

Evidence Brief: Artificial intelligence

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Produced by the Knowledge Management team Evidence Briefs offer an overview of the published reports, research, and evidence on a workforce-related topic.

Date of publication: April 2025

Please acknowledge this work in any resulting paper or presentation as:
Evidence Brief: Artificial intelligence. Hannah Wood, Katie Nicholas, Elaine Watson and Jo McCrossan. (April 2025). UK: Workforce, Training and Education Knowledge Management Team

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Key publications – the big picture

[Artificial Intelligence Playbook for the UK Government](#)

Government Digital Service, February 2025

We have defined 10 common principles to guide the safe, responsible and effective use of artificial intelligence (AI) in government organisations. The white paper [A pro-innovation approach to AI regulation](#) sets out [5 principles](#) for regulators to inform AI development in all sectors. This playbook builds on those principles and defines 10 core principles for AI use in government and public sector organisations.

[Principles for artificial intelligence \(AI\) and its application in healthcare](#)

BMA, October 2024

This report sets out how AI is being used in healthcare currently, how it could be used in the near future, and examines both the potential benefits and drawbacks with respect to patients, clinicians, and the efficiency of the overall healthcare system.

[AI in health care: what do the public and NHS staff think?](#)

The Health Foundation, July 2024

There is, on balance, support from both the public and NHS staff for the use of AI in health care, indicating a broadly receptive environment. However, a significant minority of the public is currently not supportive. One area of concern is AI's potential impact on the social and relational aspects of health care.

[What do technology and AI mean for the future of work in health care?](#)

The Health Foundation, November 2023

While unlikely to lead to widespread job losses in health care, technology is transforming, and will continue to transform, the nature of work. The right technologies, properly implemented, can not only extend human capabilities, but also enable staff to

switch their time and attention to tasks where humans add more value – supporting workforce capacity at a time of huge pressure.

We present a framework to help navigate this shifting landscape, showing how technologies can variously substitute, supersede, support or strengthen human labour. This framework can be used to understand not only how specific tasks might be affected but also how the occupational roles typically associated with those tasks might evolve.

[The Digital, Data and Technology Playbook](#)

UK Government, June 2023

This document sets out key policies and guidance for how digital projects and programmes are assessed, procured and delivered.

[Artificial Intelligence \(AI\) and Digital Healthcare Technologies Capability framework](#)

Health Education England, February 2023

This capability framework will allow individual learners to understand their needs in the digital healthcare technology space, across various workforce archetypes, of users, embedders, creators, drivers, and shapers. It will also give a foundation of capabilities which can be lifted and shifted or adapted to curricular and teaching for our healthcare professionals.

[Understanding healthcare workers' confidence in AI](#)

NHS AI Lab & Health Education England, May 2022

This research, which comprises two reports, is a collaboration between the NHS AI Lab and Health Education England. Its primary aim is to explore the factors influencing healthcare workers' confidence in artificial intelligence (AI) technologies and how these can inform the development of related education and training.

[Shaping the future of digital technology in health and social care](#)

The King's Fund, May 2021

The potential of digital technology to transform the health and social care system has still not been realised, though the Covid-19 pandemic has caused a rapid shift towards the remote delivery of care through online technologies.

[The Topol Review](#)

Health Education England, February 2019

The Topol Review outlined recommendations to ensure the NHS is the world leader in using digital technologies to benefit patients. It will involve implementing technologies such as genomics, digital medicine, artificial intelligence and robotics at a faster pace and on a greater scale than anywhere else in the world.

[Digitally-enabled primary and outpatient care will go mainstream across the NHS](#)

NHS Long Term Plan, 2019

Digital technology will provide convenient ways for patients to access advice and care. For patients and staff the starting point is interoperability of data and systems, as set out in [Chapter Five](#). Then, building on progress already made on digitising appointments and prescriptions, a digital NHS 'front door' through the [NHS App](#) will provide advice, check symptoms and connect people with healthcare professionals – including through telephone and video consultations.

[Building our future digital workforce](#)

Health Education England (no date)

Key to our work is establishing a [workforce planning model](#) for our health informatics workforce – those who work in data, digital, technology and knowledge - so we can understand both our current workforce, the demand for our future workforce and to develop a comprehensive plan to bridge the gaps.

Case Studies

[Developing AI training for NHS Staff and why patient and public involvement is important](#)

AI and Digital Regulations Service for Health and Social Care, October 2024

This case study explores the importance of developing comprehensive education and training for NHS staff working with Artificial Intelligence (AI). We spoke to a Consultant Radiologist working at an NHS Trust, who was interested in the use of AI technology to help clinicians triage and prioritise breast and chest x-ray scans. They explained the importance of giving healthcare professions the knowledge and skills to navigate the integration of AI into their daily practices, as well as the necessity of being able to speak to patients and the public openly about the use of AI within the hospital or as part of their care.

[Using AI to transform wound care in the community: North Cumbria Integrated Care](#)

NHS Employers, September 2024

To address the challenges of treating wound care and managing the workforce's caseload, NCIC started using a model which uses an AI algorithm to support the workforce at any level to assess wounds confidently, consistently and safely.

The Star for workforce redesign

More resources and tools are available by searching for 'technology', 'AI' in [the Star](#)

National Data Programme

Workforce, Training and Education staff can look at the [National Data Warehouse \(NDL\)](#) SharePoint site to find out more about datasets and Tableau products.

Published Peer Reviewed Research

Leadership and strategy

[Drawbacks of Artificial Intelligence and Their Potential Solutions in the Healthcare Sector](#)

Biomedical Materials & Devices, February 2023

We believe AI will continue its present path and ultimately become a mature and effective tool for the healthcare sector. Besides this AI-based systems raise concerns regarding data security and privacy. Because health records are important and vulnerable, hackers often target them during data breaches. The absence of standard guidelines for the moral use of AI and ML in healthcare has only served to worsen the situation.

[AI in the NHS: a framework for adoption](#)

Future Healthcare Journal, November 2022

The aim of the framework is severalfold but is, at its core, a tool with which to highlight to healthcare commissioners, end users, patients and members of the public the considerations to be mindful when introducing AI to healthcare settings.

[NHS knowledge and library services in England in the digital age](#)

Health Information & Libraries Journal, September 2022

As Artificial Intelligence and automation are implemented in health systems, knowledge and library staff form a crucial bridge between technology and those who use it. This article explores

initiatives on resource discovery as well as the need for system-wide partnership working to ensure that biomedical knowledge in computable form is findable, accessible, interoperable and reusable. Low levels of health and digital literacy pose a significant barrier to using health information and accessing health services.

[Leadership in the context of digital health services: A concept analysis](#)

Journal of Nursing Management, August 2022

Leadership attributes concerned leaders' behaviour, roles and qualities. Antecedents concerned informatics skills and competence, information and tools, understanding care systems and their complexity and education. Consequences related to organization, professionals and patient and care.

[Ten statements to support nurse leaders implement e-health tools for nursing work in hospitals: A modified Delphi study](#)

Journal of Clinical Nursing, May 2021

Implementation of e-health tools for nursing work is complex in health settings and requires careful examination of multiple factors and interactions between clinicians, tools, service users and the health organisation. This research proposes ten statements to support nurse leaders with decisions about implementing e-health tools to support nursing work in hospitals.

['Leading by Science' through Covid-19: the GDPR & Automated Decision-Making](#)

International Journal of Population Data Science, April 2021

The response to Covid-19 has shone a light on a new kind of use of automated predictions in healthcare. They are substantively different from the published, academic modelling of the disease which has been highly influential on government policy, but has also been publicly detailed and debated per the conventions of scientific discourse. The NHS Data Store thus raises the

possibility of government reliance on models which are not subject even to the post-hoc peer review that follows publication, or externally validated as medical devices. Despite the apparent secrecy of their automated mechanisms, the spectre of life-and-death decisions being made in connection with these public-private models has been raised.

AI in healthcare: general overviews, definitions, and literature analysis

[Digital Technologies Impact on Healthcare Delivery: A Systematic Review of Artificial Intelligence \(AI\) and Machine-Learning \(ML\) Adoption, Challenges, and Opportunities](#)

AI 5 (4), October 2024

A data synthesis of nine eligible studies revealed themes, including productivity enhancement, improved patient care through decision support and precision medicine, legal and policy challenges, technological considerations, organizational and managerial aspects, ethical concerns, data challenges, and socioeconomic implications. There exist significant opportunities, as well as substantial challenges and ethical concerns, associated with integrating AI and ML into healthcare delivery. Implementation strategies must be carefully designed, considering technical, ethical, and social factors.

[Artificial intelligence in healthcare: A bibliometric analysis](#)

Telematics and Informatics Reports, March 2023

The study carried out a thorough bibliometric study on healthcare-related artificial intelligence research, which will help researchers, legislators, and practitioners understand the field's growth and the prerequisites for responsible use of artificial intelligence technology within the healthcare system.

[How, for whom, and in what contexts will artificial intelligence be adopted in pathology? A realist interview study](#)

Journal of the American Medical Informatics Association, March 2023

It must not be assumed that AI tools that provide benefit in one subspecialty will provide benefit in others. Pathologists should be involved in the decision to introduce AI, with opportunity to assess strengths and weaknesses. Further research is needed concerning the evidence required to satisfy pathologists regarding the benefits of AI.

[Interpretable machine learning for dementia: A systematic review](#)

Alzheimer's & Dementia, February 2023

We identified 92 studies using PubMed, Web of Science, and Scopus. Studies demonstrate promising classification performance but vary in their validation procedures and reporting standards and rely heavily on popular data sets.

[DECIDE-AI: a new reporting guideline and its relevance to artificial intelligence studies in radiology](#)

Clinical Radiology, February 2023

This review highlights some of the specificities of AI as complex intervention, why a new reporting guideline was needed for early stage, live evaluation of this technology, and how DECIDE-AI and other AI reporting guidelines can be useful to radiologists and researchers.

[NHS England: Artificial Intelligence \(Information Governance\)](#)

NHS England, February 2023

[Examples of AI](#) which are currently being used to benefit people in health and care include:

- Analysing [X-ray images, for example mammograms](#), to support radiologists in making assessments. This frees up radiologists to spend more time with patients, or to screen greater numbers of people more quickly.

- Supporting people in [virtual wards](#), who would otherwise be in hospital to receive the care and treatment they need in their own home or usual place of residence. Remote monitoring technology such as apps and medical devices can [assess patients' health and care](#) while they are being cared for at home.
- [Helping clinicians read brain scans more quickly](#). This shortens the time it takes for patients to be treated, giving them a better quality of care.

[Artificial Intelligence: A Driving Force In Advancing Patient Centricity](#)

Journal of Pharmaceutical Negative Results, January 2023
The current article articulates how AI and data science are transforming life sciences and explains how this sector is deploying these tools to meet patient centricity.

[Sixty seconds on . . . ChatGPT](#)

BMJ, January 2023
ChatGPT is the latest artificial intelligence (AI) chatbot to cause a stir. It can respond to queries and requests with prose of surprising quality, almost indistinguishable from that of a human writer. It's so seemingly authentic and easy to use that academics and medics are both in wonder and worry over how it might shake up the system.

[Artificial Intelligence and Machine Learning Based Intervention in Medical Infrastructure: A Review and Future Trends](#)

Healthcare, January 2023
This article offers a survey of the uses of AI and ML in the healthcare industry, with a particular emphasis on clinical, developmental, administrative, and global health implementations to support the healthcare infrastructure as a whole, along with the impact and expectations of each component of healthcare. Additionally, possible future trends and

scopes of the utilization of this technology in medical infrastructure have also been discussed.

[Integrating artificial intelligence into an ophthalmologist's workflow: obstacles and opportunities](#)

Expert Review of Ophthalmology, January 2023

This review discusses integration of machine learning tools within ophthalmology clinical practices. We discuss key issues around ethical consideration, regulation, and clinical governance. We also highlight challenges associated with clinical adoption, sustainability, and discuss the importance of interoperability.

[Literature analysis of artificial intelligence in biomedicine](#)

Annals of Translational Medicine, December 2022

AI has been growing exponentially over the past few years; it is used mostly for diagnosis; COVID-19 is already in the top-3 of diseases studied using AI; China, the United States, South Korea, the United Kingdom and Canada are publishing the most articles in AI research; Stanford University is the world's leading university in AI research; and convolutional NNs are by far the most popular DL algorithms at this moment.

[On the role of artificial intelligence in psychiatry](#)

British Journal of Psychiatry, September 2022

Recently, there has been growing interest in artificial intelligence (AI) to improve efficiency and personalisation of mental health services. So far, the progress has been slow, however, advancements in deep learning may change this. This paper discusses the role for AI in psychiatry, in particular (a) diagnosis tools, (b) monitoring of symptoms, and (c) delivering personalised treatment recommendations. Finally, I discuss ethical concerns and technological limitations.

[Applications of Artificial Intelligence in Non-cardiac Vascular Diseases: A Bibliographic Analysis](#)

Angiology, August 2022

The fields developed within AI included: machine learning (n = 90; 45.0%), vision (n = 45; 22.5%), robotics (n = 42; 21.0%), expert system (n = 15; 7.5%), and natural language processing (n = 8; 4.0%). The applications were mainly new tools for: the treatment (n = 52; 29.1%), prognosis (n = 45; 25.1%), the diagnosis and classification of vascular diseases (n = 38; 21.2%), and imaging segmentation (n = 38; 21.2%). By identifying the main techniques and applications, this study also pointed to the current limitations and may help to better foresee future applications for clinical practice.

[Potential for Machine Learning in Burn Care](#)

Journal of Burn Care & Research, May/June 2022

This essay explores the forms of artificial intelligence to be implemented the field of burns management to optimize the care we deliver in the National Health Service (NHS) in the United Kingdom. Machine learning methods that predict or classify are explored. This includes linear and logistic regression, artificial neural networks, deep learning, and decision tree analysis.

[Is There a Place for Responsible Artificial Intelligence in Pandemics? A Tale of Two Countries](#)

Information Systems Frontiers, May 2021

This research examines the considerations of responsible Artificial Intelligence in the deployment of AI-based COVID-19 digital proximity tracking and tracing applications in two countries; the State of Qatar and the United Kingdom.

Natural Language Processing (NLP)

[Using natural language processing to identify opioid use disorder in electronic health record data](#)

International Journal of Medical Informatics, February 2023

NLP-based algorithms can automate data extraction and identify evidence of opioid use disorder from unstructured electronic healthcare records. The most complete ascertainment of OUD in EHR was combined NLP with ICD-10-CM codes. NLP should be considered for epidemiological studies involving EHR data.

[Associations of remote mental healthcare with clinical outcomes: a natural language processing enriched electronic health record data study protocol](#)

BMJ Open, February 2023

We aim to investigate clinical and demographic associations with remote mental healthcare in a large electronic health record (EHR) dataset and the degree to which remote care is associated with differences in clinical outcomes using natural language processing (NLP) derived EHR data.

[Application of Natural Language Processing \(NLP\) in Detecting and Preventing Suicide Ideation: A Systematic Review](#)

International Journal of Environmental Research and Public Health, January 2023

The use of AI&ML opens new avenues for considerably guiding risk prediction and advancing suicide prevention frameworks. The review's analysis of the included research revealed that the use of NLP may result in low-cost and effective alternatives to existing resource-intensive methods of suicide prevention.

[The Utility of Natural Language Samples for Assessing Communication and Language in Infants Referred with Early Signs of Autism](#)

Research on Child and Adolescent Psychopathology, January 2023

Natural Language Sampling (NLS) offers clear potential for communication and language assessment, where other data might be difficult to interpret. We leveraged existing primary data for 18-month-olds showing early signs of autism, to examine the reliability and concurrent construct validity of NLS-derived measures coded from video – of child language, parent linguistic input, and dyadic balance of communicative interaction – against standardised assessment scores.

[A review of Natural Language Processing Models for Covid-19 research](#)

Healthcare Analytics, November 2022

This survey paper reviews Natural Language Processing Models and their use in COVID-19 research in two main areas. Firstly, a range of transformer-based biomedical pretrained language models are evaluated using the BLURB benchmark. Secondly, models used in sentiment analysis surrounding COVID-19 vaccination are evaluated.

[The Role of Natural Language Processing during the COVID-19 Pandemic: Health Applications, Opportunities, and Challenges](#)

Healthcare, November 2022

In this paper, we review the applications of NLP to address diverse aspects of the COVID-19 pandemic. We outline key NLP-related advances on a chosen set of topics reported in the literature and discuss the opportunities and challenges associated with applying NLP during the current pandemic and future ones.

[Automated clinical coding: what, why, and where we are?](#)

npj Digital Medicine, October 2022

Our research reveals the gaps between the current deep learning-based approach applied to clinical coding and the need for explainability and consistency in real-world practice. Knowledge-based methods that represent and reason the standard, explainable process of a task may need to be incorporated into deep learning-based methods for clinical coding. Automated clinical coding is a promising task for AI, despite the technical and organisational challenges. Coders are needed to be involved in the development process.

[Novel approach by natural language processing for COVID-19 knowledge discovery](#)

Biomedical Journal, June 2022

We prioritized the list of therapeutic targets involved in antiviral and immune modulating drugs for experimental validation, rendering it valuable during public health crises marked by stresses on clinical and research capacity. Our automatic intelligence pipeline also contributes to other novel and emerging disease management and treatments in the future.

[Automating Large-scale Health Care Service Feedback Analysis: Sentiment Analysis and Topic Modeling Study](#)

JMIR Medical Informatics, April 2022

Using contemporary natural language processing techniques, unstructured text data were effectively characterized for further analysis and visualization. An efficient pipeline was successfully combined with a web application, making automated analysis and dissemination of large volumes of information accessible. This study represents a significant step in efforts to generate and visualize useful, actionable, and unique information from free-text patient reviews.

[Using Natural Language Processing to Explore Mental Health Insights From UK Tweets During the COVID-19 Pandemic: Infodemiology Study](#)

JMIR Infodemiology, March 2022

Using an NLP platform, we were able to rapidly mine and analyze emerging health-related insights from UK tweets into how the pandemic may be impacting people's mental health and well-being. This type of real-time analyzed evidence could act as a useful intelligence source that agencies, local leaders, and health care decision makers can potentially draw from, particularly during a health crisis.

[Using natural language processing to understand, facilitate and maintain continuity in patient experiences across transitions of care](#)

International Journal of Medical Informatics, January 2022

NLP can be used to identify themes and sentiment from patient experience survey comments relating to transitions of care in all four healthcare settings. With the help of a quality improvement framework, findings from our analysis may be used to guide patient-centred interventions to improve transitional care processes.

[Natural language processing enabling COVID-19 predictive analytics to support data-driven patient advising and pooled testing](#)

Journal of the American Medical Informatics Association, January 2022

SARS-CoV-2 testing predictive analytics and NLP successfully enabled data-driven patient advising and pooled testing.

[Artificial Intelligence in Action: Addressing the COVID-19 Pandemic with Natural Language Processing](#)

Annual Review of Biomedical Data Science, July 2021

This review surveys approximately 150 NLP studies and more than 50 systems and datasets addressing the COVID-19 pandemic. We detail work on four core NLP tasks: information retrieval, named entity recognition, literature-based discovery, and question answering. We also describe work that directly addresses aspects of the pandemic through four additional tasks: topic modeling, sentiment and emotion analysis, caseload forecasting, and misinformation detection.

[Cognitive Impairments in Schizophrenia: A Study in a Large Clinical Sample Using Natural Language Processing](#)

Frontiers in Digital Health, July 2021

Our findings demonstrate that cognitive problems are common in patients with schizophrenia, can be reliably extracted from clinical records using natural language processing, and are associated with adverse clinical outcomes. Harvesting the free text from medical records provides a larger coverage in contrast to neurocognitive batteries or rating scales, and access to additional socio-demographic and clinical variables. Text mining tools can therefore facilitate large scale patient screening and early symptoms detection, and ultimately help inform clinical decisions.

[Natural language processing in medicine: A review](#)

Trends in Anaesthesia and Critical Care, June 2021

There are challenges to the use of NLP in medicine. Unbiased training data is an essential requirement if the conclusions reached by NLP algorithms are to be trusted. Clinicians will need training to understand how NLP can be safely used as part of routine practice.

[A UK-Wide Study Employing Natural Language Processing to Determine What Matters to People about Brain Health to Improve Drug Development: The Electronic Person-Specific Outcome Measure \(ePSOM\) Programme](#)

The Journal of Prevention of Alzheimer's Disease, June 2021

The study was completed by 5,808 respondents, yielding over 80,000 free text answers. The analysis resulted in 184 themes of importance. An analysis focusing on key demographics to explore how priorities differed by age, gender and education revealed that there are significant differences in what groups consider important about their brain health.

[Automated tracking of emergency department abdominal CT findings during the COVID-19 pandemic using natural language processing](#)

American Journal of Emergency Medicine, May 2021

Dramatic decreases in numbers of acute abdominal pathologies detected by ED CT studies were observed early on during the COVID-19 pandemic, though these numbers rapidly rebounded. The proportions of CT cases with these pathologies did not increase, which suggests patients deferred care during the first pandemic peak. NLP can help automatically track findings in ED radiology reporting.

[Applying natural language processing and machine learning techniques to patient experience feedback: a systematic review](#)

BMJ Health & Care Informatics, March 2021

NLP and ML have emerged as an important tool for processing unstructured free text. Both supervised and unsupervised approaches have their role depending on the data source. With the advancement of data analysis tools, these techniques may be useful to healthcare organisations to generate insight from the volumes of unstructured free-text data.

[Using Natural Language Processing on Electronic Health Records to Enhance Detection and Prediction of Psychosis Risk](#)

Schizophrenia Bulletin, March 2021

Using NLP on EHRs can considerably enhance the prognostic accuracy of psychosis risk calculators. This can help identify patients at risk of psychosis who require assessment and specialized care, facilitating earlier detection and potentially improving patient outcomes.

[Applied natural language processing in mental health big data](#)

Neuropsychopharmacology, September 2020

'Big data' has transformative potential in mental health research, including the use of data from electronic health records and the 'unlocking' of text-field information contained here through natural language processing (NLP). Over the last 10 years, we have made substantial progress in applying NLP within the Clinical Record Interactive Search (CRIS) platform to enhance research at the South London and Maudsley Trust (SLaM): a large mental healthcare provider serving an urban catchment of around 1.3 million residents. CRIS provides a deidentified copy of SLaM's electronic health record [1], accessed within a robust data security and governance framework, currently drawing data from over 500,000 patients and having supported over 200 published research papers. A number of other UK mental healthcare providers now have CRIS-like capability, extending the potential for multi-site projects.

Chatbots

[ChatGPT: the future of discharge summaries?](#)

The Lancet Digital Health, March 2023

ChatGPT allows doctors to input a brief of the specific information to include, concepts to elaborate on, and guidance to explain, outputting a formal discharge summary in a matter of seconds. Discharge summaries are an obvious choice for this

technology because of their largely standardised format; this standardisation has previously been recognised through the creation of templates – e.g., from the Royal College of Physicians. Automation of this process could therefore ease the work burden upon junior doctors allowing more time for the delivery of patient care and the seeking of training opportunities in often roles centered on service provision.

[An automated, web-based triage tool may optimise referral pathways in elective orthopaedic surgery: A proof-of-concept study](#)

Digital Health, January 2023

The aims of this study were (1) retrospectively establish the magnitude of unnecessary imaging in knee pain patients at a single academic hospital and (2) prospectively develop and ascertain whether an electronic chatbot triage system might be capable of outperforming existing clinical pathways with regards to the investigation of knee pain prior to arrival in secondary care.

[User-Chatbot Conversations During the COVID-19 Pandemic: Study Based on Topic Modeling and Sentiment Analysis](#)

Journal of Medical Internet Research, January 2023

Based on the analysis of user-chatbot interactions on a live platform, this work provides insights into people's informational and emotional needs during a global health crisis. Users sought health-related information and shared emotional messages with the chatbot, indicating the potential use of chatbots to provide accurate health information and emotional support.

[Qualitative exploration of digital chatbot use in medical education: A pilot study](#)

Digital Health, July 2021

Both staff and students have clear benefits from using chatbots in medical education. However, they documented possible

limitations to their use. The creation of chatbots to support the medical curriculum should be further explored and urgently evaluated to assess their impact on medical students training both during and after the global pandemic.

[Row over Babylon's chatbot shows lack of regulation](#)

BMJ, February 2020

Four regulators oversee AI in healthcare, but there is still a lack of accountability, finds Gareth Iacobucci, after one doctor's concerns about a triage system are dismissed.

[Acceptability of artificial intelligence \(AI\)-led chatbot services in healthcare: A mixed-methods study](#)

Digital Health, August 2019

Most internet users would be receptive to using health chatbots, although hesitancy regarding this technology is likely to compromise engagement. Intervention designers focusing on AI-led health chatbots need to employ user-centred and theory-based approaches addressing patients' concerns and optimising user experience in order to achieve the best uptake and utilisation.

Imaging

[Implementation of artificial intelligence in thoracic imaging—a what, how, and why guide from the European Society of Thoracic Imaging \(ESTI\)](#)

European Radiology, February 2023

Broad clinical implementation of AI is on the horizon. Once the systems are good enough for clinical practice, the remaining challenges concerning continued quality assurance, finance, and training of future radiologists will have to be resolved for AI.

[Lessons learned from independent external validation of an AI tool to detect breast cancer using a representative UK data set](#)

British Journal of Radiology, February 2023

This study showed the importance of testing AI tools on all types of cases (including non-standard) and the clarity of any warning messages. The acceptable difference in sensitivity and specificity between the AI tool and human readers should be determined.

[Automated brain image analysis in dementia using artificial intelligence: a roadmap for the development of clinical tools](#)

Old Age Psychiatry, January 2023

Artificial intelligence (AI) and machine learning (ML) developments applied to neuroimaging in dementia are rapidly advancing. This paper provides a roadmap for clinically meaningful translation of this to healthcare systems.

[Artificial intelligence-based triage of large bowel biopsies can improve workflow](#)

Journal of Pathology Informatics, January 2023

NHS laboratory staff were able to implement an AI solution to accurately triage large bowel biopsies into several diagnostic classes and this improved reporting turnaround times for cases with neoplasia or with inflammation.

[NHS England: AI in imaging](#)

The NHS AI Lab is supporting the research and innovation of new AI screening technologies for health and social care.

[Predicting attitudes towards screening for neurodegenerative diseases using OCT and artificial intelligence: Findings from a literature review](#)

Journal of Public Health Research, October 2022

Differential screening rates for various screening programmes in England indicate that multiple factors influence uptake. In this

narrative literature review, some of these potential factors are explored in relation to predicting uptake of an early screening tool for neurodegenerative diseases using AI. These include: awareness of the disease, perceived risk, social influence, the use of AI, previous screening experience, socioeconomic status, health literacy, uncontrollable mortality risk, and demographic factors. The review finds the strongest and most consistent predictors to be ethnicity, social influence, the use of AI, and previous screening experience.

[Quality of reporting in AI cardiac MRI segmentation studies – A systematic review and recommendations for future studies](#)

Frontiers in Cardiovascular Medicine, July 2022

This systematic review highlights important gaps in the literature of CMR studies using AI. We identified key items missing – most strikingly poor description of patients included in the training and validation of AI models and inadequate model failure analysis – that limit the transparency, reproducibility and hence validity of published AI studies. This review may support closer adherence to established frameworks for reporting standards and presents recommendations for improving the quality of reporting in this field.

[High-throughput whole-slide scanning to enable large-scale data repository building](#)

Journal of Pathology, May 2022

Here we review several practical considerations for deploying high-throughput scanning and we present strategies to increase efficiency with a focus on quality. Finally, we review remaining challenges and issue a call to vendors to innovate in the areas of automation and quality control in order to make high-throughput scanning realizable to laboratories with limited resources.

[Automated Echocardiographic Detection of Severe Coronary Artery Disease Using Artificial Intelligence](#)

JACC: Cardiovascular Imaging, May 2022

Automated analysis of stress echocardiograms is possible using AI and provision of automated classifications to clinicians when reading stress echocardiograms could improve accuracy, inter-reader agreement, and reader confidence.

[Point-of-care screening for heart failure with reduced ejection fraction using artificial intelligence during ECG-enabled stethoscope examination in London, UK: a prospective, observational, multicentre study](#)

The Lancet Digital Health, February 2022

A deep learning system applied to single-lead ECGs acquired during a routine examination with an ECG-enabled stethoscope can detect LVEF of 40% or lower. These findings highlight the potential for inexpensive, non-invasive, workflow-adapted, point-of-care screening, for earlier diagnosis and prognostically beneficial treatment.

[The utility of color normalization for AI-based diagnosis of hematoxylin and eosin-stained pathology images](#)

Journal of Pathology, January 2022

Our results show that color normalization does not consistently improve classification performance when both training and testing data are from a single center. However, using four multi-center datasets of two cancer types (ovarian and pleural) and objective functions, we show that color normalization can significantly improve the classification accuracy of images from external datasets (ovarian cancer: 0.25 AUC increase, $p = 1.6 \times 10^{-5}$; pleural cancer: 0.21 AUC increase, $p = 1.4 \times 10^{-10}$).

Furthermore, we introduce a novel augmentation strategy by mixing color-normalized images using three easily accessible algorithms that consistently improves the diagnosis of test

images from external centers, even when the individual normalization methods had varied results.

[National COVID-19 Chest Imaging Database \(NCCID\)](#)

NHS England, 2022

The NHS AI Lab set up this national database to support better understanding of COVID-19 and develop technology enabling the best care for patients hospitalised with a severe infection. It is a centralised UK database containing chest X-ray (CXR), magnetic resonance imaging (MRI) and computed tomography (CT) images from hospital patients across the country.

[Towards nationally curated data archives for clinical radiology image analysis at scale: Learnings from national data collection in response to a pandemic](#)

Digital Health, November 2021

The National COVID-19 Chest Imaging Database, led by NHSX, British Society of Thoracic Imaging, Royal Surrey NHS Foundation Trust and Faculty, is an example of such a national initiative. Here, we summarise the experiences and challenges of setting up the National COVID-19 Chest Imaging Database, and the implications for future ambitions of national data curation in medical imaging to advance the safe adoption of artificial intelligence in healthcare.

[Leveraging Machine Learning and Artificial Intelligence to Improve Peripheral Artery Disease Detection, Treatment, and Outcomes](#)

Circulation Research, June 2021

In this review, we provide an introduction to important concepts in the fields of machine learning and artificial intelligence, detail the current state of how these technologies have been applied to peripheral artery disease, and discuss potential areas for future care enhancement with advanced analytics.

[DIAG a Diagnostic Web Application Based on Lung CT Scan Images and Deep Learning](#)

Studies in Health Technology and Informatics, May 2021

Our approach reaches more than 92% accuracy on 2 different distributions. In addition, we propose a computer aided diagnosis web application for Covid-19 diagnosis. The results suggest that our proposed deep learning tool can be integrated to the Covid-19 detection process and be useful for a rapid patient management.

[Automated Left Ventricular Dimension Assessment Using Artificial Intelligence Developed and Validated by a UK-Wide Collaborative](#)

Circulation: Cardiovascular Imaging, May 2021

Experts at multiple institutions successfully cooperated to build a collaborative AI. This performed as well as individual experts. Future echocardiographic AI research should use a consensus of experts as a reference. Our collaborative welcomes new partners who share our commitment to publish all methods, code, annotations, and results openly.

[Artificial intelligence in oncology: Path to implementation](#)

Cancer Medicine, May 2021

Concrete actions that major stakeholders can take to overcome barriers to AI implementation in oncology include training and educating the oncology workforce in AI; standardizing data, model validation methods, and legal and safety regulations; funding and conducting future research; and developing, studying, and deploying AI tools through multidisciplinary collaboration.

[CS2-Net: Deep Learning Segmentation of Curvilinear Structures in Medical Imaging](#)

Medical Image Analysis, January 2021

Automated detection of curvilinear structures, e.g., blood vessels or nerve fibres, from medical and biomedical images is a crucial early step in automatic image interpretation associated to the management of many diseases. We introduce a new curvilinear structure segmentation network (CS2-Net), which includes a self-attention mechanism in the encoder and decoder to learn rich hierarchical representations of curvilinear structures.

[Deep neural network based artificial intelligence assisted diagnosis of bone scintigraphy for cancer bone metastasis](#)

Scientific Reports, October 2020

Our AI model achieved considerable time-efficiency, accuracy, specificity and sensitivity in diagnosis of bone metastasis in patients with lung cancer, prostate cancer, breast cancer, and other cancers. With further assessment and validation, this model could facilitate diagnosing programs and help physicians improve the diagnostic efficiency and accuracy of bone metastasis, particularly in remote or low-resource areas, leading to a beneficial clinical impact.

Video analytics

[Automated extraction of clinical measures from videos of oculofacial disorders using machine learning: feasibility, validity and reliability](#)

Eye, February 2023

The presented program is capable of taking consumer grade videos of patients with oculofacial disease and providing clinically meaningful and reliable eyelid measurements that show promising validity.

[Enhancing Free-Living Fall Risk Assessment: Contextualizing Mobility Based IMU Data](#)

Sensors, January 2023

A single stroke survivor was recruited, and he conducted a series of mobility tasks in a lab and beyond while wearing video-based glasses and a single IMU. The latter generated topical gait characteristics that were discussed according to current research practices. Although current IMU-based approaches are beginning to provide habitual data, they remain limited. Given the plethora of extrinsic factors that may influence mobility-based gait, there is a need to corroborate IMUs with video data to comprehensively inform fall risk assessment. Use of artificial intelligence (AI)-based computer vision approaches could drastically aid the processing of video data in a timely and ethical manner.

[Cloud Based AI-Driven Video Analytics \(CAVs\) in Laparoscopic Surgery: A Step Closer to a Virtual Portfolio](#)

Cureus 14 (9), September 2022

Cloud-based AI-driven video analytics is an emerging new technology that enables users to store, analyze, and review videos. This technology has the potential to improve training, governance, and standardization procedures. Moreover, with the future adaptation of the technology, CAVs can be integrated into the trainees' portfolios as part of their virtual curriculum. This can enable a structured assessment of a surgeon's progression and degree of experience throughout their surgical career.

Predictive analytics

[Risk prediction models for incident systemic lupus erythematosus among women in the Nurses' health study cohorts using genetics, family history, and lifestyle and environmental factors](#)

Seminars in Arthritis and Rheumatism, February 2023

To our knowledge, this is the first SLE prediction model based on known risk factors. It might be feasibly employed in at-risk populations as genetic data are increasingly available and the risk factors easily assessed. The NHS cohorts include few non-White women and mean age at incident SLE was early 50s, calling for further research in younger and more diverse cohorts.

[A multi-granular stacked regression for forecasting long-term demand in Emergency Departments](#)

BMC Medical Informatics and Decision Making, February 2023

Combining models of population health and wider urgent care service capacity for predicting monthly ED attendances leads to an improved performance compared to each model individually. Policies designed to improve population health will reduce ED attendances and enhance quality and safety in the long-term.

[Accuracy of a tool to prioritise patients awaiting elective surgery: an implementation report](#)

BMJ Health & Care Informatics, January 2023

Health systems, such as the NHS in England, must look at innovative methods to prioritise patients awaiting surgery in order to best use limited resources. Clinical decision support tools, such as the PTL tool, can improve prioritisation and thus positively impact clinical care and patient outcomes.

[Evaluation of prototype risk prediction tools for clinicians and people living with type 2 diabetes in North West London using the think aloud method](#)

Digital Health, January 2023

The prevalence of type 2 diabetes in North West London (NWL) is relatively high compared to other parts of the United Kingdom with outcomes suboptimal. This presents a need for more effective strategies to identify people living with type 2 diabetes who need additional support. An emerging subset of web-based interventions for diabetes self-management and population management has used artificial intelligence and machine learning models to stratify the risk of complications from diabetes and identify patients in need of immediate support.

[Continuous ECG monitoring should be the heart of bedside AI-based predictive analytics monitoring for early detection of clinical deterioration](#)

Journal of Electrocardiology, November 2022

We review evidence that supports the role of continuous cardiorespiratory monitoring in these predictive analytics monitoring tools. In particular, we review how continuous ECG monitoring reflects the patient and not the clinician, is less likely to be biased, is unaffected by changes in practice patterns, captures signatures of illnesses that are interpretable by clinicians, and is an underappreciated and underutilized source of detailed information for new mathematical methods to reveal.

[Wearable Sensor Technology to Predict Core Body Temperature: A Systematic Review](#)

Sensors, October 2022

Robust machine learning methods offer the ability to develop more accurate, reliable, and personalized CBT prediction algorithms using wearable devices by including additional data on user characteristics, workout intensity, and the surrounding environment.

[Identification of undiagnosed atrial fibrillation using a machine learning risk prediction algorithm and diagnostic testing \(PULsE-AI\) in primary care: cost-effectiveness of a screening strategy evaluated in a randomized controlled trial in England](#)

Journal of Medical Economics, August 2022

Compared with routine care only, it is cost-effective to target individuals at high risk of undiagnosed AF, through an AF risk prediction algorithm, who should then undergo diagnostic testing. This AF risk prediction algorithm can reduce the number of patients needed to be screened to identify undiagnosed AF, thus alleviating primary care burden.

[Predicting surgical operative time in primary total knee arthroplasty utilizing machine learning models](#)

Archives of Orthopaedic and Trauma Surgery, August 2022

This study shows excellent performance of machine learning models for predicting surgical operative time in primary total knee arthroplasty. The accurate estimation of surgical duration is important in enhancing OR efficiency and identifying patients at risk for prolonged surgical operative time.

[Artificial intelligence-driven prescriptive model to optimize team efficiency in a high-volume primary arthroplasty practice](#)

International Orthopaedics, June 2022

AI-ML predicted OR success without increasing resources. Benchmarks track OR performance, demonstrate effects of strategic changes, guide decisions, and provide teamwork improvement opportunities.

[Machine learning prediction of non-attendance to postpartum glucose screening and subsequent risk of type 2 diabetes following gestational diabetes](#)

PLoS ONE 17 (3), March 2022

Postpartum screening following GDM is still poor. Women who did not attend postpartum screening appear to have higher metabolic risk and higher conversion to type 2 diabetes by two years post-delivery. Machine learning model can predict women who are unlikely to attend postpartum glucose test using simple antenatal factors. Enhanced, personalised education of these women may improve postpartum glucose screening.

[Taking a machine learning approach to optimize prediction of vaccine hesitancy in high income countries](#)

Nature, February 2022

We assessed willingness to take a vaccine and a comprehensive set of putative predictors. Predictive power was analysed with a machine learning algorithm. Only 57.4% of the participants indicated that they would definitely or probably get vaccinated. A parsimonious machine learning model could identify vaccine hesitancy with high accuracy (i.e. 82% sensitivity and 79–82% specificity) using 12 variables only.

[Using Machine Learning to Predict Mortality for COVID-19 Patients on Day 0 in the ICU](#)

Frontiers in Digital Health, January 2022

Using two independent patient datasets, we designed a machine-learning-based model that could predict the risk of mortality from severe COVID-19 with high accuracy. The most decisive variables in our model were increased levels of BUN, lowered albumin levels, increased creatinine, INR, and RDW, along with gender and age. Considering the importance of early triage decisions, this model can be a useful tool in COVID-19 ICU decision-making.

[Combining machine learning and conventional statistical approaches for risk factor discovery in a large cohort study](#)

Scientific Reports, November 2021

In this study, mortality models were built using gradient boosting decision trees (GBDT) and important predictors were identified using a Shapley values-based feature attribution method, SHAP values. Cox models controlled for false discovery rate were used for confounder adjustment, interpretability, and further validation. Our GBDT-SHAP pipeline was able to identify relevant predictors 'hidden' within thousands of variables, providing an efficient and pragmatic solution for the first stage of hypothesis free risk factor identification.

[Uncovering Clinical Risk Factors and Predicting Severe COVID-19 Cases Using UK Biobank Data: Machine Learning Approach](#)

JMIR Public Health and Surveillance, September 2021

We identified numerous baseline clinical risk factors for severe/fatal infection by XGboost. For example, age, central obesity, impaired renal function, multiple comorbidities, and cardiometabolic abnormalities may predispose to poorer outcomes. The prediction models may be useful at a population level to identify those susceptible to developing severe/fatal infections, facilitating targeted prevention strategies. A risk-prediction tool is also available online. Further replications in independent cohorts are required to verify our findings.

[Predicting the epidemic curve of the coronavirus \(SARS-CoV-2\) disease \(COVID-19\) using artificial intelligence: An application on the first and second waves](#)

Informatics in Medicine Unlocked, August 2021

Our proposed model has shown satisfactory accuracy in predicting the new cases of COVID-19 in certain contexts. The influence of this pandemic is significant worldwide and has already impacted most life domains. Decision-makers must be aware, that even if strict public health measures are executed

and sustained, future peaks of infections are possible. The AI-based models are useful tools for forecasting epidemics as these models can be recalculated according to the newly observed data to get a more precise forecasting.

[Using Predictive Modeling and Supervised Machine Learning to Identify Patients at Risk for Venous Thromboembolism Following Posterior Lumbar Fusion](#)

Global Spine Journal, May 2021

Predictive analytics and machine learning can be leveraged to aid in identification of patients at risk of VTE following PLF.

[Artificial Intelligence Techniques That May Be Applied to Primary Care Data to Facilitate Earlier Diagnosis of Cancer: Systematic Review](#)

Journal of Medical Internet Research, March 2021

AI techniques have been applied to EHR-type data to facilitate early diagnosis of cancer, but their use in primary care settings is still at an early stage of maturity. Further evidence is needed on their performance using primary care data, implementation barriers, and cost-effectiveness before widespread adoption into routine primary care clinical practice can be recommended.

[A unified machine learning approach to time series forecasting applied to demand at emergency departments](#)

BMC Emergency Medicine, January 2021

Simple linear methods like generalized linear models are often better or at least as good as ensemble learning methods like the gradient boosting or random forest algorithm. However, though sophisticated machine learning methods are not necessarily better than linear models, they improve the diversity of model predictions so that stacked predictions can be more robust than any single model including the best performing one.

[Artificial Intelligence Forecasting Census and Supporting Early Decisions](#)

Nursing Administration Quarterly, December 2020

This experience suggests that operational leaders empowered with effective predictive analytics can take decisive proactive staffing and capacity management choices. Predictive analytic information can also result in team learning and ensure safety and operational excellence is supported in all aspects of the organization.

[Clinical Implementation of Predictive Models Embedded within Electronic Health Record Systems: A Systematic Review](#)

Informatics, September 2020

Of 32 studies that reported effects on clinical outcomes, 22 (69%) demonstrated improvement after model implementation. Overall, EHR-based predictive models offer promising results for improving clinical outcomes, although several gaps in the literature remain, and most study designs were observational.

[Development of Proteomic Prediction Models for Transition to Psychotic Disorder in the Clinical High-Risk State and Psychotic Experiences in Adolescence](#)

JAMA Psychiatry, August 2020

In individuals at risk of psychosis, proteomic biomarkers may contribute to individualized prognosis and stratification strategies. These findings implicate early dysregulation of the complement and coagulation cascade in the development of psychosis outcomes.

[Prediction of progression from pre-diabetes to diabetes: Development and validation of a machine learning model](#)

Diabetes/Metabolism Research and Reviews, January 2020

Machine-learning models preserve their performance across populations in diabetes prediction, and can be integrated into

large clinical systems, leading to judicious selection of persons for interventional programmes.

Machine learning simulation and modelling

[Using simulation and machine learning to maximise the benefit of intravenous thrombolysis in acute stroke in England and Wales: the SAMueL modelling and qualitative study](#)

Health and Social Care Delivery Research, October 2022

This study found that average stroke thrombolysis rates of 18% are achievable, and inter-hospital variation came from differences in local patient populations and in-hospital processes and decision making.

[Defining factors in hospital admissions during COVID-19 using LSTM-FCA explainable model](#)

Artificial Intelligence in Medicine, October 2022

This paper proposes a model that utilizes Formal Concept Analysis (FCA) to explain a machine learning technique called Long–short Term Memory (LSTM) on a dataset of hospital admissions due to COVID-19 in the United Kingdom. This paper intends to increase the transparency of decision-making in the era of ML by using the proposed LSTM-FCA explainable model. Both LSTM and FCA are able to evaluate the data and explain the model to make the results more understandable and interpretable.

[Use of Clinical Pathway Simulation and Machine Learning to Identify Key Levers for Maximizing the Benefit of Intravenous Thrombolysis in Acute Stroke](#)

Stroke, July 2022

Machine learning and clinical pathway simulation may be applied at scale to national stroke audit data, allowing extended use and analysis of audit data. Stroke thrombolysis rates of at least 18%

look achievable in England and Wales, but each hospital should have its own target.

[Optimising the balance of acute and intermediate care capacity for the complex discharge pathway: Computer modelling study during COVID-19 recovery in England](#)

PLoS ONE, June 2022

Computer modelling can be a valuable asset for determining optimal capacity allocation along the complex care pathway. With results supporting a Business Case for increased downstream capacity, this study demonstrates how modelling can be applied in practice and provides a blueprint for use alongside the freely-available model code.

[Warped Bayesian linear regression for normative modelling of big data](#)

NeuroImage, December 2021

Normative modelling is becoming more popular in neuroimaging due to its ability to make predictions of deviation from a normal trajectory at the level of individual participants. It allows the user to model the distribution of several neuroimaging modalities, giving an estimation for the mean and centiles of variation. With the increase in the availability of big data in neuroimaging, there is a need to scale normative modelling to big data sets.

However, the scaling of normative models has come with several challenges.

[Machine Learning Approaches Reveal That the Number of Tests Do Not Matter to the Prediction of Global Confirmed COVID-19 Cases](#)

Frontiers in Artificial Intelligence, November 2020

Coronavirus disease 2019 (COVID-19) has developed into a global pandemic, affecting every nation and territory in the world. Machine learning-based approaches are useful when trying to understand the complexity behind the spread of the disease and

how to contain its spread effectively. The unsupervised learning method could be useful to evaluate the shortcomings of health facilities in areas of increased infection as well as what strategies are necessary to prevent disease spread within or outside of the country. Most strikingly, the analysis found that the variable number of tests by the country did not play a vital role in the prediction of the cumulative number of confirmed cases.

Educating the workforce and role development

AI education for clinicians

eClinicalMedicine 79, January 2025

To foster confidence in AI tools, methods need to be interpretable and safe. They will be subject to scrutiny and oversight from regulatory bodies, but also require understanding by individual clinicians and their patients. Interdisciplinary dialogue among clinicians, machine learners, educators, and ethicists is pivotal for the future of AI in medical education, and forums should continue to be formed. To drive meaningful innovation, clinicians must be able to effectively communicate their needs and insights to AI researchers and developers, while being aware of technical constraints.

How should we train clinicians for artificial intelligence in healthcare?

Future Healthcare Journal 11 (3), September 2024

Successful implementation of AI in medical education is essential to meet the requirements of AI in healthcare. To achieve this, actionable guidance for a wide community of educationalists and the upscaling of training programmes for clinical champions appear as priorities for system-level intervention.

Artificial intelligence in the NHS: Moving from ideation to implementation

Future Healthcare Journal 11 (3), September 2024

Adapting medical education to the digital age will take time and while there have been calls for further evolution of curricula to include digital skills, this remains absent from national guidance for what is expected from medical school graduates. Perhaps even more challenging than updating medical school curricula will be the need to launch educational programmes for the existing workforce.

AI integration in nursing practice: striking a balance between technology and the human touch

British Journal of Nursing, August 2024

Striking a balance between technology and the human touch in nursing practice requires deliberate efforts on multiple fronts. Nurses must be equipped with the knowledge and skills to effectively use AI tools while maintaining their role as advocates for patients' holistic wellbeing. This includes ongoing education and training on AI technologies, updated ethical standards, and communication strategies that foster trust and collaboration between nurses, patients and AI systems.

An evidence-based approach to artificial intelligence education for medical students: A systematic review

PLOS Digital Health 2 (11), April 2023

This is the first study that examines the evidence-based recommendations for implementation of AI educational programs in the global undergraduate medical curriculum. Through systematically evaluating various aspects of AI, we were able to look at the current trends in multiple domains of AI curricula including ethical, technical, and economic points of view.

[Artificial intelligence in radiology: trainees want more](#)

Clinical Radiology, April 2023

Despite the current limited availability of AI-based activities and teaching within UK training programmes, UK trainees' attitudes towards AI are mostly positive with many showing interest in being involved with AI-based projects, activities, and teaching.

[Putting undergraduate medical students in AI-CDSS designers' shoes: An innovative teaching method to develop digital health critical thinking](#)

International Journal of Medical Informatics, March 2023

Putting students in AI-CDSS designers' shoes seemed to be a fruitful and innovative strategy to develop digital health skills and critical thinking toward AI technologies. We expect that such programs could help future doctors work in rapidly evolving digitalized environments and position themselves as key leaders in digital health.

[Artificial intelligence education for radiographers, an evaluation of a UK postgraduate educational intervention using participatory action research: a pilot study](#)

Insights Into Imaging, February 2023

The findings of our work show that an AI module can assist educators/academics in developing similar AI education provisions for radiographers and other medical imaging and radiation sciences professionals. A blended learning delivery format, combined with customisable and contextualised content, using an interprofessional faculty approach is recommended for future similar courses.

[Promoting Research, Awareness, and Discussion on AI in Medicine Using #MedTwitterAI: A Longitudinal Twitter Hashtag Analysis](#)

Frontiers in Public Health, July 2022

These results demonstrate the generated considerable interest of using #MedTwitterAI for promoting relevant content and engaging a broad and geographically diverse audience. The use of hashtags in Twitter-based campaigns can be an effective tool to raise awareness of interdisciplinary fields and enable knowledge-sharing on a global scale.

[Virtual Interactive Surgical Skills Classroom: A Parallel-group, Non-inferiority, Adjudicator-blinded, Randomised Controlled Trial \(VIRTUAL\)](#)

Journal of Surgical Education, June 2022

VCT provides greater accessibility and resource efficiency compared to FFT, with similar educational benefit. VCT has the potential to improve global availability and accessibility of surgical skills training.

[Artificial intelligence and medical education: A global mixed-methods study of medical students' perspectives](#)

Digital Health 8, May 2022

Medical students from all countries should be provided teaching on artificial intelligence as part of their curriculum to develop skills and knowledge around artificial intelligence to ensure a patient-centred digital future in medicine. This teaching should focus on the applications of artificial intelligence in clinical medicine. Students should also be given the opportunity to be involved in algorithm development. Students in low- and middle-income countries require the foundational technology as well as robust teaching on artificial intelligence to ensure that they can drive innovation in their healthcare settings.

[Digital health must be better integrated into medical education](#)

BMJ, February 2022

Digital health must be better integrated into our medical education and developed throughout the curriculum. As digital natives, medical students should be consulted on the design of digital health education, and we should push for better training within our medical schools. We must be equipped with the technological, legal, and ethical skills to prepare for a digital future and to ultimately provide the best care for our patients.

[The impact of artificial intelligence on clinical education: perceptions of postgraduate trainee doctors in London \(UK\) and recommendations for trainers](#)

BMC Medical Education, August 2021

Trainee doctors have an overall positive perception of AI technologies' impact on clinical training. There is optimism that it will improve 'research and quality improvement' skills and facilitate 'curriculum mapping'. There is skepticism that it may reduce educational opportunities to develop 'clinical judgement' and 'practical skills'. Medical educators should be mindful that these domains are protected as AI develops. We recommend that 'Applied AI' topics are formalized in curricula and digital technologies leveraged to deliver clinical education.

[Integration of Technology in Medical Education on Primary Care During the COVID-19 Pandemic: Students' Viewpoint](#)

JMIR Medical Education, 2020

Even in the absence of face-to-face teaching and clinical placements, students have been able to hone their medical knowledge and soft skills through these virtual, simulated consultations. They have been exposed to a new consultation style while in a safe and collaborative learning space.

Workforce and service user perspective

[Health professionals' perspectives on the use of Artificial Intelligence in healthcare: A systematic review](#)

Patient Education and Counseling 134, May 2025

AI technologies have the potential to morph patient safety and outcomes. Despite that, there is still a great deal of debate and uncertainty around AI and its application. Our review highlights that Healthcare professionals though emphasize the necessity for high-quality health data and time-saving by AI tools, but these benefits were overshadowed by the potential harm AI may pose to the clinical expertise and capacity of healthcare professionals.

['In the Midst of Every Crisis, Lies Great Opportunity': Perceptions of the Future Use of Artificial Intelligence in the UK NHS Primary Care](#)

Muskuloskeletal Care 23(2), April 2025

Findings suggest a cautious but optimistic view of AI as a tool for improving efficiency and patient safety in primary care, emphasising the need for robust governance structures to ensure its beneficial integration into clinical workflows. This study underlines the necessity of balancing technological innovation with the preservation of essential human elements within the healthcare process.

[How patients are using AI](#)

BMJ, November 2024

Should patients be using AI tools? How should the healthcare system react to patients using a new, often untested, tool in addition to human diagnoses? And what does patients' use of AI tell us about the gaps in the health service and how to fix them?

[Health Care Professionals' Experience of Using AI: Systematic Review With Narrative Synthesis](#)

Journal of Medical Internet Research 26, October 2024

Our review identified several important issues documented in various studies on health care professionals' use of AI tools in real-world health care settings. Opinions of health care professionals regarding the added value of AI tools for supporting clinical decision-making varied widely, and many professionals had concerns about their understanding of and trust in this technology. The findings of this review emphasize the need for concerted efforts to optimize the integration of AI tools in real-world health care settings.

[Experiences of using artificial intelligence in healthcare: a qualitative study of UK clinician and key stakeholder perspectives](#)

BMJ Open, December 2023

Four core themes were identified: positive perceptions of AI; potential barriers to using AI in healthcare; concerns regarding AI use and steps needed to ensure the acceptability of future AI tools. Overall, we found that those working in healthcare were generally open to the use of AI and expected it to have many benefits for patients and facilitate access to care. However, concerns were raised regarding the security of patient data, the potential for misdiagnosis and that AI could increase the burden on already strained healthcare staff.

[Survey of liver pathologists to assess attitudes towards digital pathology and artificial intelligence](#)

Journal of Clinical Pathology, December 2023

This study outlines current interest, priorities for research and concerns around digital pathology and AI for liver pathologists. The majority of UK liver pathologists are in favour of the application of digital pathology and AI in clinical practice, research and education.

[Public perceptions on the application of artificial intelligence in healthcare: a qualitative meta-synthesis](#)

BMJ Open, July 2023

Results showed that the public acknowledges the unique advantages and convenience of medical AI. Meanwhile, several concerns about the application of medical AI were observed, most of which involve ethical and legal issues. The standard application and reasonable supervision of medical AI is key to ensuring its effective utilisation. Based on the public's perspective, this analysis provides insights and suggestions for health managers on how to implement and apply medical AI smoothly, while ensuring safety in healthcare practice.

[Surgeons' perspectives on artificial intelligence to support clinical decision-making in trauma and emergency contexts: results from an international survey](#)

World Journal of Emergency Surgery, January 2023

Results depict the presence of technology enthusiasts and skeptics and surgeons' preference toward more classical decision-making aids like clinical guidelines, traditional training, and the support of their multidisciplinary colleagues. A lack of knowledge about several AI-related aspects emerges and is associated with mistrust.

[Stakeholder Perspectives of Clinical Artificial Intelligence Implementation: Systematic Review of Qualitative Evidence](#)

Journal of Medical Internet Research, January 2023

Clinical AI implementation is influenced by many interdependent factors, which are in turn influenced by at least 5 distinct stakeholder groups. This implies that effective research and practice of clinical AI implementation should consider multiple stakeholder perspectives. The current underrepresentation of perspectives from stakeholders other than HCPs in the literature may limit the anticipation and management of the factors that influence successful clinical AI implementation.

[Clinician and computer: a study on doctors' perceptions of artificial intelligence in skeletal radiography](#)

BMC Medical Education, January 2023

This study identifies clear support, amongst a cross section of student and qualified doctors, for both the general use of AI technology in healthcare and in its application to skeletal radiography for trauma. The development of systems to address this demand appear well founded and popular. The engagement of a small but reticent minority should be sought, along with improving the wider education of doctors on AI.

[Digital Technologies and the Role of Health Care Professionals: Scoping Review Exploring Nurses' Skills in the Digital Era and in the Light of the COVID-19 Pandemic](#)

JMIR Nursing, October 2022

Further advancing nurses' readiness in adopting telemedicine requires an integrated approach, including combination of technical knowledge, management abilities, soft skills, and communication skills.

[An insight into the current perceptions of UK radiographers on the future impact of AI on the profession: A cross-sectional survey](#)

Journal of Medical Imaging and Radiation Sciences, September 2022

Respondents were unsure about the ways in which AI is currently used in practice and how AI will impact on careers in the future. It was felt that AI integration will lead to increased job opportunities to contribute to decision making as an end user. Job security was not identified as a cause for concern.

[Meaningful patient and public involvement in digital health innovation, implementation and evaluation: A systematic review](#)

Health Expectations, August 2022

PPI is largely viewed as valuable and essential in digital health innovation, but rarely practised. Several barriers exist for both innovators and patients, which currently limits the quality, frequency and duration of PPI in digital health innovation, although improvements have been made in the past decade.

[UK reporting radiographers' perceptions of AI in radiographic image interpretation – Current perspectives and future developments](#)

Radiography, July 2022

Responses indicate that AI will have a strong impact on reporting radiographers' decision making in the future. Respondents are confident in how an AI makes decisions but less confident explaining this to others. Trust levels could be improved with explainable AI solutions.

[Patient Perceptions on Data Sharing and Applying Artificial Intelligence to Health Care Data: Cross-sectional Survey](#)

Journal of Medical Internet Research, August 2021

There were significant variations in the patient perceptions, levels of support, and understanding of health data research and AI. Greater public engagement levels and debates are necessary to ensure the acceptability of AI research and its successful integration into clinical practice in future.

[Women's attitudes to the use of AI image readers: a case study from a national breast screening programme](#)

BMJ Health & Care Informatics, April 2021

Women of screening age are ready to accept the use of AI in breast screening but are less likely to use other AI-based health applications. A large number of women are undecided, or had

mixed views, about the use of AI generally and they remain to be convinced that it can be trusted.

[Perceptions of Artificial Intelligence Among Healthcare Staff: A Qualitative Survey Study](#)

Frontiers in Artificial Intelligence, October 2020

Despite agreeing on the usefulness of AI in the medical field, most health professionals lack a full understanding of the principles of AI and are worried about potential consequences of its widespread use in clinical practice. The cooperation of healthcare workers is crucial for the integration of AI into clinical practice and without it the NHS may miss out on an exceptionally rewarding opportunity. This highlights the need for better education and clear regulatory frameworks.

[Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey](#)

Insights Into Imaging, February 2020

UK medical students understand the importance of AI and are keen to engage. Medical school training on AI should be expanded and improved. Realistic use cases and limitations of AI must be presented to students so they will not feel discouraged from pursuing radiology.

Ethics

[The human role to guarantee an ethical AI in healthcare: a five-facts approach](#)

AI Ethics 5, October 2023

The collaborative models based on PCC and EBM care approaches which advocate for an active involvement of patients together with the rest of human stakeholders in the AI scene emerge as the optimal choice to ensure a patient centered approach that in turn enables an ethical AI deployment. By educating and empowering citizens, and promoting collaborative

and human interaction between medical practitioners, patients, and developers, a patient-centered healthcare could flourish in a very challenging period where machines and humans seem to be placed on a twin-pan balance that measures who will stay and who should go.

[Ethics of generative AI](#)

Journal of Medical Ethics, May 2023

Artificial intelligence (AI) and its introduction into clinical pathways presents an array of ethical issues that are being discussed in the JME. The development of AI technologies that can produce text that will pass plagiarism detectors and are capable of appearing to be written by a human author present new issues for medical ethics.

[Holding AI to Account: Challenges for the Delivery of Trustworthy AI in Healthcare](#)

ACM Transactions on Computer-Human Interaction 30 (2), April 2023

The need for AI systems to provide explanations for their behaviour is now widely recognised as key to their adoption. In this article, we examine the problem of trustworthy AI and explore what delivering this means in practice, with a focus on healthcare applications. Work in this area typically treats trustworthy AI as a problem of Human–Computer Interaction involving the individual user and an AI system. However, we argue here that this overlooks the important part played by organisational accountability in how people reason about and trust AI in socio-technical settings.

[Ethical Challenges in the Use of Digital Technologies: AI and Big Data](#)

In: Digital Transformation in Policing: The Promise, Perils and Solutions, January 2023

We discuss how biases are introduced by design in the workplace through technology and policy decision-making, how legal protections can become ambiguous through lack of definition, thus enhancing cyber-criminality, and demonstrate weakness in how the General Data Protection Regulations (GDPR) may adapt in light of new social phenomena and cultural change.

[NHS England: The AI Ethics Initiative](#)

The AI Ethics Initiative supports research and practical interventions that could strengthen the ethical adoption of AI-driven technologies in health and care. We are translating principles into practice by building the evidence base needed to introduce new measures for mitigating risk and providing ethical assurance.

[Philosophical evaluation of the conceptualisation of trust in the NHS' Code of Conduct for artificial intelligence-driven technology](#)

Journal of Medical Ethics, May 2022

The UK Government's Code of Conduct for data-driven health and care technologies, specifically artificial intelligence (AI)-driven technologies, comprises 10 principles that outline a gold-standard of ethical conduct for AI developers and implementers within the National Health Service. Considering the importance of trust in medicine, in this essay I aim to evaluate the conceptualisation of trust within this piece of ethical governance.

[The ethical challenges of artificial intelligence-driven digital pathology](#)

Journal of Pathology: Clinical Research, February 2022

Digital pathology – the digitalisation of clinical histopathology services through the scanning and storage of pathology slides – has opened up new possibilities for health care in recent years, particularly in the opportunities it brings for artificial intelligence (AI)-driven research. Recognising, however, that there is little scholarly debate on the ethics of digital pathology when used for AI research, this paper summarises what it sees as four key ethical issues to consider when deploying AI infrastructures in pathology, namely, privacy, choice, equity, and trust.

[The ethics of facial recognition technologies, surveillance, and accountability in an age of artificial intelligence: a comparative analysis of US, EU, and UK regulatory frameworks](#)

AI and Ethics, July 2021

This article contains a discursive discussion considering the complexity of the ethical and regulatory dimensions at play in these spaces including considering data protection and human rights frameworks. It concludes that data protection impact assessments (DPIA) and human rights impact assessments together with greater transparency, regulation, audit and explanation of FRT use, and application in individual contexts would improve FRT deployments. In addition, it sets out ten critical questions which it suggests need to be answered for the successful development and deployment of FRT and AI more broadly.

[The computer says no: AI, health law, ethics and patient safety](#)

British Journal of Nursing, May 2021

John Tingle, Lecturer in Law, Birmingham Law School, University of Birmingham, discusses some recent reports on artificial intelligence (AI) and machine learning in the context of law, ethics and patient safety.

[Boundaries Between Research Ethics and Ethical Research Use in Artificial Intelligence Health Research](#)

Journal of Empirical Research on Human Research Ethics, March 2021

Using artificial intelligence population health research in the United Kingdom and Canada as a case study, we combine a mapping study of journal publications with 18 interviews with researchers to explore how the ethical dimensions associated with this societal impact are incorporated into research agendas. Researchers separated the ethical responsibility of their research with its societal impact. We discuss the implications for both researchers and actors across the Ethics Ecosystem.

[AI in Cardiac Imaging: A UK-Based Perspective on Addressing the Ethical, Social, and Political Challenges](#)

Frontiers in Cardiovascular Medicine, April 2020

We describe what is being done in the United Kingdom to identify the principles that should guide AI development for health applications, as well as more recent efforts to convert adherence to these principles into more practical policy. We also consider the approaches being taken by healthcare organizations and regulators in the European Union, the United States, and other countries. Finally, we discuss ways by which researchers and frontline clinicians, in cardiac imaging and more broadly, can ensure that these technologies are acceptable to their patients.

[Ethical barriers to artificial intelligence in the national health service, United Kingdom of Great Britain and Northern Ireland](#)

Bulletin of the World Health Organization, February 2020

As a result of the vast linkable data that the NHS holds on all citizens throughout their lives, the service could have a leading role in taking forward artificial intelligence development for health care; however, its use remains limited, with little overarching policy guiding its development and application. In 2018, the

government of the United Kingdom published a code of conduct outlining expectations for artificial intelligence development in the NHS, covering aspects such as the appropriate handling of data, the need for algorithmic transparency and accountability.

Diversity and inclusion

[Shaping the future of AI in healthcare through ethics and governance](#)

Humanities and Social Sciences Communications 11 (410), March 2024

The purpose of this research is to identify and evaluate the technical, ethical and regulatory challenges related to the use of Artificial Intelligence (AI) in healthcare. A few recommendations were made to protect health data, mitigate risks and regulate more efficiently the use of AI in healthcare through international cooperation and the adoption of harmonized standards under the World Health Organization (WHO) in line with its constitutional mandate to regulate digital and public health. European Union (EU) law can serve as a model and guidance for the WHO for a reform of the International Health Regulations (IHR).

[A participatory initiative to include LGBT+ voices in AI for mental health](#)

Nature Medicine, January 2023

Artificial intelligence (AI) can help clinicians to improve healthcare decision-making by integrating data from high-volume, heterogeneous electronic health records (EHRs). However, there is growing evidence that AI solutions in healthcare carry considerable risk of harm for people belonging to racial, ethnic, sexual and gender minority communities, which can exacerbate inequalities.

[Explainable artificial intelligence for mental health through transparency and interpretability for understandability](#)

npj Digital Medicine, January 2023

We argue that the need for understandability is heightened in psychiatry because data describing the syndromes, outcomes, disorders and signs/symptoms possess probabilistic relationships to each other—as do the tentative aetiologies and multifactorial social- and psychological-determinants of disorders. If we develop and deploy AI/ML models, ensuring human understandability of the inputs, processes and outputs of these models is essential to develop trustworthy systems fit for deployment.

[Equity within AI systems: What can health leaders expect?](#)

Healthcare Management Forum, October 2022

Equity as an aim in healthcare delivery is an important and often overlooked factor in health informatics. AI can provide potential benefits and risks to patients as it can enhance or diminish equity. While steps to mitigate equity concerns in AI projects are needed and available, a systematic equitable AI approach is yet to be developed.

[The need for feminist intersectionality in digital health](#)

The Lancet Digital Health, August 2021

In this Viewpoint, we show that because of lower access and exclusion from app design, gender imbalance in digital health leadership, and harmful gender stereotypes, digital health is disadvantaging women – especially women with racial or ethnic minority backgrounds. Tackling digital health's gender inequities is more crucial than ever.

Sustainability, the environment, and climate change

[A survey on artificial intelligence for reducing the climate footprint in healthcare](#)

Energy Nexus, March 2023

The primary mission of the healthcare sector is to protect from various ailments with improved healthcare services and to use advanced diagnostic solutions to promote reliable treatments for complex diseases. However, healthcare is among the significant contributors to the current climate crisis. With the advances in AI, there are green AI goals for potentially reducing emissions through data-driven and well-optimized models for healthcare. Furthermore, novel machine learning and deep learning techniques are continually proposed for improved efficiency to reduce emissions.

[Artificial Intelligence Education for the Health Workforce: Expert Survey of Approaches and Needs](#)

JMIR Medical Education, November 2021

The responses highlighted the importance of education on ethical implications, suitability of large data sets for use in AI clinical applications, principles of machine learning, and specific diagnosis and treatment applications of AI as well as alterations to cognitive load during clinical work and the interaction between humans and machines in clinical settings. Respondents also outlined barriers to implementation, such as lack of governance structures and processes, resource constraints, and cultural adjustment.

[Artificial Intelligence in the NHS: Climate and Emissions](#)

The Journal of Climate Change and Health 4, October 2021

In this narrative scoping review using the NHS as a case study we consider: AI in healthcare, methodologies for quantifying AI associated emissions, and opportunities for using AI to support NHS emission reduction efforts. We present the metrics and

approaches commonly used to quantify climate impact in the field of AI and interpret them alongside healthcare AI.

Competency Frameworks

[Competency Framework example]

[Competency framework for perinatal mental health](#)

Health Education England, July 2018

This competency framework has been developed for all staff working to support mothers and families across the perinatal care pathway, from preconception to postnatal care.