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Artificial intelligence prediction tool for pre-diabetes and Type 2 diabetes risk stratification using computed tomography scans: An early economic evaluation

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Introduction

An artificial intelligence (AI) tool for pre-diabetes and type 2 diabetes mellitus (T2DM) prediction and risk stratification using computed tomography (CT) scans has been developed to identify pre-diabetic and diabetic patients by analysing location-specific changes in fat tissue inflammation. The tool enables earlier detection and more precise risk stratification, potentially reducing diabetes progression and its complications, thus helping alleviate the considerable economic burden associated with the disease, currently estimated at £10.7 billion annually, with £6.2 billion specifically attributed to diabetes-related complications within the National Health Service (NHS) (1).

Aim & Objectives

Health Innovation Oxford & Thames Valley (HIOTV) conducted this hypothetical early stage economic analysis to evaluate the potential cost implications of introducing the new AI-powered risk stratification tool within the NHS in England. The objectives are:

1. To compare population reach and the number of pre-diabetic and diabetic cases identified and averted between the standard of care (SOC) and the combined SOC and AI approach.
2. To estimate and evaluate the costs incurred and potential future cost savings in the SOC compared to the combined SOC and AI pathway.
3. To establish the conditions under which the AI-powered tool would result in potential cost savings.

Methodology

Informed by a scoping review, this early-stage hypothetical analysis employed decision tree models to simulate patient journeys for both the SOC NHS health check pathway utilising HbA1C as the main screening test and the SOC pathway coupled with the new AI-powered tool as an additional detection and risk stratification tool (Figures 1 and 2). A cohort of 10,000 individuals was modelled over one-year and five-year time horizons, reflecting the natural disease progression across various stages (pre-diabetes, diabetes and complicated diabetes). The primary outcomes measured in each pathway were the number of diabetic cases averted, the number of prediabetic patients prevented from progressing to complicated diabetes and the number of diabetic patients prevented from developing complications.

The analysis adopted a bottom-up NHS perspective, considering the costs associated with screening, interventions, disease management and health workforce resources within the UK healthcare system. Key model inputs included epidemiological data, diagnostic accuracy of tests, intervention uptake rates and progression rates through various stages. Sensitivity analyses were conducted to account for uncertainties around AI costs and disease prevalence. All costs were inflated to 2024 price years, and future costs were discounted at the recommended 3.5% discount rate based on NICE guidelines (2).

Conclusion

The early hypothetical economic evaluation suggests that integrating the new AI tool into the current SOC for pre-diabetes and diabetes detection in the NHS could result in future cost savings by preventing disease progression and complications. However, the study acknowledges limitations, including reliance on assumptions requiring real world data refinement. Further clinical and economic studies are recommended to strengthen the case for the potential adoption of the technology into the NHS.

References

1.Cost of devastating complications highlights urgent need to transform diabetes care in the UK | Diabetes UK [Internet]. [cited 2024 Oct 1]. Available from: https://www.diabetes.org.uk/about-us/news-and-views/cost-complications-highlights-urgent-need-transform-diabetes

2.4 Economic evaluation | NICE health technology evaluations: the manual | Guidance | NICE.

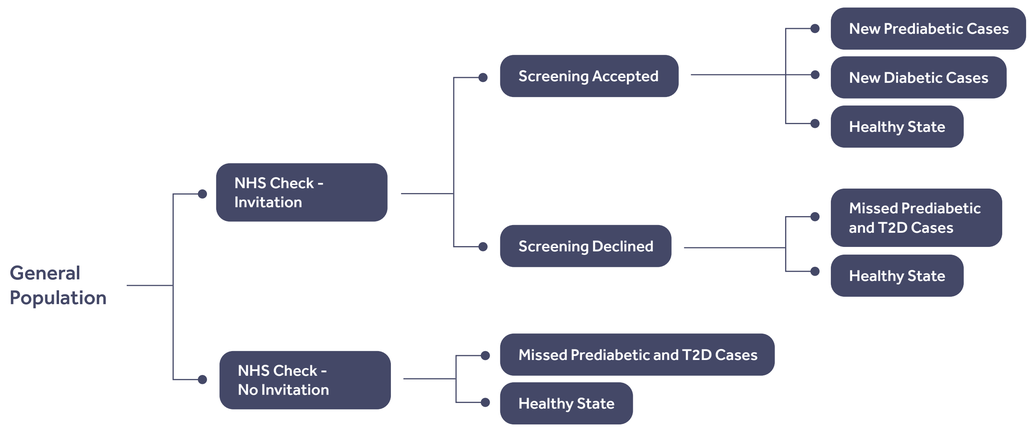

Figure 1: A simplified diagrammatic representation of the SOC pathway using NHS health vheck for pre-diabetes and diabetes detection

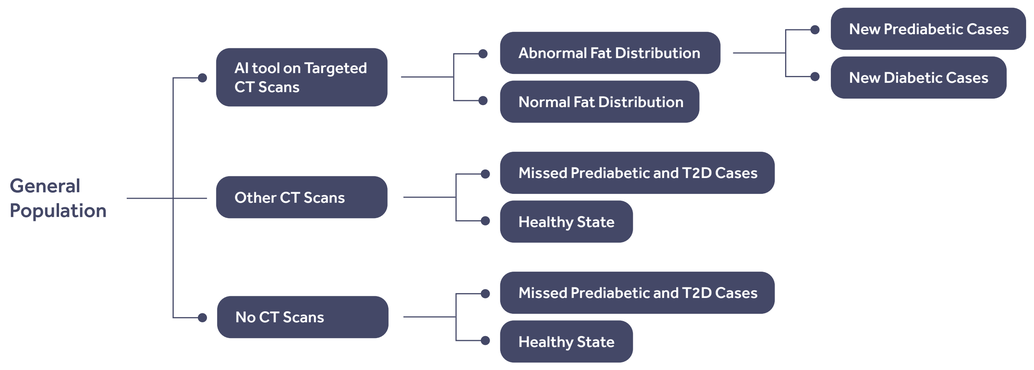

Figure 2: A simplified diagrammatic representation of the proposed pathway with the new AI technology used as an additional prediction and risk stratification tool

Results

The early analysis indicated that integrating the AI tool into the NHS pathway could enhance the identification of pre-diabetic and diabetic patients. Expanding population coverage by an additional 6.5% - representing the eligible CT scan population - could potentially prevent two additional diabetic cases, six pre-diabetic cases from progressing to complicated diabetes, and nine diabetic patients from developing complications within the cohort of 10,000 individuals. As detailed in Table 1, this integration is estimated to result in incremental cost savings of £26,454 per 10,000 people over the one- and five-year horizon.

Table 1: Estimated health outcomes and cost savings from integrating the AI tool with the standard of care (soc) for diabetes management

Outcome/ Metric	Cases averted & cost savings (SOC)	Incremental cases averted and cost savings (AI Tool)	SOC + AI tool
Diabetic cases averted	3	2	5
Prediabetic cases prevented from progressing to complicated DM	8.5	6	14.5
Diabetic cases prevented from developing complications	12.7	9	21.7
Total cost savings	**£19,010**	**£26,454**	**£45,464**

Sensitivity analyses assessed the robustness of findings under various scenarios, including changes in disease prevalence and implementation costs. The technology remained economically viable, with over 4% of CT scans indicating pre-diabetes and diabetic risk and a cost of £46 per scan. Adopting per-licence hypothetical costs, the initial licence cost of £53,000 for the AI resulted in net negative savings of £23,296 in the first year. However, with reduced maintenance and support costs of £14,800 in subsequent years, the integration is projected to generate incremental cost savings of £14,904 annually (Table 2).

Table 2: Incremental cost savings with the new AI tool in the per-licence scenario per year

Year	Total Costs Averted (A)	Initial Incurred Costs * (B)	Incremental Savings with the AI Tool (A-B)
First year	£45,621	£68,917	-£23,296
Subsequent years (Per year)	£45,621	£30,717	£14,904

* Note: The initial incurred costs include the hypothetical cost per licence and other costs associated with confirming true positive cases, linking pre-diabetic cases to the diabetes prevention programme and reclassifying false positive cases to healthy states.