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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Objective: Onset of Alzheimer's disease (AD) pathology is estimated to begin 20-30 years prior to clinical symptom onset. Resting state EEG may yield useful early biomarkers of pathology, but its use along the AD clinical continuum is still limited, especially in individuals who are at high risk for AD but have yet to show symptoms. EEG waveform oscillations are classified based by frequency range (alpha, beta, theta, delta). Changes within these frequency bands have been identified in individuals with AD-dementia as compared to those with MCI and normal aging. Typical changes involve increases in low frequency power bands of delta and theta and decreases in beta and alpha frequencies, particularly in more posterior brain regions. However, these methods have yet to be explored in cognitively normal individuals who are at high risk for AD, as work has shown between individuals with MCI and healthy older adults.
Participants and Methods: We compared differences in resting state EEG between older adults (age 60+) at high risk for AD (positive family history, genetic risk defined as carrying 1+ ApoE ε4 alleles) and individuals at low risk (negative family history, no ε4 allele). We collected 1) neuropsychological test performance; 2) self-report measures of subjective cognitive complaints and cognitive reserve; and 3) five minutes of eyes-open resting state EEG using 64-channel active electrodes. Clusters of three electrodes were average for regions and absolute power within 5 frequency bands was calculated. Theta/beta ratio was calculated by dividing absolute power of bands at its respective site. Correlations between absolute power for specific regions, self-report measures, and neuropsychological test scores.
Results: Analysis of 20 individuals collected to date (14 high risk, 6 low risk) found associations (p<0.05) between risk group and beta and gamma power across multiple electrode clusters, with high-risk individuals having higher power. Significant correlations were also found between calculated measures of cognitive reserve and posterior theta/beta ratio, subjective cognitive complaints and beta power, and neuropsychological test composites of learning performance with delta and executive functioning with frontal theta power.
Conclusions: This work provides preliminary evidence for differences in resting state EEG activity in those at risk for AD, prior to onset of clinical symptoms. Future work will examine patients with mild cognitive impairment as a comparison group to characterize resting state EEG across the early AD continuum.

Categories: Dementia (Alzheimer's Disease)
Keyword 1: electroencephalography
Keyword 2: cognitive functioning
Keyword 3: memory disorders
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34 Specific Agitation Behaviors in Dementia Differentially Contribute to Caregiver Burden

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Objective: Agitation is a common neuropsychiatric symptom within the dementia spectrum, experienced by 70 percent of individuals with cognitive decline. Prior literature demonstrates a strong association between care recipient agitation and burden in caregivers of individuals with dementia, as these symptoms are often difficult to manage and predict. Understanding how agitation symptoms in the person with dementia may influence caregiver burden is imperative given these strong associations; however, both agitation and burden are complex, multidimensional constructs. Agitation in dementia involves a range of behaviors including increased motor activity, emotional distress, and aggressive behaviors. Caregiver burden is also multi-faceted and often incorporates dimensions of social/relationship, emotional, and physical health strain. The current study sought to determine whether specific presentations of

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