

Neuropsychological and Clinical Variables Associated with Cognitive Trajectories in Patients with Alzheimer's Disease

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The NeuroArtP3 (NET-2018-12366666) is a multicenter study funded by the Italian Ministry of Health. The aim of the project is to identify the prognostic trajectories of Alzheimer's disease (AD), through the application of artificial intelligence (AI). In literature just few studies investigated the variables associated with cognitive worsening in AD. The Mini Mental State Examination (MMSE) is one of the screening tests used in clinical practice to evaluate global cognitive functioning. This study is aimed at identifying which variables are associated with a MMSE worsening over time. A sample of n=126 patients diagnosed with AD in the initial phase (MMSE > 19) were followed during 4 years [4 time-points: T0 for the baseline and T1, T2 and T3 for the years of follow-up (FU)]. Collected data included demographic variables (e.g., age, gender, education, occupation), measures of functional ability [Activities of Daily Living (ADLs) and Instrumental (IADLs)], severity of dementia [the Clinical Dementia Rating Scale (CDR)], clinical variables (presence or absence of comorbidity with other pathologies), behavioural variable and the equivalent scores (ES) of cognitive tests. Logistic regression, random forest and gradient boosting were applied on the baseline data to estimate the MMSE scores (decline of at least >3 points) measured at T1, T2 and T3. The patients were divided into training and test datasets and the optimisation of the models was carried out through cross validation on the training subset only. The predictive capacity (balanced accuracy, AUROC, AUPCR, F1 score and MCC) was calculated on the test set only. To ensure the robustness of the results the optimization was repeated 10 times. A SHAP-type analysis was carried out to identify the predictive variables. Finally, a total of 30 variables were included in the analyses: 7 socio-demographic variables, ADLs, IADLs, CDR, 7 clinical variables, 3 behavioural variables and 10 neuropsychological variables. The model was significantly predictive of the MMSE outcome associated with T3. The variables at T0 that predict worsening of the global cognitive state at T3 are: the presence of hypertension, low IADLs scores, poor performance on the spatial memory test (Corsi block-tapping test) and on the verbal episodic long-term memory test (Babcock's story recall). While the variables associated with a lower cognitive worsening are: high level of education (>8 years), high performance on the Corsi block-tapping test and both poor and good performance on the Babcock's story recall test. This study identified which variables could predict the trajectories of MMSE in early AD. Among the socio-demographic, functional and clinical variables, low functional independence and the presence of hypertension are predictive of cognitive worsening, whereas high education is associated with a better global cognitive level over time. In relation to the neuropsychological assessment, the scores indicate that different performance on spatial and verbal long-term memory tests can influence the trajectory of the cognitive status in a distinctive way. These data could help in the prognostic interpretation of the clinical and cognitive variables associated with the initial phase of the disease and can be useful to build personalised therapies.

References

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