

31 Machine Learning Algorithm to Predict Duration to Full Time Care after Alzheimer's Disease Diagnosis

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Objective: Patients and their families often ask clinicians to estimate when full-time care (FTC) will be needed after Alzheimer's Disease (AD) is diagnosed. Although a few algorithms predictive algorithms for duration to FTC have been created, these have not been widely adopted for clinical use due to questions regarding precision from limited sample sizes and lack of an easy, user friendly prediction model. Our objective was to develop a clinically relevant, data-driven predictive model using machine learning to estimate time to FTC in AD based on information gathered from a) clinical interview alone, and b) clinical interview plus neuropsychological data.

Participants and Methods: The National Alzheimer's Coordinating Center dataset was used to examine 3,809 participants (M age at AD diagnosis = 76.05, SD = 9.76; 47.10% male; 87.20% Caucasian) with AD dementia who were aged ≥ 50 years, had no history of stroke, and not dependent on others for basic activities of daily living at time of diagnosis based on qualitative self or informant report. To develop a predictive model for time until FTC, supervised machine learning algorithms (e.g., gradient descent, gradient boosting) were implemented. In Model 1, 29 variables captured at the time of AD diagnosis and often gathered in a clinical interview, including sociodemographic factors, psychiatric conditions, medical history, and MMSE, were included. In Model 2, additional neuropsychological variables assessing episodic memory, language, attention, executive function, and processing speed were added. To train and test the algorithm(s), data were split into a 70:30 ratio. Prediction optimization was examined via cross validation using 1000 bootstrapped samples. Model evaluation included assessment

of confusion matrices and calculation of accuracy and precision.

Results: The average time to requiring FTC after AD diagnosis was 3.32 years (Range = 0.53-14.57 years). For the clinical interview only model (Model 1), younger age of onset, use of cholinesterase inhibitor medication, incontinence, and apathy were among the clinical variables that significantly predicted duration to FTC, with the largest effects shown for living alone, a positive family history of dementia, and lower MMSE score. In Model 2, the clinical predictors remained significant, and lower Boston Naming Test and Digit-Symbol Coding scores showed the largest effects in predicting duration to FTC among the neuropsychological measures. Final prediction models were further tested using five randomly selected cases. The average estimated time to FTC using the clinical interview model was within an average of 5.2 months of the recorded event and within an average of 5.8 months for the model with neuropsychological data.

Conclusions: Predicting when individuals diagnosed with AD will need FTC is important as the transition often carries significant financial costs related to caregiving. Duration to FTC was predicted by clinical and neuropsychological variables that are easily obtained during standard dementia evaluations. Implementation of the model for prediction of FTC in cases showed encouraging prognostic accuracy. The two models show promise as a first step towards creation of a user friendly prediction calculator that could help clinicians better counsel patients on when FTC after AD diagnosis may occur, though the development of separate models for use in more diverse populations will be essential.

Categories: Dementia (Alzheimer's Disease)

Keyword 1: activities of daily living

Keyword 2: caregiver burden

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32 Altered Resting State EEG Spectral Properties in Older Individuals at High Risk for Alzheimer's Disease

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