

Development Of Tiered Machine Learning Models To Estimate Risk Of Dementia In Home And Hospital Settings

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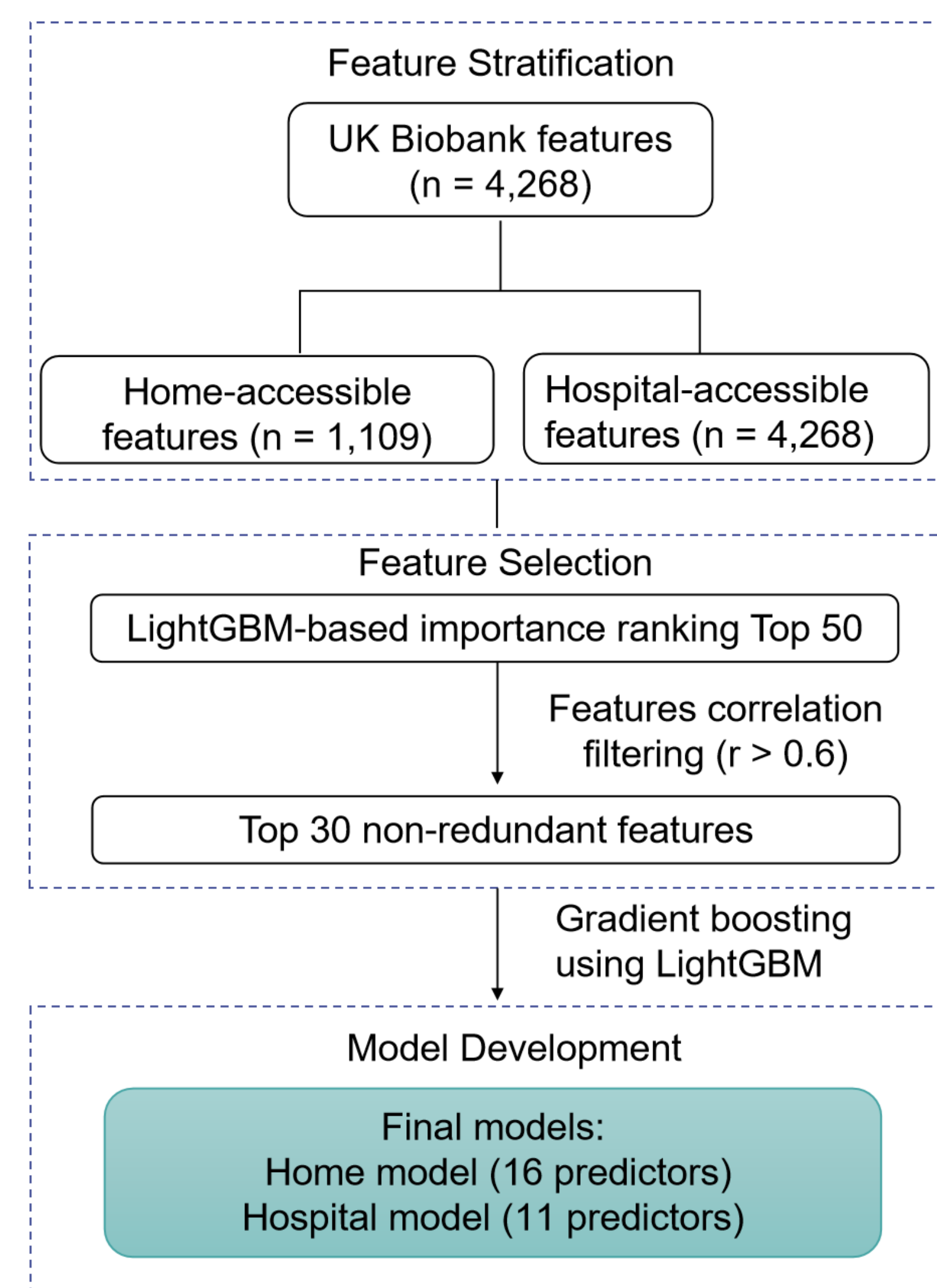
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Background

Early identification of individuals at increased risk of dementia may support timely preventive interventions. In practice, risk assessment needs to accommodate differences in data availability, from self-assessment at home to clinical evaluation in hospital settings. We aimed to develop data-driven, tiered machine learning models for dementia risk prediction that align with home and hospital settings.

Methods

We analyzed 500,714 dementia-free UK Biobank participants and predicted incident all-cause dementia. Candidate predictors were grouped into home- and hospital-based feature sets. LightGBM was used for feature selection and model development. Model performance was evaluated using discrimination, calibration, and comparison with established dementia risk scores.



Results

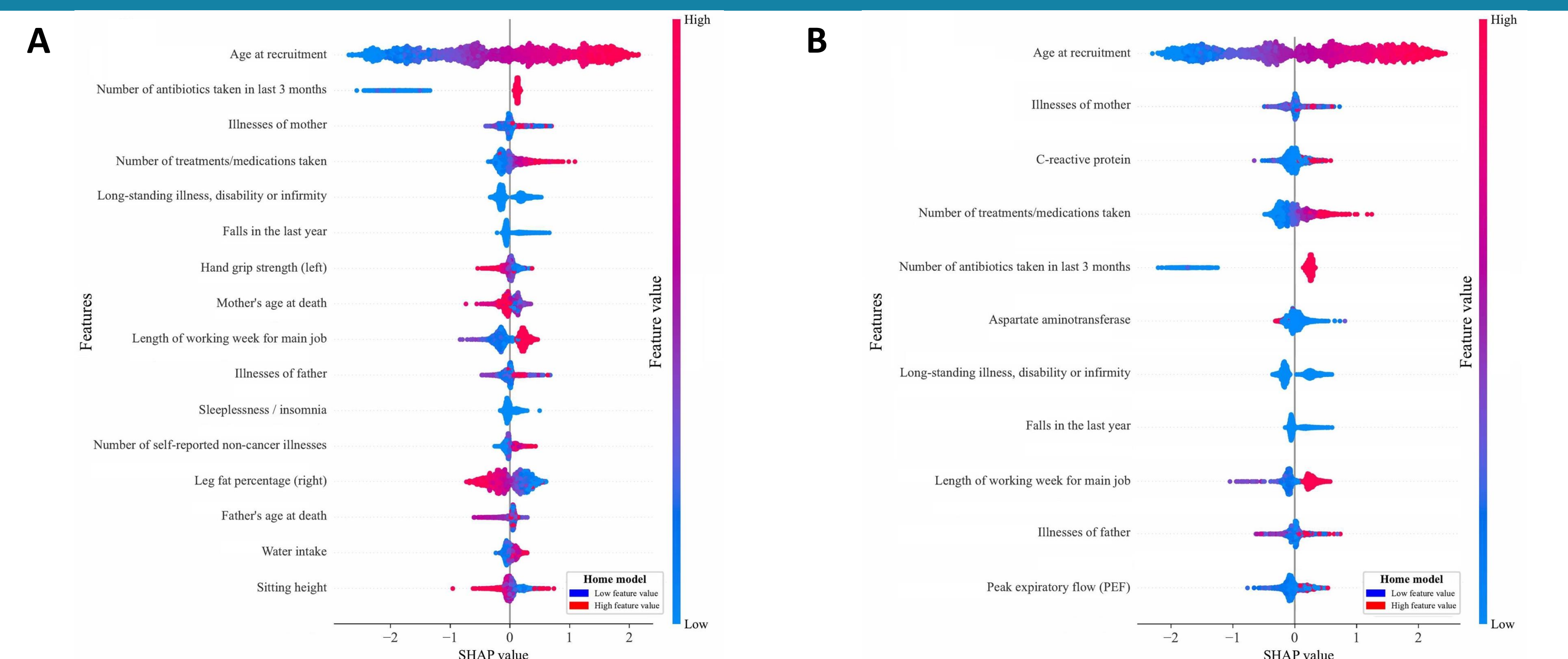


Figure 1. SHAP visualization plots showing the contribution of selected predictors in the Home (A) and Hospital (B) models.

(A) The Home model incorporated 16 predictors based on self-reported and self-measured data spanning family history, lifestyle factors, and physical measures.

(B) The Hospital model incorporated 11 predictors including additional routinely collected clinical information.

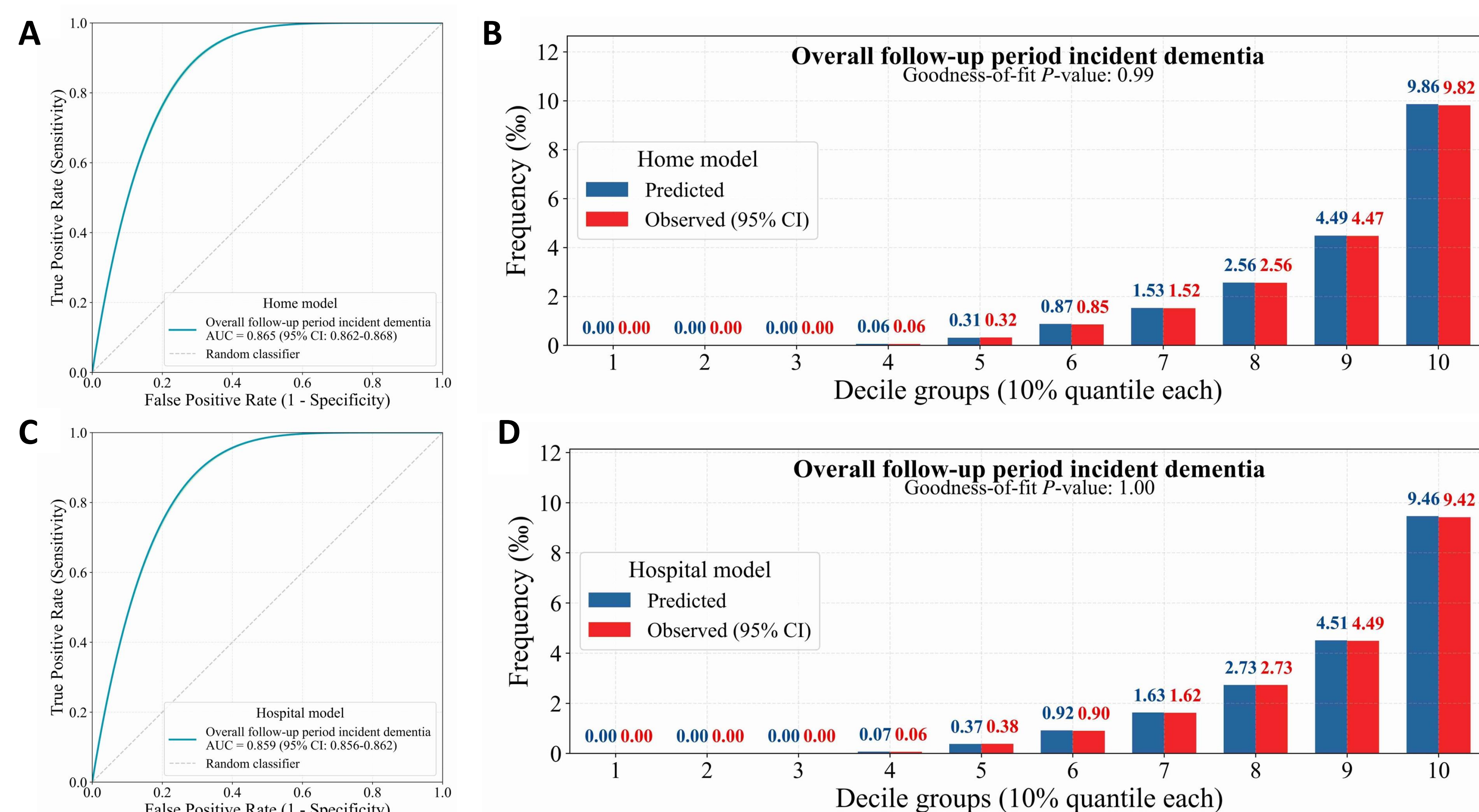


Figure 2. Discriminative performance and calibration of dementia risk predictions of the Home (A-B) and Hospital (C-D) models.

(A, C) Both models demonstrate robust discriminative ability for overall incident dementia, with AUCs of 0.865 and 0.859, respectively.

(B, D) Both models exhibit exceptional calibration, with predicted risk (blue) and observed risk (red) perfectly matching across all deciles.

Conclusion

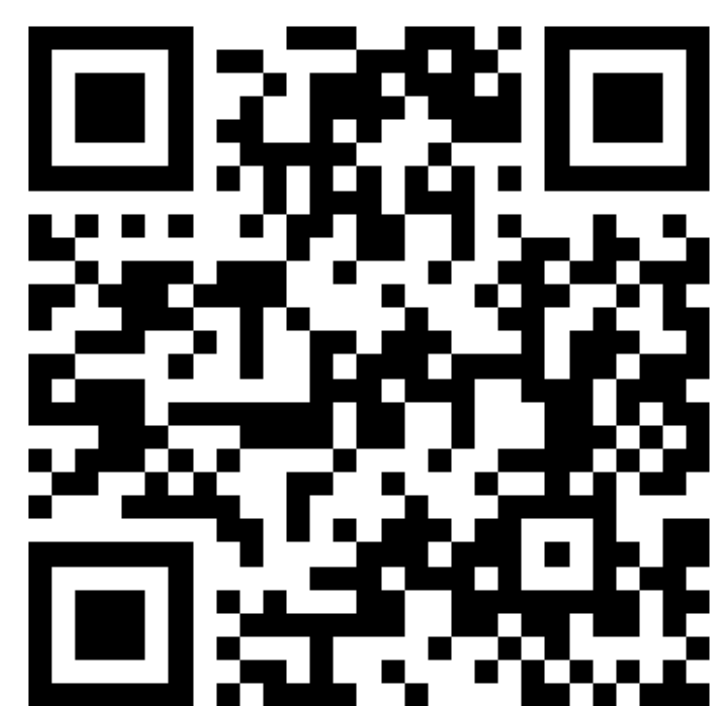
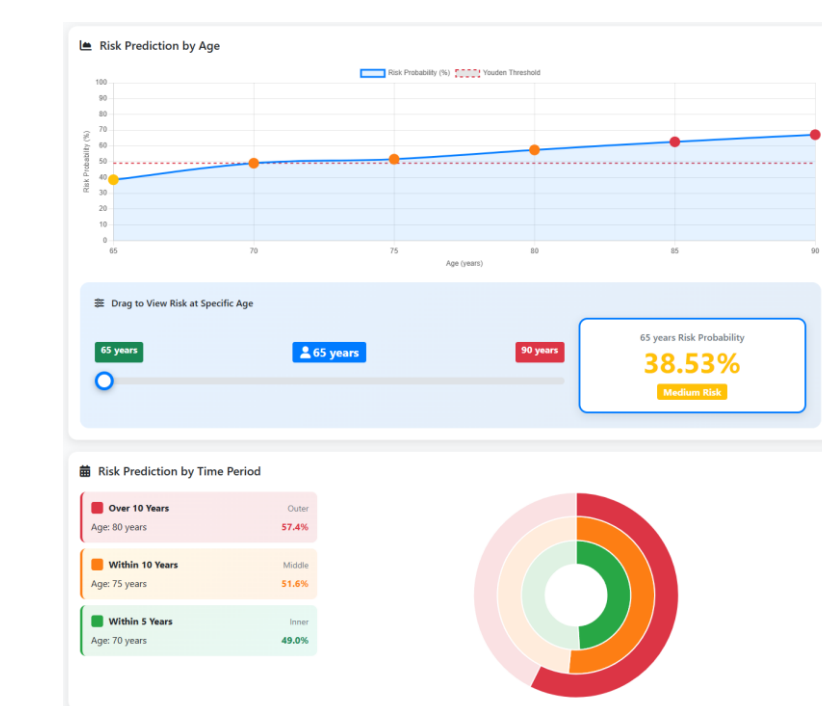
This study developed Home and Hospital models for dementia risk prediction that may be applied across community and clinical settings.

The tiered models enable dementia risk estimation under different levels of data availability and provide individualized risk prediction that may support early identification of individuals at increased risk.

Further evaluation in independent and diverse populations is needed to assess generalizability of these models and their potential role in preventive strategies.

Interactive web-based tool

We developed an interactive web-based tool based on the Home and Hospital models to enable individualized dementia risk estimation across different time horizons.



Try the Live Demo: Scan the QR code or visit <http://112.124.54.134:9008/>

