# ARTIFICIAL INTELLIGENCE AND HEALTHCARE TRANSFORMATION IN THE UK

**GYAKARI NTIM**

## ABSTRACT

Artificial intelligence (AI) is a disruptive field of computer science that has the ability to mimic human intelligence and carry out intricate automated activities using computers and machine learning techniques. AI-enabled devices are able to sort through massive amounts of big medical data to find patterns, anomalies, and trends that has the potential to drastically alter medical practice and healthcare delivery. It is a potent tool for high and efficient output. This article discusses the progress and potential future path of AI-augmented healthcare systems in the UK under four area; Patient Record Management, Patient Diagnoses matching with Medication, Patient Care Delivery and Procurement and Supplies. The article also evaluates current advancements and their implications in the application of AI to the provision of high-quality healthcare in the UK, and outlines a roadmap for creating effective, safe, and dependable AI systems.

**Keywords:** Artificial Intelligence, Digital Bureaucracy, Digital Discrimination

## LIST OF ABBREVIATIONS

CQC Care Quality Commission
AI Artificial Intelligence
BMA British Medical Association
UK United Kingdom
EU European Union
GP General Practitioner
NHS National Health Service
BBC British Broadcasting Corporation
EHR Electronic Health Records

## 1.0 INTRODUCTION

The UK's healthcare systems confront enormous obstacles in efforts to improve population health, patient and carer satisfaction, and the economy of care while lowering the ever-increasing cost of treatment. Governments, payers, regulators, and providers are under pressure to innovate and change healthcare delivery models due to the ageing population, increased prevalence of chronic diseases, and rising healthcare expenditures worldwide. Furthermore, in light of the current global pandemic, healthcare systems are faced with the challenge of "performing" and "transforming" care at scale through the integration of real-world data-driven insights into patient care. (Spatharou, A. et al, 2020). The epidemic has brought attention to the UK's personnel shortfall in the healthcare industry as well as disparities in access to high-quality care.

Budgetary allocation to the health and care sector paved way for a boost in the adoption of AI technologies in the health and care sector in the UK. An official document released by the Department of Health and Social Care revealed how this commitment can revolutionalise the health and care sector by helping to diagnose cancer and heart attacks earlier than before and provide the right support for mental health (Ministry of Health and Social Care, 2021). The establishment of an NHS AI Lab was a significant project in accomplishing a digital transformation of healthcare delivery in the United Kingdom.

The lab was founded in 2019 and unites technology companies, healthcare providers, and the UK government to create AI-enabled solutions that enhance patient lives. It provides a range of programmes all year long and allots funds to find, finance, and facilitate the swift assessment and approval of promising artificial intelligence projects in the British healthcare system (Awasthi & Jani, 2023)

The systematic approach taken by the NHS to enroll on a full AI health and care delivery system in the UK in an effort to ensure quality and a universal access calls various international health and care organisations and other UK educational institutions and agencies to get involved. Introducing the Accelerated Access Collaborative which connects Industry, government, regulators, patients, and the NHS to break down barriers and hasten the introduction of innovative new medicines and diagnostics that have the potential to revolutionise healthcare have had major breakthroughs for health delivery. The UK government's investment in AI projects across the NHS like medical-imaging devices cuts waiting time for cancer patients for radiotherapy, the great strides achieved creates the urgency for advancement and healthcare development (BBC, no date)

## 1.1 Problem Statement

Artificial Intelligence (AI) is still a relatively new technology, even with the growing trend and the UK Government's commitment to research in the field within the NHS. Many of the health effects on medical personnel and patience are yet unclear, and not all of the drawbacks of AI have been recognised. The application of AI in healthcare has several obstacles, which require in-depth analysis and investigation as the systems gain traction.

The challenges get more complex as this has to do with human lives, people trusting their lives and data to an unknown systems of machines for data analysis and gathering. The vulnerability of data fraud brings the topic to the research table for deeper studies. One critical area of concern is the legal and regulatory frameworks regarding the adoption of AI in the healthcare sector of the UK as secret chains of systems uses client confidential health data for health research and analysis.

Even though research and interest in artificial intelligence (AI) in healthcare are constantly expanding, there is still a lot we don't know about how AI has transformed the industry by matching patients with the right drugs for their conditions, how to overcome implementation obstacles, and how to improve the chances of long-term adoption and acceptance in practise. Most of the research on artificial intelligence in healthcare has focused on developing algorithms, evaluating proof of concepts, and addressing moral and legal issues. Moreover, because modern AI systems are typically developed from a technical perspective, they have

not achieved the goals that have been proposed for them. The problem is that machines which do not speak and are without emotions are now treating humans with emotions-how far best?

## 2.0 AREAS OF TRANSFORMATION

### 2.1 Patient Record Management

Electronic health records (EHRs), which assist clinicians in ordering medications, documenting treatment decisions, and reviewing laboratory results, have replaced paper charts in the NHS and the majority of hospitals. These digital records can improve efficiency in many ways and provide patients and healthcare providers with more comprehensive data to work with when making decisions. Sharing client data is now instantaneous, saving both time and lives

However, EHRs must be able to exchange data among the numerous hospitals, offices, and other healthcare facilities where people seek care in order for patients and clinicians to have access to this information. This is particularly important when medical professionals are seeing new patients and need to get information from previous providers. Put differently, the alignment of data formats with established models and schema, along with a shared vocabulary, are essential for success. According to the CQC, digital health is underpinned by four guiding principles Person Centered, Availability, Security and Governance (CQC, 2023) The urgency of COVID 19 drove a significant transformation in the NHS and the health and social care sector in general. The adoption of COVID 19 Apps for ''Test and Tracing'' gave adequate capabilities to accumulate and gather client data for health needs. This helped to identify the vulnerable class with ease and to provide them with preventive mechanisms in order to stay safe. This digital transformation plan adopted highlighted how data should be used and shared (Department of Health and Social Care, 2022). The Department for Health and Social Care set aside £250 million in funding to the NHSX for establishing an AI Lab, which is aimed at improving health and care delivered to patients. The safety-critical nature of the healthcare sector and the consequences of using AI incorrectly, however, are among the most important factors to take into account when using AI. The top priorities are safety and ethics, and every choice made and lines of code written must reflect these values. It's not always simple to develop scalable AI for healthcare that can function well and reproduce outcomes throughout the intricate network of the National Health Service (NHS). Machine learning models are a common focus of AI solutions, but they can be challenging to reproduce in the lack of "perfect" training datasets. Due to operational pressures and human variables, real-world medical practitioners make optimal decisions that may not always align with the clinically perfect dataset that is available in the past (Dosanjh, 2021)

The ambition to use artificial intelligences to gather client data slowed after the number of cases reduced to almost zeros, now the pandemic is no more a killer disease and commitment to client data collection moves at a slow pace. The issue brings to mind the remaining category of people who didn't fit the vulnerable class and who never contracted the disease, the data for this class of people may not have been captured. Cancer patients who were given priority before COVID now go through the same record procedures with other patients and some of the cancer patients and their records are missing from the NHS and cannot be traced. The increasing waiting times in taking and matching client data remains a continuous threat to other services that may follow after (BBC, 2021)

Through the use of the enormous volume of data that the NHS collects and handles on a daily basis, interoperability would enable the development of innovative procedures and therapies but it depends on the design and caliber of the IT systems integrated into every health and care provider in the network. This poses a unique challenge, primarily due to the disparities in digital maturity among NHS organisations and the absence of standardisation among the numerous technical systems and interfaces in use (Eastham & Morgan, 2023). NHSX is a client record management platform that creates wider venue for data input and feedback in the UK. It ensures that data are colleceted, managed and disposed properly and legally. (Health Tech Newspaper, 2020)

## 2.2 Matching Patient Diagnoses with Medication

According to the NHS, Personalised medicine which is the treatment of patients based individual client's needs and health conditions is the way forward for medication. The field of personalised medicine will present opportunities to advance disease treatment. Treatment can be customised to address the underlying cause of various patient subtypes within a given condition based on thorough genomic and diagnostic characterisation. The NHS now uses individual approaches and therapies to achieve the best outcome in the interest of the client is a great step from the ''one size fits all'' approach previously used (NHS, no date). Combining stem cells with AI software, patient diagnoses are matched to drugs for timely treatments, even though this is not something popular in the UK, the NHS has positive interventions to implement such technologies in the future (BBC, no date)

We're still a long way from fully utilising AI for medical diagnosis. Nonetheless, more information is becoming available for the use of AI in the diagnosis of various illnesses, including cancer. An AI system for the diagnosis of breast cancer was trained with a sizable dataset of mammograms in a UK study that was published. According to this study, using an AI system to interpret mammograms resulted in a 5.7% and 9.4% absolute decrease in false positives and false negatives, respectively (Alowais et al, 2023) According to Will Quince (Minister for Health and Secondary care), The UK's future health plans is to be the genotype superpower of the world, to support the early detection of disease (Department of Health and Social Care, 2022) The Health and Social Care sector has not seen much improvement in this area as most of the commitments and innovations are in their early stages, this means a continuous support and funding from successive government will influence this revolution in diagnoses and personalized medications.

The British Medical Association through the NHS adopted guidelines in 2018 to ensure safe client drug prescriptions and treatment. The document lays out the arrangement regarding switching a patient from an expensive drug to a relatively cheaper one (BMA, 2018). This document emphasis on provisions clinicians must comply with without enough evidence of support for GP's and clinicians in their roles. The need for on the job trainings and technical supports were not much appreciated in the pact. Despite the increasing client data mining and access, very limited is done about the scope of client data collection necessary for data management. In most Trusts within the NHS, there are no or unclear codes about the depth of information needed from a client as far as health is concerned. The capturing of certain sensitive information about patients exposes client safety, dignity and mental stability.

**2.3 Patient Care Delivery**

Generative AI courses are taught in UK educational institutions to teach students how to use AI appropriately in their studies while also warning them about the risks associated with plagiarism, bias, and inaccuracies. In order to assist students—many of whom are already utilising other AI tools for their assignments—staff members receive in-service training. To lower the likelihood of cheating, new methods of evaluating students are probably going to appear (Weale, 2023). This goes a long way to advance the knowledge and skills of the workforce for the NHS. To give an in-depth view of Patient care, client care shall be categorized into six sub care services as follows.

Preventive Care: The NHS has partnered with health apps such as the COVID App, which leverage artificial intelligence (AI) to provide real-time guidance on symptom management, medication administration, and customised lifestyle modifications. With this new capability, people can monitor their health more closely, identify possible problems early, and take preventative action without having to leave their homes. People are better able to understand their conditions and treatment plans thanks to AI's capacity to present information in an understandable format. The goal of self-care is problem prevention, and AI can be very helpful in that regard. AI can help individuals at risk before chronic conditions manifest by using predictive analytics to identify them. AI can recommend workout regimens, dietary adjustments, and stress-reduction strategies based on individuals' data and behaviours (Liazoghli, 2023). It is critical to mention stable internet connections and affordability, patients ability to access AI Apps rest on their ability to afford these mobile technologies and be able to buy data packages to operate these services. According to the BBC, UK has some of the most expensive data packages in Europe and conditions like this affects patients ability to effectively benefit from AI and preventive care (BBC, 2019)

Triage and Diagnoses: Triage is the process of determining what level of assistance is required, when it should be provided, and who is most suited to handle the patient or request. Clinical triage can assist medical practices in allocating resources based on each patient's unique needs, guaranteeing that each person receives the best care possible (NHS, 2033). Many Trusts moved to digitally enabled 'total triage' system during COVID-19 pandemic. This means request were remotely screened before directed for consultation. Some practices used a simpler form of telephone/video first with any patients with a lot more hospitals using the traditional method. Daniela Rodrigues hold the view that the inability to formalize triage in healthcare and the use of different approaches by hospitals and care centres affect the universality of systems and health services rendered (Rodrigues, D. et al, 2022). Client-clinician communications have faced challenges in the NHS for years, in events of speaking with patients with hearing difficulties and difficulty in seeing. Have there been interventions made in the past about client-clinician communications and have these interventions been adequate? (NHS, 2020). Initial communication is key to subsequent services provided, care planning and other important care plans depend on effective client-clinician communications

Clinical decisions: The NHS uses AI in the detection and treatment of addiction. AI applications are able to identify the needs of the individual and help design health plans. An artificial intelligence programme with models that can predict patients' likelihood of developing opioid dependence with 80% accuracy (C3 AI, no date). These apps allow NHS

frontline staff to identify patients who may become dependent and take preventative measures to stop dependence from starting. To reduce the risk of hospitalisation and healthcare costs, administrators can create tailored health services for high-risk communities. Addiction prevention improves patient outcomes and provides more individualised care, which benefits society as a whole. These AI technologies rely on inputs by humans, ideal decisions are not possible but considerable improvements can be when there is the needed level of understanding. One important challenge of decision making in the NHS resource allocation and since AI depends on human inputs, to what level of accuracy can AI give about decisions made.

## 2.4 Diagnostics

When applied to unseen data, AI can predict efficient and more accurate information about diseases. AI can diagnose disease based on data such as lab results, scans, symptoms, and images of confirmed and susceptible cases. One notable achievement of AI surpassing human clinicians is in the area of Ethomics projects, which aims to record and track human behaviour. Since our brains can only communicate with the outside world through movement—eating, talking, and walking—anything that has an impact on the brain, nervous system, or physiology is likely to manifest itself in how people move.

Very subtle changes in our nervous system can be detected by applying novel algorithms to data obtained from behaviour measurements at very high resolution, critical diagnoses can be made easily (Imperial College London, no date). The testing and research for a variety of AI products that aid in diagnosis, such as cancer screening, stroke image assessment, and much more, is funded by the NHS AI Lab's AI in Health and Care Award. The advancement of AI technology is not limited to image analysis.

Care delivery; The NHS with a mission to increase efficiency has adopted AI which is able to assess critical health conditions and non-critical ones, this will help to cut down hospital visitations by clients and ensure proper allocation of the reducing health resources. Moreover, this will give clinicians time and space to pay enough attention to serious health conditions. This means, queues and waiting lines are going to be eliminated very soon (BBC, no date). Virtual therapeutics: In the UK, patients with pain management, neurological disorders, behavioural health issues, and physical health are benefiting from new digital therapies that use extended reality technologies. Health apps provide evidence-based platforms that immerse patients in virtual environments, equipping users with coping mechanisms and resources that help them manage stress, anxiety, and fear for the rest of their lives (Accenture, 2022). The availability of portable defibrillators across the UK has given preventive care a new phase in the NHS, these devices are fully AI-engineered which tells users how to operate them. It is a great effort to access healthcare at a more beneficial level.

Chronic care: More than 17 million people in the UK suffer from chronic illnesses, which account for 70% of inpatient bed occupancy and a major portion of emergency hospital admissions (McGinness, no date). Because of this rising demand relative to supply, the NHS implemented innovative care models that use data and digital tools to give patients on-demand care. Adopting digital home care can also result in high-risk patients receiving community-based intervention earlier and avoid subsequent hospital admissions.

These areas of care with the patient in the middle has been shown in the diagram below.
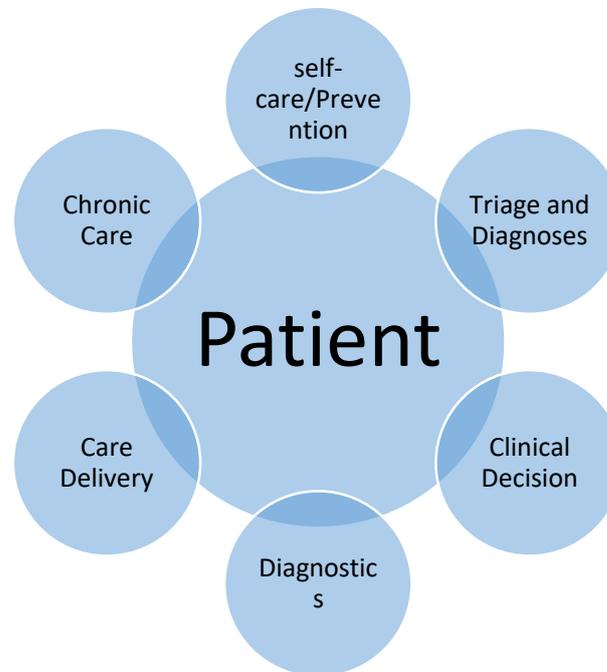


**Fig 1. Areas of Impact for AI in Healthcare (Spatharou, A. et al, 2020)**

## 2.5 Procurement and supplies

Health and care organisations can now view various certified clinical IT systems from the procurement frameworks that are a part of the Digital Care Services commercial model thanks to a Digital Buying Catalogue that the NHS introduced. Users can search through, evaluate, and rank systems from any of these frameworks. The Buying Catalogue makes it possible to showcase an ever-expanding selection of cutting-edge, contemporary, and superior IT systems. They are able to be obtained, examined, and assessed. Additionally, it offers a digitally efficient method for managing and submitting orders. Every item listed in the purchasing catalogue is referred to as Catalogue Solutions (NHS, 2023)

For certain suppliers, the NHS procurement procedure can still be difficult. Contractual controls must be implemented by NHS organisations in order to satisfy current and changing policy objectives and guidelines, which could result in more difficult negotiation situations. Less control over the terms and conditions of the agreement is given to suppliers. IT providers can anticipate being obliged to affix their signature to the TechUK Interoperability Charter, which entails sharing and cooperating with other NHS suppliers regarding technical specifications and embracing globally recognised standards (Digital Health, 2022)

## 3.0 FINDINGS & DISCUSSIONS

AI ethics exacerbating access inequalities of intelligent tools in the UK influences service output and overall productivity .The adoption of AI in the healthcare industry is critically dependent on safety and ethics, and this must be considered in every choice and line of code.

It's not always simple to develop scalable AI for healthcare that can function well and reproduce outcomes throughout the intricate network of the National Health Service (Chada, B.V. & Summers, L. 2022). Machine learning models are a common focus of AI solutions, but they can be challenging to reproduce in the lack of "perfect" training datasets. Due to operational pressures and human variables, real-world medical practitioners make optimal decisions that may not always align with the clinically perfect dataset that is available in the past. This may make large-scale AI solution replication difficult.

Funding has been a major problem to the adoption of AI in the health and social care sector in the UK. The NHS fully relies on public taxes to fund innovations and major structural adjustments in the sector, the agents and institutions collaborating in this course rely on the government for funding and support, and this affects the overall efficiency and timeliness of AI systems and facilities. The AI Diagnostic fund set aside to finance the deployment of AI tools still waits the tax cycles of the public who are unwilling to spend due to high cost of living. This means that the long run efficiency of AI in health care transformation chances on the unstable public taxes accumulated for spending, painting a wavering picture of healthcare. An official document submitted to the House of Commons revealed that ''Trusts are still kitted out with old, poor-quality PCs and laptops. They run old versions of Microsoft Windows. It can take over 15 minutes just for a PC to turn on, before people can start logging-on to their clinical system. Wi-Fi provision is often inadequate'', this reveals the level of inadequacy in logistics and infrastructures affecting digital enrollment and care delivery (UK Parliament, 2023). Some of the AI services rendered to patients in the UK are paid for by the client. The government's ability to bear all the cost associated with AI treatments communicates a lot to patient's service delivery and healthcare sustainability.

AI is not a single supercomputer but many interrelated computer systems connected from different geographical areas. The many complex applications and systems produces a long chain of instructions and authority which affect the nature and quality of care delivered. Patients needing immediate care and attention needs to wait on an agents and other expert's approval before certain diagnoses could be allowed and certain intelligent tools could be used. There is the possibility of digital bureaucracy- thus a long and unwanted formal lines of commands and approval is like to occur in the future.

Strong legal frameworks needed to regulate the service and client information. The very moment a person transfers information to another, contract of trust starts building up and legal provisions needs to be considered. Unlike the EU, the UK has not made any positive steps to come out with any strong AI Act. This means that both clients and clinicians are going to act above or below expected, and the dynamics of power and authority determines who feels strong to abuse the law. In this case, clinicians who have control over the system can choose to abuse clients in the name of AI. Vollers & Dennis believe that regulations set should come out clear and transparent and reduce inconsistencies, this will make both staff and patients safe to know that they working within the framework. (Vollers, N & Dennis, A. 2023).

Constant evaluation is needed on the Return on Investments, as the NHS continues to secure funding into AI projects, continuous evaluations of the various infrastructures are necessary to the overall success of the era. A continuous responsibility of providing adequate oversight of all AI projects and be a part of a larger plan that includes data utilisation, digital process

automation, and citizen engagement if it is to genuinely benefit from investing in AI is very necessary at this stage(Ford, 2019)

Digital discrimination in healthcare delivery is likely to occur when digitization becomes the order of services in the NHS. Patients who cannot access technology due to several justifiable reasons are going to suffer unattended to because they could not logon to communicate with a GP or couldn't access their platforms to cancel appointments. This worsens the entire care plan and procedures, GP's and clinicians' appointments will be disrupted by these category of patients who can use these health technologies and the system would be forced to sideline them for those who can.

## 3.1 Potential Implication for IT and Health Organisations

The government and healthcare providers in the UK must determine what unique role they can play in the adoption of AI in healthcare, and it urgent to assess their resources, skills, degree of digitization, availability and quality of data, and capabilities before deciding how ambitious they want to be with AI in order to align it with their strategic objectives. Creating an AI ecosystem through partnerships to jointly develop the best solutions for their population, working with patients and practitioners to craft an engaging AI narrative, defining and developing the best use cases in collaboration with end users, identifying and filling in staff members' digital literacy skill gaps, improving their value proposition for AI talent, addressing data-quality, access, governance, and interoperability issues, and cultivating an entrepreneurial culture are a few examples (Imperial College, no date).

IT providers may be able to use their insights to position themselves to deliver integrated solutions for NHS organisations across the nation by acquiring important knowledge and developing relationships with health and care personnel. Long integration phases are a common source of pain, which this could help avoid. There are a growing number of alternative procurement routes available, such as tendering for a spot on the new NHS Digital Buying Catalogue through new or upcoming frameworks, even though some suppliers may still choose to work directly with an NHS organization (Argyres, D. et al, 2022). The growing need for healthcare solutions that offer accessibility, convenience, and better patient outcomes is driving the market for digital health. Client inclinations: Consumers in the digital health space are more and more looking for solutions like telemedicine and remote patient monitoring that let them get healthcare services from a distance. Additionally, they favour digital solutions like wearable technology and smartphone health apps that offer proactive, individualised healthcare. Market trends: The use of telemedicine services is one of the key developments in the digital health industry. By eliminating the need for in-person consultations, telemedicine enables patients to consult with medical professionals remotely and offers convenience. This predicts a favourable consumer trend for digital health enterprises to expand revenues and sales in the UK. (Statista, 2023)

## 4.0 CONCLUSION AND RECOMMENDATIONS

Innovations in AI have the potential to revolutionise a number of healthcare-related fields and pave the way for a more individualised, accurate, predictive, and portable future. The impact of these technologies and the digital renaissance they bring requires health systems to think about how best they will adapt to the changing landscape. It is unclear if we will see a radical

or incremental adoption of these technological innovations. For the NHS, using these technologies can actually give medical staff members more time to devote to their patients. This will allow them to concentrate on what matters most to their patients and, in the future, use a globally democratised set of data assets that comprise the "highest levels of human knowledge" to "work at the limits of

For safe and reliability health systems, the NHS needs enough funding to facilitate the procurement of advanced computers for all trusts and health organisations in the UK. Companies that provides health and care services either directly or indirectly must enroll on this digital platform or must do so without any technological inefficiencies. Giving room for differences in the level of tools gives justifiable reasons to provide under-efficient health services, many health agencies compete on different levels of resource efficiency, from human capital, monetary, intellectual and many fronts, toppling up with technology goes a long way to affect output and productivity.

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