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Elderly drivers with brain disorders: Is their driving behavior the same before and after an unexpected incident? #636

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Introduction

- Driving in traffic is not just knowing how to handle the basic operating mechanisms of the vehicle.
- It is a task of **high cognitive complexity** which requires the driver to receive sensory information, process this information quickly, and make proper, timely judgments and responses.
- Cognitive functions which **decline over age** are of critical importance regarding driving performance.
- **Diseases affecting a person's brain functioning**, may significantly impair the person's driving performance.

Objective

- This study's objective is the comparison of driving behaviour of elderly drivers before and after an unexpected incident, through a large driving simulator experiment.

Overview of the experiment

- Medical/neurological assessment: a full clinical medical, ophthalmological and neurological evaluation
- Neuropsychological assessment: a series of neuropsychological tests and psychological - behavioural questionnaires to the participants
- Driving at the simulator: assessing the driving behaviour of participants by means of programming of a set of driving tasks into a driving simulator for different driving scenarios.
- The impact of several risk factors namely, the presence of a neurological disease affecting cognition, and the mobile phone use while driving is investigated.
- The driving behaviour was examined in terms of lateral position and mean driving speed of the vehicle and the neurological diseases affecting cognitive functions concern diseases with high prevalence in the general population: Alzheimer's disease (AD), Parkinson's disease (PD), and Mild Cognitive Impairment (MCI).

Driving at the simulator assessment

- FOERST Quarter-cab driving simulator total field of view 170 degrees, validated against a real-world environment
- At first, one practice drive (usually 10-15 minutes)
- Afterwards, the participant drives at a rural route (approx. 10 minutes), single carriageway, zero gradient, mild horizontal curves
- One route with mobile phone use and one without distraction.
- During each trial, 2 unexpected incidents are scheduled to occur:
- sudden appearance of an animal (deer or donkey) on the roadway

Sample size

- 125 participants (76% males) (>55 y.o. and of similar demographics)
- 34 Healthy Controls, 28 AD, 43 MCI, 20 PD patients

Methodology

- Simulator Data 40 seconds before the start of the event and 40 seconds after the event is fully completed, were isolated
- 2 General Linear Mixed Models in order to mathematically quantify the impact of the examined cerebral diseases and of other risk factors to the mean speed and the lateral position of the vehicle before and after an incident.

Table 1. GLM parameter estimates for mean speed before and after an unexpected incident

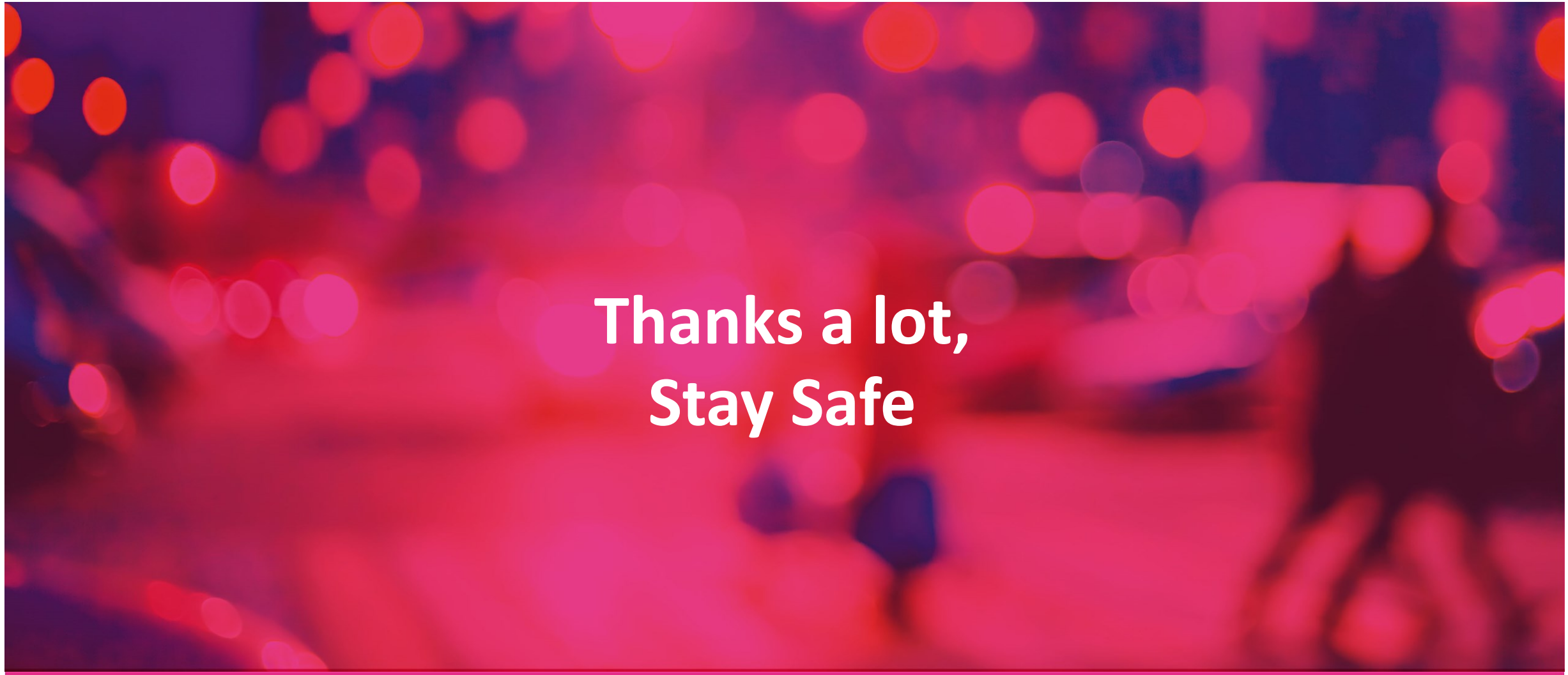
Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	**-28.39**	0.50	-56.98	< 2e-16 ***
Mobile Phone	**-1.72**	0.47	-3.66	0.000265 ***
Parkinson's Disease	**-4.56**	0.67	-6.77	1.76e-11 ***
Alzheimer's Disease	**-3.48**	0.66	-5.23	1.85e-07 ***
Mild Cognitive Impairment	**-1.98**	0.54	-3.70	0.000219 ***
Gender	**-1.03**	0.41	-2.52	0.011914 *
Experience	**0.10**	0.01	7.45	1.41e-13 ***
Significance codes:	0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			

Table 2. GLM parameter estimates for lateral position before and after an unexpected incident

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	-0.11	0.7	-2.08	0.048123*
Mobile Phone	-0.07	0.02	-3.43	0.000619***
Parkinson's Disease	-0.05	0.26	-2.17	0.041772*
Gender	-0.06	0.17	-3.68	0.000241***
Experience	0.002	0.001	3.30	0.000984***
Significance codes:	0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			

Discussion

- The existence of an unexpected incident seem to **alternate the driving behaviour** of the elderly drivers: Their mean **driving speed is reduced** and they also tend to drive more closely to the right border of the road.
- What should be highlighted though is the impact of MCI, AD, PD, and **mobile phone use** to the model. All these risk factors significantly reduce driving speed after an unexpected event, even more (**PD had the greatest influence on the model**)
- Regarding the lateral position, the use of mobile phone and the existence of PD **lead to drive even more closely to the right border of the road** after the incident.
- Patients with cerebral diseases and **especially PD follow a more conservative pattern of driving behavior**, compared to the control group, in order to compensate the driving difficulties such as an unexpected incident or/and mobile phone use.



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