and over will grow to around 22%[iii]. While celebrating longevity, the country needs to prepare itself for the forthcoming strain for the NHS. Advancing age is associated with increased mental and physical frailty. Health care for comorbidities, to which people with advancing age are more prone, is costly[iv]. Thus, to provide high-quality health and social care, the system requires larger financial and human capital.

Staffing shortages in healthcare, an ongoing issue for many years, have been exacerbated during the COVID-19 pandemic. In June 2022, the House of Commons Health and Social Care Committee launched a report, which suggested that the NHS in England could be short of 12,000 hospital doctors and over 50,000 nurses and midwives[v]. The shortages lead to growing procedure waitlists, and a decline in the well-

being of the healthcare staff, to the extent that it may cause "a serious risk to staff and patient safety both for routine and emergency care"[v].

A combination of growing needs for healthcare, a need to address elective and non-urgent care procedures delayed due to COVID-19, strained healthcare staff capacity and economic challenges result in an array of dynamic issues. These include increasing waiting lists and times, declining staff well-being, lack of funding, deteriorating estates, falling NHS bed numbers and outdated IT systems. Some Healthcare professionals, struggling with the strain of working in the NHS are leaving the profession, and others are expressing their concerns by taking industrial action. Since a mere scaling-up of funding and facilities is not sufficient to address the complex situation, the demand for ingenious solutions through technological innovation is higher than ever.

3. Target areas of technological intervention

Waiting lists

According to the International Fiscal Studies report, in September 2022, almost 3,000,000 million procedures in England were on the waiting list for over 18 weeks with a consultant-led referral[vi]. In the same period, the total waiting list for procedures across NHS England was at a record high[vi] of 7,200,000. The numbers are expected to grow further, especially in winter periods. Therefore, it is highly likely that medical technologies will be selected for widespread adoption in the system, depending on their effectiveness in reducing the patient waitlist.

Primary Care

Throughout the pandemic, primary care has seen a huge increase in the integration of tele- and digital patient consultation. These shifts are in line with the ambitions of the NHS planning committee: "The NHS Long Term Plan" states the aim to introduce a digital-first approach to primary care by 2023/4, including their goal to reduce outpatient appointments by a third by 2024 with a particular focus on reducing the volume of Did Not Attend (DNAs) appointments[vii]. Digital First Primary Care supports the transition of primary care to the digital platform. The digital tools are designed to support patient access to appropriate and timely care, help practices to better manage

demand, and improve patient and staff experience[viii]. The tools are also expected to help create time-savings for NHS staff[vii].

To assist primary care digitisation, NHS Digital launched a Tech Innovation Framework (TIF) in June 2022. The framework is designed to boost innovation and choice in the primary care IT market and to empower GPs and commissioning groups by giving them access to the best available technology[ix]. The new IT buying catalogue also benefits new entrants into the market by allowing them to compete with existing system suppliers.

Precision Medicine and AI (Artificial Intelligence)

Precision medicine advances our understanding of disease prediction and risk, onset, and progression in patients, and informs better selection and development of evidence-based target therapies and associated diagnostics[x]. Currently, there is growing demand for precision medicine on a global scale[xi].
Recently, artificial intelligence (AI) and machine learning (ML) tools have been increasingly applied in the healthcare field. AI applications in precision medicine have been particularly attractive for their potential to revolutionise healthcare[xii]. Johnson et al. (2021) outline three principles for the successful adoption of AI in healthcare. The first pillar is data and security: to establish transparency and trust in AI-produced outputs, the training methods and the data sources in AI algorithm development have to be relevant and reliable for patient groups and conditions. Analytics and insights suggest that AI should be used as a complementary rather than a substitutive tool for clinical decision-making. A shared experience aspect entails that human professionals and AI systems should enter a complementary relationship, where they inform each other to achieve the best possible outcomes[xii]. Moreover, it needs to be noted that the rapid expansion of AI tools in healthcare calls for a shift to more IT-skilled professionals in the healthcare field.

Extensive digitisation of medical health record data has enormously contributed to the growth of healthcare-related databases[xiii]. This, in turn, has been very helpful for developing AI algorithms. To date, artificial intelligence (AI) applications in precision medicine have been the most impactful in the medical imaging of skin lesions and treatable retinal diseases[xiii]. The NHS Long Term plan also sets out the priority of using artificial intelligence tools in supporting decision-making for selecting the most effective treatment therapies and eliminating unwarranted variation across the whole pathway of care[vii].

4. Some successful Cases

A growing number of technological innovations are entering the healthcare market. The most promising physical and digital tools tend to be those that can generate large improvements in patient outcomes, address systemic NHS issues, and facilitate patient self-monitoring.

Smart Goggles

The NHS is trailing the use of high-tech goggles for community nurses to increase their time for clinical tasks. Currently, community nurses are estimated to spend half of their working time doing administrative tasks, such as filling out forms and manually inputting patient data[xiv]. With a patient's consent, a virtual reality headset can perform several of these administrative tasks such as transcription of the appointment notes into electronic records. It also allows the sharing of live footage with hospital clinicians if a second opinion is needed. Furthermore, the technology can perform thermal imaging to assess the healing process of injuries and wounds. These smart goggles thus free up nurses time and allow them to focus on performing clinical tasks such as dressing wounds, and checking blood pressure helping to alleviate nursing shortages[xiv].

Smart watches for Parkinson's patients

The Parkinson's Kinetigraph is a smart watch, containing sensors, that is worn to monitor Parkinson's patients' movements at home. The collected information is analysed by doctors and enables them to make an informed decision about the suitability of the current treatment pathways [xv]. The device has also an in-built function to remind patients to take medication. The smart gadget significantly contributes to improving patients' quality of life while staying at home. The introduction of the gadget is also efficient for the NHS in freeing up space and time in the hospital. Currently, hundreds of patients have been issued with the watch. The scheme could be expanded across the country to cover around 120,000 patients with Parkinson's disease[xv].

Traffic Control Centres

In winter 2022, over 40 healthcare 'traffic control centres' have been established across the country, helping to reduce the waiting times for inpatient care[xvi]. The innovation uses hospital data and can divert ambulances to a nearby hospital with more capacity and identify hospitals that need additional support. The traffic control centres enable healthcare staff to use data and local insights to make informed decisions about resource distribution and plan for additional pressures. Health and Social Care Secretary Steve

Barclay expects that the innovation will contribute to timely patient access to care and will help to focus the NHS resources on emergency care[xvi].

5. Key concerns

Not unexpectedly, the rapid growth of innovative technologies in the healthcare field comes with additional costs and a concerns. One of the most frequently outlined issues is collecting, logging, and managing patient data, which imposes additional burden on an already stretched workforce. However, the provision of effectively sorted data will eventually lead to more efficient use of healthcare resources.

Another concern is that the technology could increasingly replace human experts and so will minimise human interaction between physicians and patients. Although technologies are increasingly penetrating clinical pathways, it is important to emphasise that technologies are developed to support but not replace human experts. Human expertise will remain essential in monitoring complex treatment processes, interpreting available data, and making important decisions.

Nevertheless, a change in the skill-mix is bound to occur in the field. The technology is expected to reduce time-consuming routine practices (such as patient data logging) and increase patient and carer ability to monitor and manage health conditions. This will result in lower demand for nursing staff to undertake those routine activities. On the contrary, the demand for IT skills in the healthcare sector is expected to grow. Nurses and physicians will have to engage with more complex technologies; doctors are also expected to engage with AI training for algorithm development. The demand for IT specialists in healthcare will continue to grow. Although this may cause initial challenges, including requirement for additional training, it is expected to help alleviate severe understaffing issues.

Intellectual Property

Since the medical technology and innovation field is rapidly growing, it is essential that innovators understand their Intellectual Property (IP) position. This will enable them, where appropriate, to protect their IP and also ensure that the product in development does not infringe any patents held by others. IP assets are an essential aspect of the core business services and may have an impact on the long-term growth and sustainability of the company[xvii]. Firstly, the innovators should ascertain that there is no existing

technology already protected with IP by conducting a Freedom to Operate (FTO) search. If the technology is indeed unique, the creators should make sure to protect their IP in the best possible way to maximise potential revenue streams and the value of their innovation.

6. Future Developments

The healthcare sector will continue to improve through medical technology. Artificial intelligence and machine learning will penetrate the sector and assist in diagnosis, monitoring, and treatment choices for various conditions. It will also contribute to the developing field of precision medicine. Medical robotics will also continue to transform the field. Robots can already perform many types of surgical interventions and have proven to be beneficial in rehabilitation; integration of AI will be the next progression in medical robotics. Robotics is also applied in developing the latest treatments for diseases. Ongoing research projects explore the application of robots in delivering drugs into to cancer cells, which is expected to improve treatment effectiveness[xviii]. Wearable technologies, currently applied for diagnostic and monitoring purposes, are developing rapidly, and are expected to penetrate drug delivery and other areas of the medical industry such as, for example, surgical implants and neurostimulation.
Medical technologies offer great opportunities to improve population health and alleviate structural issues in the healthcare system. To realise the technological potential and sustainably improve the sector, adequate funding and structural flexibility and the necessary workforce are essential.

7. Lasting change?

The two years of the COVID-19 pandemic have facilitated a revolution in healthcare technology. The necessities of the pandemic have stimulated innovation in accelerating the development, and application, of technology to produce efficient, cost-effective solutions for previously un-met needs in the NHS.
Prior to the pandemic, while the development of innovations in, and applications for, technology across medicine and healthcare was encouraged, routes to mass adoption and integration were slow and turbulent, constraining the health service's ability to operate to maximum potential.
Prevalent issues such as regulation complexity, devolution and bureaucracy all meant that, while the willingness to explore innovations in healthtech was widely shared

amongst clinicians and healthcare providers, the capacity to integrate and adopt new inventions in a systemic way was always lacking. Urgent necessity, brought about by the pandemic, almost immediately eradicated the steadiness of the status quo, and capacity was created to integrate new technologies in the fastest and most impressive pivot of any industry throughout this time.

As well as the important commendation of the front-line clinicians and healthcare workers for their agility in adopting new ways of working throughout this health crisis, administrators, directors and technology providers also played their part in enabling the rapid integration of new systems and technologies into the health service throughout the pandemic. The integration occurred at such an incredible pace because central bodies enabled the changes to occur, providing guidance on information governance and fast-track procurement frameworks, for example.

The acceleration of these plans demonstrates the capacity of the health service to effectively reduce the existing barriers to mass integration when required, and is a model that should be considered to facilitate unlocking routes to market for tech innovators.

8. References

[i] Williams, Robin. 2021. "Beginning a Joint Digitally Enabled Transformation and Learning Journey in the English National Health Service." July 2021. https://www.ed.ac.uk/sites/default/files/atoms/files/final_report_gde_evaluation_programme.pdf.

[ii] Blackwood, Anne, and Joop Tanis. 2022. "COVID-19 and beyond – Accelerating Medical Innovation through Technology." February 2, 2022. https://www.med-technews.com/medtech-insights/latest-medtech-insights/covid-19-and-beyond-%E2%80%93-accelerating-medical-innovation-throug/.

[iii] "2022 Ageing & Older Population Statistics." 2022. July 9, 2022. https://www.ageukmobility.co.uk/mobility-news/article/ageing-and-older-population-uk-statistics-for-2022.

[iv] England, N. H. S. 2015. "NHS England » Meeting the Challenges of an Ageing Population." 2015. https://www.england.nhs.uk/blog/catherine-thompson/.

[v] Health and Social Care Committee (House of Commons). 2022. "Workforce: Recruitment, Training and Retention in Health and Social Care." Third Report of Session 2022-2023, July. https://committees.parliament.uk/publications/23246/documents/171671/default/#page=5.

[vi] "NHS Waiting Lists." n.d. Institute for Fiscal Studies. Accessed December 30, 2022. https://ifs.org.uk/collections/nhs-waiting-lists.

[vii] Alderwick, Hugh, and Jennifer Dixon. 2019. "The NHS Long Term Plan." BMJ 364 (January): l84.

[viii] England, N. H. S. n.d. "Digital First Primary Care." NHS England. Accessed December 29, 2022. https://www.england.nhs.uk/gp/digital-first-primary-care/.

[ix] "Tech Innovation Framework." n.d. NHS Digital. Accessed December 29, 2022. https://digital.nhs.uk/services/digital-care-services-catalogue/tech-innovation-framework.

[x] "Precision_Medicines_Booklet_Final_Web__002_.pdf." n.d. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/483560/Precision_Medicines_Booklet_Final_Web__002_.pdf.

[xi] "Precision Medicine Market Size, Share, Report 2022 to 2030." n.d. Accessed December 30, 2022. https://www.precedenceresearch.com/precision-medicine-market.

[xii] Johnson, Kevin B., Wei-Qi Wei, Dilhan Weeraratne, Mark E. Frisse, Karl Misulis, Kyu Rhee, Juan Zhao, and Jane L. Snowdon. 2021. "Precision Medicine, AI, and the Future of Personalized Health Care." Clinical and Translational Science 14 (1): 86–93.

[xiii] Uddin, Mohammed, Yujiang Wang, and Marc Woodbury-Smith. 2019. "Artificial Intelligence for Precision Medicine in Neurodevelopmental Disorders." NPJ Digital Medicine 2 (November): 112.

[xiv] England, N. H. S. n.d. "NHS England » NHS Trials Smart Goggles to Give Nurses More Time with Patients." Accessed December 29, 2022. https://www.england.nhs.uk/2022/08/nhs-trials-smart-goggles-to-give-nurses-more-time-with-patients/.

[xv] England, N. H. S. n.d. "NHS England » Parkinson's Patients Benefit from Revolutionary Watch on the NHS to Manage Care at Home." Accessed December 29, 2022. https://www.england.nhs.uk/2022/04/parkinsons-patients-benefit-from-revolutionary-watch-on-the-nhs-to-manage-care-at-home/.

[xvi] England, N. H. S. n.d. "NHS England » NHS Delivers on Winter Plan as System Control Centres Go Live." Accessed December 29, 2022. https://www.england.nhs.uk/2022/12/nhs-delivers-on-winter-plan-as-system-control-centres-go-live/.

[xvii] "Benefits of IP Protection." n.d. IPOI. Accessed December 30, 2022. https://www.ipoi.gov.ie/en/commercialise-your-ip/benefits-of-ip-protection/.

[xviii] Sabah, Noor ul. 2022. "Future of Robotics in Healthcare: These 4 Associated Challenges Make Things Complicated." Bhaitv (blog). Hamza Khattak. October 25, 2022. https://bhaitv.com/future-of-robotics-in-healthcare/.