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Deviant driving measures of healthy controls, MCI and AD patients in simulated driving

A. Economou[1], I. Beratis[2], D. Pavlou[3], N. Andronas[2], J. Papatriantafyllou[4], S. G. Papageorgiou[2], G. Yannis[3]

[1] Department of Psychology, National and Kapodistrian University of Athens, Athens, Greece, [2]"Attikon" University General Hospital, Department of Neurology, University of Athens, Athens, Greece, [3]Department of Transportation Planning and Engineering, National Technical University of Athens, Athens, Greece, [4]IASIS Community Medical Center for the Elderly, Glyfada, Greece

BACKGROUND & AIMS

Both driver characteristics and driving scenarios are shown to affect driving performance in simulated driving. Driver characteristics are participant type, and driving scenarios are traffic load and use of distraction. Despite some findings on the above variables, little is known about the performance of *individual* drivers, that is, the proportion of drivers who deviate significantly from the mean in different driving measures.

The study examines the proportion of healthy controls, MCI and AD patients who deviate significantly from the mean in simulated driving.

METHODS

Participants

- 21 healthy controls over 52 years of age (age of youngest patient)
- 37 Mild Cognitive Impairment (MCI) patients
- 16 mild Alzheimer's disease (AD) patients

All participants were regular drivers

Driving simulator experiment

- Data from **Distract and DriverBrain** research projects
- All participants underwent a neurological, neuropsychological and ophthalmological assessment
- **Driving simulator assessment**: all drivers drove a quarter-cab FOERST driving simulator (3 LCD wide screens 42'', full HD: 1920x1080pixels - total field of view 170 degrees, validated against a real world environment) in **4 rural conditions**, counterbalanced across participants:

moderate traffic
with & without distraction

high traffic
with & without distraction

- A practice drive (10-15 minutes) preceded the driving assessment
- The rural drive took place in a single carriageway route, zero gradient, with mild horizontal curves

Distraction condition: conversation with passenger

Measures

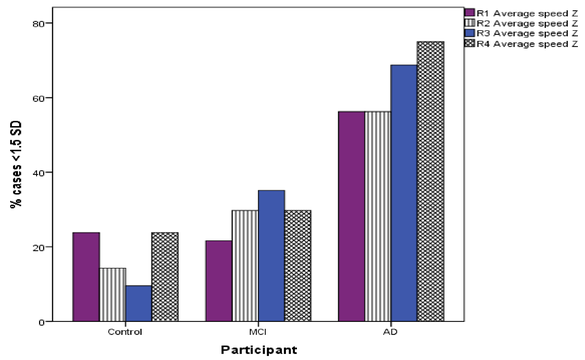
- **Average speed** (in km)
- **Headway average** (distance from the vehicle ahead in m)
- **Lateral position variability** (SD of the distance of the vehicle from the right road border in m)

- The measures were z-transformed based on the performance of all 86 control participants in each of the driving conditions (mean age 46±16.04) and the number of participants deviating by > 1.5 SD from the mean were computed.

RESULTS

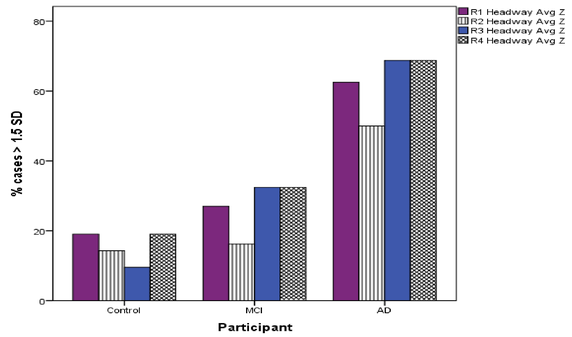
R1: moderate speed; R2: high speed; R3: moderate speed with distr.; R4: high speed with distr.

Figure 1. Average speed by participant by condition



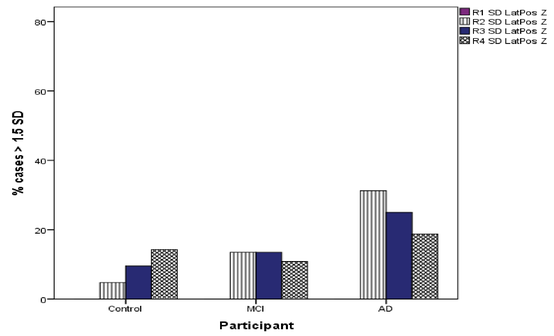
R1: $\chi^2(2, N=74) = 6.90$, $p = .03$
R2: $\chi^2(2, N=74) = 7.53$, $p = .02$
R3: $\chi^2(2, N=74) = 13.98$, $p = .001$
R4: $\chi^2(2, N=74) = 12.19$, $p = .002$

Figure 2. Headway average by participant by condition



R1: $\chi^2(2, N=74) = 8.81$, $p = .01$
R2: $\chi^2(2, N=74) = 8.46$, $p = .02$
R3: $\chi^2(2, N=74) = 14.30$, $p = .001$
R4: $\chi^2(2, N=74) = 10.21$, $p = .006$

Figure 3. Lateral position variability by participant by condition



All χ^2 *ns*

CONCLUSION

- Deviant scores are frequent in the patient groups, observed in more than 50% of the AD patients in average speed and headway distance.
- Distraction increased the percentage of deviant scores.
- The clinical significance of deviant scores is being explored in further analyses, in relation with braking during unexpected incidents.