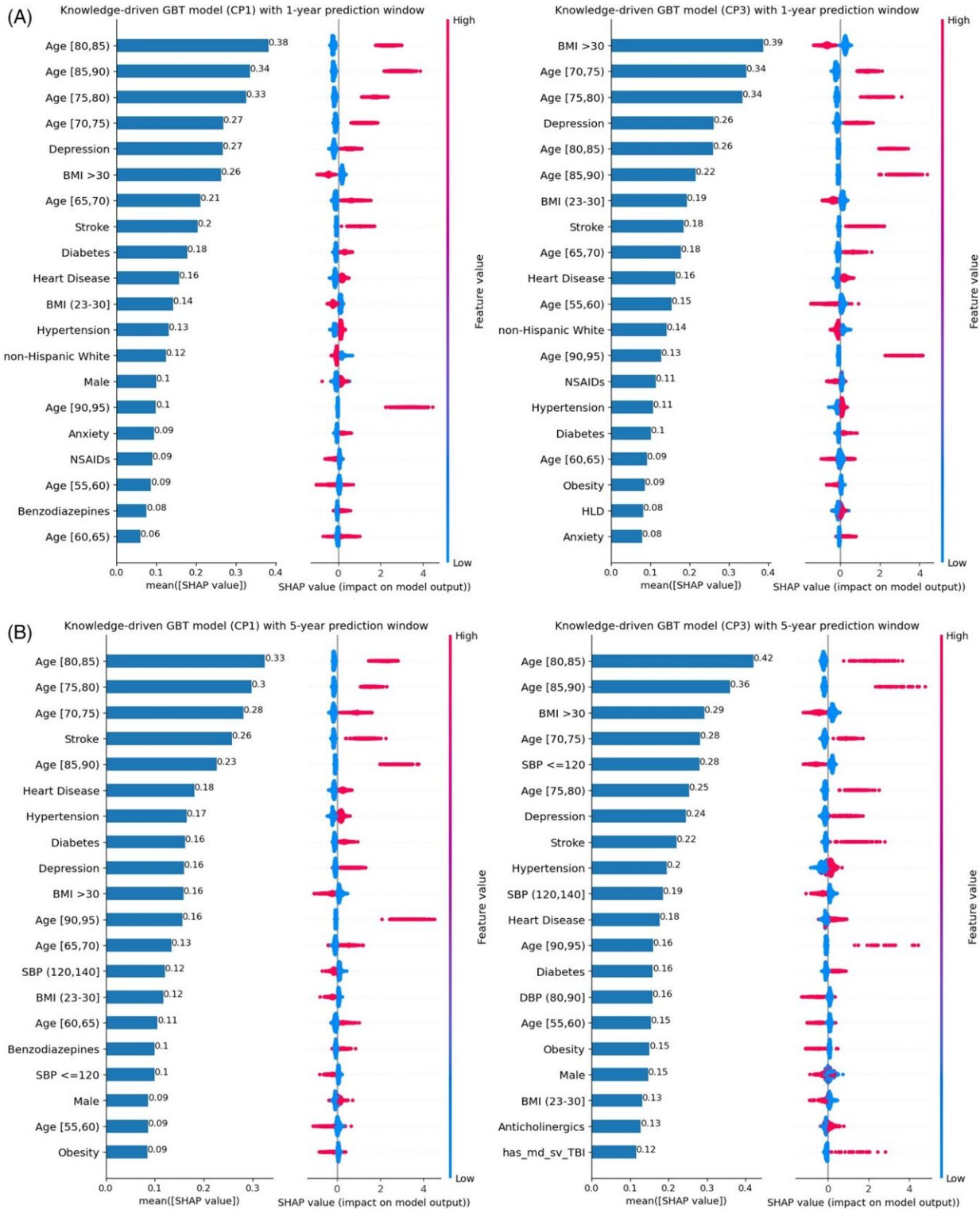


Using artificial intelligence and patient medical records to predict Alzheimer's disease

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Under the knowledge-drive approach, SHAP plot of the top-20 features for GBT models based on CP1 and CP3 algorithms: (A) 1-year prediction window and (B) 5-year prediction windows. Credit: *Alzheimer's & Dementia* (2023). DOI:

Using data in electronic health records, University of Florida researchers have designed an artificial intelligence system that can predict which patients will develop Alzheimer's disease up to five years before receiving a diagnosis.

Currently, there are no early screening tests for Alzheimer's disease, which is diagnosed only after patients develop symptoms. By that time, the disease already has caused significant brain damage.

Real-world [clinical data](#), such as [electronic health records](#), have the potential to be powerful screening tools for conditions like Alzheimer's disease, said Jiang Bian, Ph.D., chief data scientist for University of Florida Health and a professor of biomedical informatics in the College of Medicine. Many known risk factors for Alzheimer's disease, such as obesity, hypertension and high cholesterol, routinely are recorded in patients' electronic health records.

"We are developing and testing models that use artificial intelligence to extract this kind of information from patients' medical records and predict which patients are likely to develop the disease many years before a [diagnosis](#) is made," Bian said. A study team led by Bian and Jie Xu, Ph.D., a new UF AI hire and an assistant professor in the department of health outcomes and biomedical informatics, published their findings this week in *Alzheimer's & Dementia*.

The researchers reported that both of the AI models they tested scored in the "excellent" to "outstanding" range using standard performance measures that determine how well an AI model completes a given task.

"More testing is needed before these AI tools are available to doctors and their patients," Bian said.

But the study shows it is feasible to use patient information in electronic health records to screen for Alzheimer's disease. More than 6.5 million Americans 65 and older are living with Alzheimer's disease and related dementias. This neurodegenerative disease leads to progressive memory loss and declining cognitive function. Over time, the disease robs older adults of the skills they need to live independently.

Research suggests that changes in the brain leading to Alzheimer's disease and other forms of dementia begin much earlier than previously thought—perhaps as early as middle age.

"The earlier physicians and high-risk patients can intervene, the better the odds that those interventions will work," Xu said.

The study team used real-world patient data, scrubbed of patients' identifying information, from some 16.8 million Floridians housed in the OneFlorida+ Data Trust repository to identify nearly 24,000 patients over age 40 who were diagnosed with Alzheimer's or dementia. These patients served as the "case" group. Nearly 1.04 million patients over age 40 who were not diagnosed with dementia served as a control group.

The OneFlorida+ Data Trust is a repository of secure electronic health records for millions of patients in Florida and select cities in the Southeast.

The team tested two [prediction models](#), asking each to scan nearly 10 years of patient data and identify patients they knew later developed Alzheimer's disease. The computers were scored on the accuracy of their predictions at four moments: at the time of the patients' diagnosis and at one, three and five years before diagnosis.

The team's knowledge-driven model based its predictions on current scientific evidence, including known risk factors for Alzheimer's disease, such as health conditions, behaviors, lifestyle habits and medications known to contribute to Alzheimer's, along with prescriptions for drugs approved for the treatment of Alzheimer's disease and related forms of dementia.

The team's data-driven prediction model used the same scientific evidence as the knowledge-based model when making predictions, but had the flexibility to consider other available data in the health records that might contribute to Alzheimer's disease.

"We wanted to see if the data-driven model could identify risk factors and social determinants of health in the data that experts were not even aware of," Bian said.

Both models performed well overall, but the more flexible data-driven model significantly outperformed the knowledge-driven model for predicting Alzheimer's disease both before and at diagnosis.

Using a machine learning metric known as "area under the curve," or AUC, to measure how well their AI models predicted Alzheimer's disease before a diagnosis, the study team reported that both AI algorithms they tested achieved AUC scores from 0.85 to 0.95, which are considered "excellent" to "outstanding."

The data-driven model was the top performer, with "outstanding" scores of 0.939 for predicting Alzheimer's disease at the time of [patients'](#) diagnosis and 0.906 a year before diagnosis. Although its performance declined somewhat as the prediction window increased, the data-driven model still achieved "excellent" scores of 0.884 in predicting Alzheimer's disease at three years before a diagnosis and 0.854 at five years before a diagnosis.

The data-driven model also identified several possible [risk factors](#) that the knowledge-driven model didn't, including muscle weakness, mood disorders, malaise and fatigue. Additionally, the data-driven model found that women who receive preventive health care, including regular medical exams, gynecological exams and mammogram screenings, have a lower risk of developing Alzheimer's disease than women who don't receive such care.

Early recognition of Alzheimer's using screening tests like these is a crucial first step in developing effective treatments and improving patient outcomes.

"Interventions begun during the incubation period of the disease likely are to be much more effective in maintaining or improving cognitive performance, delaying symptoms, or even preventing Alzheimer's disease altogether," Bian said.

More information: Qian Li et al, Early prediction of Alzheimer's disease and related dementias using real-world electronic health records, *Alzheimer's & Dementia* (2023). [DOI: 10.1002/alz.12967](https://doi.org/10.1002/alz.12967)

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