

2nd International Conference on **Alzheimer's Disease and Dementia** September 23-25, 2014 Valencia Convention Centre, Spain

Speed and accident rates in MCI and mild AD patients: Preliminary results from a large driving simulation experiment with the use of distraction

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Objectives: Driver performance in different road conditions with and without the use of distraction offers valuable information concerning driving safety, yet it is difficult to investigate during on-road driving. Herein, initial findings on speed of driving of MCI and mild AD patients and middle aged/older healthy controls are presented in two rural driving simulation environments: High traffic with and without distraction (conversation). Moreover, total number of crashes in unexpected incidents, were computed separately for all rural and urban driving conditions of the experiment. The study aims to examine the contributions of traffic load and distraction to measures of driving behavior in the above groups. It is part of a larger driving simulator experiment funded by the National Strategic Reference Framework (NSRF 2007-13, O.P. "Thales"), which integrates subject variables with driving conditions.

Methods: Participants: In these analyses, 52 drivers were included: 22 controls (mean age: 56.4±8.9), 22 mild cognitive impairment (MCI) patients (mean age: 66.41±10.00), and 8 mild AD patients (mean age: 73.13±8.81), Number of participants entering each type of analysis varied. Measures: Average speed (in km) in each condition and during each unexpected incident specifically. Two unexpected incidents occurred per condition. Total number of crashes for all Rural and Urban environments (4 conditions per environment: High and Low Traffic, with and without distraction).

Results: Univariate analyses of variance were performed for each of the measures, with group as fixed variable and age as covariate, comparing each patient group to the control group. Both age and participant type were significant ($p \leq 0.01$) in the rural high traffic without distraction condition. AD patients drove more slowly than controls in the high traffic without distraction environment ($p \leq 0.05$). Only age was significant ($p \leq 0.05$) in the rural high traffic with distraction condition. Univariate analyses of variance of the unexpected incident situations showed that AD patients were marginally slower than the control group in one of the two incidents with distraction. Nonparametric (Kruskal-Wallis) tests showed that the distribution of total number of crashes did not differ in the rural condition but was significantly different in the Urban Condition only, with controls showing fewer crashes ($p \leq 0.05$). The low number of participants who have completed the more challenging urban condition thus far precluded comparisons of speed across the four groups.

Conclusion: AD patients drove slower than controls in rural high traffic without distraction and were marginally slower during the unexpected event with distraction. Age was also an important determinant of speed. The lower speed of AD patients appears to relate to cognitive decline. The Urban environment is more demanding for the patients' ability to handle unexpected incidents. Findings will be corroborated with the addition of more patients. Preliminary associations of performance with neuropsychological variables will be presented.

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