# AI model Foresight set to revolutionise NHS care by predicting health complications



# Groundbreaking AI Model 'Foresight' Aims to Predict Health Complications in NHS Patients

A revolutionary advancement in artificial intelligence (AI) is emerging from the collaboration between researchers at University College London (UCL) and King’s College London (KCL). This innovative AI model, named Foresight, is being trained on data from 57 million individuals in England’s National Health Service (NHS), aiming to predict diseases and complications before they arise. The potential implications of this research, described by officials as capable of igniting a "healthcare revolution," offer an optimistic glimpse into the future of preventative medicine.

Foresight leverages deep learning technologies akin to those used in ChatGPT but extends its capabilities far beyond text prediction. The AI assesses extensive medical histories to forecast health issues, drawing upon eight routinely collected datasets — including hospital admissions, emergency department visits, and vaccination records. These are processed in a strictly controlled environment, ensuring that all personal data is anonymised.

Dr Chris Tomlinson from UCL remarked on the model's promise, stating, “Foresight is a significant step towards being able to predict disease and complications before they happen.” By analysing population-wide data, Foresight can identify the risk of unscheduled hospitalisations, a crucial indicator often preceding significant health deterioration. This proactive approach not only aims to improve patient outcomes but also seeks to optimise resource allocation within the NHS, which faces increasing pressure from rising demand.

In a notable trial, Foresight is initially focusing on Covid-19, with intentions to broaden its applicability to predict a host of over 1,000 health conditions and patient outcomes, including the risk of hospitalisation or mortality within the next year. This expansion could substantially inform healthcare interventions and personalised risk management strategies.

Furthermore, the model has been validated with impressive accuracy rates in previous studies, achieving approximately 88% accuracy in predicting patient outcomes when tested against both UK and US data sources. Foresight stands out by integrating structured and unstructured data — crucially, the AI can interpret free-text notes, which constitute a significant portion of electronic health records (EHRs). This capability allows Foresight to provide nuanced health insights that may otherwise remain hidden, thus enhancing clinician decision-making.

As the NHS continues to explore the potential applications of AI in healthcare, Foresight represents just one facet of a growing trend. For instance, another AI model known as AIRE-DM has been developed to analyse electrocardiogram (ECG) readings, successfully predicting the risk of type 2 diabetes up to a decade in advance. These advancements underline a broader shift towards employing sophisticated technology for preventative measures, moving away from reactive healthcare models.

Supporting this trend, Dr Vin Diwakar, National Director of Transformation at NHS England, emphasised the role of the NHS Secure Data Environment in facilitating such research. "This pioneering work allows for earlier treatments and interventions targeted to those at risk,” he discussed, highlighting the beneficial alignment with the NHS's goals for personalised and preventative care.

The hope is that tools like Foresight and others can translate data-driven predictions into tangible health outcomes, ultimately leading to a fundamental transformation in how healthcare is delivered. Science and Technology Secretary Peter Kyle remarked on the significance of such initiatives, stating, “This ambitious research shows how AI, paired with the NHS’s wealth of secure and anonymised data, is set to unlock a healthcare revolution.”

As this project unfolds, the potential for AI in healthcare is becoming increasingly evident, offering both a promise of enhanced individual care and a reimagining of the healthcare system's operational dynamics. By prioritising preventative approaches, the NHS may indeed be on the brink of a significant transformation in managing public health.

## Reference Map:

* Paragraph 1 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[2]](https://www.kcl.ac.uk/news/researchers-investigate-ability-of-their-new-ai-tool-to-predict-medical-events)
* Paragraph 2 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[6]](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/)
* Paragraph 3 – [[3]](https://arxiv.org/abs/2212.08072), [[6]](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/)
* Paragraph 4 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[4]](https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/november/ai-could-predict-type-2-diabetes-up-to-10-years-in-advance)
* Paragraph 5 – [[2]](https://www.kcl.ac.uk/news/researchers-investigate-ability-of-their-new-ai-tool-to-predict-medical-events), [[6]](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/)
* Paragraph 6 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[5]](https://www.england.nhs.uk/long-read/case-study-ai-tool-improving-outcomes-for-patients-by-forecasting-ae-admissions/)
* Paragraph 7 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[6]](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/)
* Paragraph 8 – [[1]](https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html), [[6]](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/)

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## Bibliography

1. <https://www.independent.co.uk/news/health/nhs-uk-data-ai-model-foresight-disease-b2746646.html> - Please view link - unable to able to access data
2. <https://www.kcl.ac.uk/news/researchers-investigate-ability-of-their-new-ai-tool-to-predict-medical-events> - Researchers at King's College London, in collaboration with University College London (UCL), King's College Hospital NHS Foundation Trust, and Guy's and St Thomas' NHS Foundation Trust, have developed an AI tool named Foresight. This tool utilizes deep learning to analyze both structured and unstructured data from electronic health records (EHRs) to predict future health events, such as disorders, symptoms, medications, and procedures. In a study published in The Lancet Digital Health, Foresight demonstrated high precision in forecasting the next disorder in a patient's health timeline, achieving accuracy rates of 68% and 76% in two UK NHS Trusts, and 88% in the US MIMIC-III dataset. The tool's ability to process free-text data, which constitutes over 80% of a patient's record, allows it to capture detailed phenotypic information, potentially aiding clinicians in decision-making and improving patient monitoring. ([kcl.ac.uk](https://www.kcl.ac.uk/news/researchers-investigate-ability-of-their-new-ai-tool-to-predict-medical-events?utm_source=openai))
3. <https://arxiv.org/abs/2212.08072> - The paper titled 'Foresight -- Generative Pretrained Transformer (GPT) for Modelling of Patient Timelines using EHRs' introduces Foresight, a novel transformer-based model designed to forecast a wide range of future medical events by analyzing both free-text and structured data from electronic health records (EHRs). The study processed data from three datasets: King's College Hospital NHS Foundation Trust, South London and Maudsley NHS Foundation Trust, and the US MIMIC-III dataset, encompassing a total of 811,336 patients. Foresight achieved high precision in predicting the next disorder in a patient's timeline, with accuracy rates of 68%, 76%, and 88% across the three datasets, respectively. Additionally, the model demonstrated a precision of 80%, 81%, and 91% in forecasting the next biomedical concept, which could be a disorder, symptom, relapse, or medication. The study suggests that Foresight can be a valuable tool for real-world risk forecasting, virtual trials, and clinical research, aiding in the study of disorder progression and the simulation of interventions. ([arxiv.org](https://arxiv.org/abs/2212.08072?utm_source=openai))
4. <https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/november/ai-could-predict-type-2-diabetes-up-to-10-years-in-advance> - Researchers have developed an artificial intelligence (AI) tool named AIRE-DM that analyzes electrocardiogram (ECG) readings to identify individuals at risk of developing type 2 diabetes up to ten years before the condition manifests. The study, funded by the British Heart Foundation (BHF), utilized approximately 1.2 million ECGs from hospital records and validated the AI's ability to detect subtle changes in routine ECGs that could signify an increased risk of type 2 diabetes. AIRE-DM accurately predicted future risk in individuals of various ages, genders, ethnicities, and socioeconomic backgrounds about 70% of the time. The researchers suggest that this AI tool could help identify individuals who might otherwise not have been recognized as likely to develop the condition, enabling early interventions to reduce the risk of type 2 diabetes and its associated complications. ([bhf.org.uk](https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/november/ai-could-predict-type-2-diabetes-up-to-10-years-in-advance?utm_source=openai))
5. <https://www.england.nhs.uk/long-read/case-study-ai-tool-improving-outcomes-for-patients-by-forecasting-ae-admissions/> - NHS England has developed an AI tool designed to forecast Accident & Emergency (A&E) admissions, enabling healthcare providers to proactively plan for surges in demand. The tool accounts for historical trends, seasonality, weather, and public holidays, providing forecasts broken down by age to assist in specific bed planning, such as for pediatric patients. By offering accurate three-week ahead forecasts, the AI tool allows NHS leaders to anticipate and prepare for increased demand, ensuring timely treatment for patients and efficient resource allocation. The tool has been co-developed in collaboration with frontline, clinical, and operational staff in nine pilot NHS trusts and is now available to 123 hospital trusts, demonstrating approximately twice the accuracy of baseline comparison models in predicting admissions. ([england.nhs.uk](https://www.england.nhs.uk/long-read/case-study-ai-tool-improving-outcomes-for-patients-by-forecasting-ae-admissions/?utm_source=openai))
6. <https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/> - Health Data Research UK (HDR UK) highlights the potential of AI models like Foresight to enhance healthcare systems by supporting clinical decision-making and real-world risk forecasting. Foresight, developed by researchers at King's College London, UCL, King's College Hospital NHS Foundation Trust, and Guy's and St Thomas' NHS Foundation Trust, utilizes deep learning to recognize complex patterns in both structured and unstructured data from electronic health records (EHRs). Unlike models trained on publicly available information, Foresight is trained on NHS EHR data, ensuring medical verification. The study published in The Lancet Digital Health demonstrated that Foresight achieved high precision in forecasting the next diagnosis of a condition in a patient's health record, with accuracy rates of 68% and 76% in two UK NHS Trusts, and 88% in the US MIMIC-III dataset. The tool's ability to process free-text data, which constitutes over 80% of a patient's record, allows it to capture detailed phenotypic information, potentially aiding clinicians in decision-making and improving patient monitoring. ([hdruk.ac.uk](https://www.hdruk.ac.uk/news/new-ai-tool-may-offer-insights-into-patients-future-health/?utm_source=openai))