Drivers with AD and MCI: The predictive value of neurological and neuropsychological measures

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Senior drivers: general information

- 13% of drivers > 65 years old (2009)
- 23% increase between 1999 and 2009
- Elderly individuals keep their driving license longer and drive larger distances
- During 2013, 6,500 older drivers lost their lives in car accidents (Eurostat, 2014)
- Life loss in elderly represent the 26% of all road fatalities in the EU (Eurostat, 2014)

The percentage of older drivers that are at risk due to cognitive or physical impairments remains unknown
Cognitive functions critical for safe driving

1. Attention
2. quick perception of the environment
3. Executive functions
4. process multiple simultaneous environmental cues
5. make rapid, accurate and safe decisions
6. Visuo-spatial skills
7. position the car accurately on the road
8. manoeuvre the vehicle correctly
9. judging distances and predicting the development of traffic situations
10. Memory
11. journey planning
12. adapting behaviour

(Reger et al., 2004)
Cognitive Disorders and Driving
Alzheimer disease and accident risk

AD patients are 2.5 to 4.7 times more likely to be involved in a car crash than age-matched controls 
(Brown and Ott 2004; Dobbs et al. 2002; Ernst et al. 2010; Withaar et al. 2000, Brorsson, 1989; Massie & Campbell, 1993; Tuokko et al., 1995)

But ~ 50% of patients with AD continue driving for at least three years after their initial diagnosis (Adler and Kuskowski 2003; Seiler et al. 2012, Johansson and Lundberg, 1997; Dubinsky et al., 1992; Rizzo et al., 2001; Charlton et al., 2004; Uc et al., 2005; Uc et al., 2006; Ott 2008; Ernst et al. 2010)

However, certain drivers with AD maintain adequate driving fitness at the initial stages of the disease (Carr et al., 2000; Perkinson et al., 2005)
Driving Predictors - Alzheimer Disease

Performance on neuropsychological measures assessing
• visuospatial skills,
• attention,
• executive functioning
• And probably memory
Appear to be related with the driving fitness of patients with AD (Brown et al., 2005; Grace et al., 2005; Ott et al., 2008; Uc et al., 2005)

*Neuropsychological and neurological measures in combination with driving evaluations (on-road or simulator environment) could be used for providing effective recommendations in drivers with AD* (Frittelli et al., 2009; Ott et al., 2008; Ott et al., 2003; Rizzo et al., 1997)
Practice Parameter update: Evaluation and management of driving risk in dementia
Report of the Quality Standards Subcommittee of the American Academy of Neurology

Evaluate for risk factors

<table>
<thead>
<tr>
<th>CDR 0.5-1.0</th>
<th>CDR 2.0</th>
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</thead>
</table>

Risk factors:

<table>
<thead>
<tr>
<th>Level B evidence</th>
<th>Caregiver report of marginal or unsafe skills</th>
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<tbody>
<tr>
<td></td>
<td>History of citations</td>
</tr>
<tr>
<td></td>
<td>History of crashes</td>
</tr>
<tr>
<td></td>
<td>Driving &lt; 60 miles / week</td>
</tr>
<tr>
<td></td>
<td>Situational avoidance</td>
</tr>
<tr>
<td></td>
<td>Aggression, impulsivity</td>
</tr>
<tr>
<td>MMSE ≤24</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level C evidence</th>
<th>Alcohol, medications, sleep disorders, visual impairment, motor impairment</th>
</tr>
</thead>
</table>

| Other             |                                                                                   |

Risk factors:

- None
  - CDR 0.5
  - CDR 1.0
- Few
  - CDR 0.5
  - CDR 1.0
- Several
  - CDR 0.5
  - CDR 1.0
- Multiple
  - CDR 0.5

Relatively low risk

Risk Management

- Encourage family support for alternate transportation.
- Strongly consider voluntary surrender of driving privileges.
- Consider DMV referral or professional driving evaluation, based on state guidelines.

Intervention pursuant to state guidelines

Relatively high risk
MCI and driving: a controversial issue

- Wadley et al., 2009 *on-road*
- Devlin et al., 2012 *simulator*
- Jeong et al., 2012 *questionnaire*

- Snellgrove et al., 2005 *on-road* (50% of MCI failed the on-road test)
- Kawano et al., 2012 *simulator*
- O’Connor et al., 2010 *questionnaire*
Predictors of driving behavior in MCI

- Measures associated with driving performance in patients with MCI
- Cognitive domains:
  - mental flexibility (TMT-B)
  - Inhibitory control (modified Stroop test)
  - visual attention (TMT-A)
- When controlling for memory impairment, TMT-B seemed to be the best predictor

(Kawano et al., 2012)
Interdisciplinary Research Project 2012-2015

- Driving simulator experiment focusing on drivers with cognitive disorders [MCI (N=59), AD (N=25), PD (N=25)]

- Majority of drivers >55 years old (N=154)

- Cognitively healthy drivers of similar age and driving experience were also included

- Interdisciplinary research team (neurologists, psychiatrists, neuropsychologists, transportation research scientists)
Procedure

• Part 1. Medical, Clinical & Neurological evaluation
  Attikon General Hospital, (~1,5 hours)

• Part 2. Neuropsychological Assessment
  Attikon General Hospital, (~2 hours)

• Questionnaire on driving habits
  At home (~20 minutes)

• Part 3. Driving simulation experiment
  NTUA Driving Simulator (~1,5 hour)

• Part 1B. Medical evaluation, Part 2B. Neuropsychological Assessment
  Attikon General Hospital, (~1 hours)
Medical/Neurological Assessment

Comprehensive Clinical Evaluation (general medical and neurological)

- Present & past history, pharmacological treatment, life habits (alcohol consumption, smoking, etc)
- Detailed neurological examination (neurological signs: markers for a disease)
- Psychiatric assessment for depression, anxiety, behavioral disturbances
- Ophthalmological evaluation: visual acuity, visual fields, fundoscopy
- **Motor ability-tests in Fitness to Drive**: Specific clinical tests examining motor control, balance, visual fields etc. related to driving skills
Neuropsychological Assessment

General Cognitive Functioning: MMSE, MOCA

Working memory/attention: Letter-Number Sequencing, Spatial Span, Spatial Addition (WMS), Neuropsychological Assessment Battery - Driving Scenes Test.

Episodic Memory: Hopkins Verbal Learning Test, Brief Visuospatial Memory Test.

Visual Perception: Benton’s Judgment of Line Orientation, Witkin’s Embedded Figure Test.

Executive function/processing speed: Frontal Assessment Battery, Trail Making Test, Comprehensive Trail Making Test, Symbol Digit Modalities Test.

Computerized tests: Useful Field of View, Psychomotor Vigilance Test.
Outcome Measures

- **Indexes of Driving Performance**
  a) Average Speed
  b) Speed Variation
  c) Lateral Position
  d) Variation of Lateral Position
  e) Headway Distance
  f) Variation of Headway Distance
  g) Hits of side bars
  h) Speed limit violations
  i) Accident Risk
  j) Reaction time
Driving Simulator Environment:
Urban and Rural Area

Driving Simulator Assessment:
• Rural and urban area
• two traffic scenarios (low and high traffic volumes)
• three distraction conditions (undistracted driving, driving while conversing with a passenger and driving while conversing on a mobile phone)
MCI & driving: current findings
Predictors of driving performance in individuals with MCI: preliminary results

Sokratis Papageorgiou¹, Ion Beratis¹, Nikolaos Andronas¹, Alexandra Economou², Dimosthenis Pavlou³, Anastasios Bonakis¹, George Tsivgoulis¹, Leonidas Stefanis¹, George Yannis³

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²Department of Psychology, University of Athens,  
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Results (Average Speed)

Outcome: Driving Speed

Predictors:
(1st level) general cognitive functioning (MMSE)
(2nd level) balance and movement coordination (Tandem Walking, $\beta=-.63$, $p=.007$)

The model explained 55.9% of the variance in average driving speed

$$R^2=.559, F(2,13)=8.25, p=.005.$$ 

• In the cognitively intact group the same regression model did not contribute to the prediction of average driving speed

$$R^2=.166, F(2,11)=1.10, p=.368$$

Normal Group ($Mean=43.62$, $SD=7.33$) vs MCI Group ($Mean=42.24$, $SD=7.46$)

$$t(28)=-.51, p=.614$$
Results (Number of Crashes)

Outcome: Number of Crashes

Predictors:
(1st level) general cognitive functioning (MMSE)
(2nd level) visuospatial memory (BVMT_Recognition, $\beta = -.40, p = .056$) and speed of attention (UFV_1, $\beta = .48, p = .027$)

The model explained 77.3% of the variance in number of crashes

$R^2 = .773, F(3, 10) = 11.35, p = .001$

- In the cognitively intact group the same regression model did not contribute to the prediction of number of crashes

$R^2 = .279, F(3, 10) = 1.29, p = .330$

Normal Group ($Mean = .43, SD = .65$) vs MCI Group ($Mean = .56, SD = .81$)
- $t(28) = .49, p = .25$
Results (Reaction Time)

Outcome: Reaction Time

Predictors:
(1\textsuperscript{st} level) general cognitive functioning (MMSE)
(2\textsuperscript{nd} level) information processing speed (SDMT, \(\beta=-.60\), \(p=.014\)) and balance and movement coordination (Tandem Walking\_RNC, \(\beta=.54\), \(p=.007\))

The model explained 73.2\% of the variance in reaction time

\[ R^2 = .732, F(3,12)=10.92, p=.001 \]

- In the cognitively intact group the same regression model did not contribute to the prediction of reaction time

\[ R^2=.119, F(3,10)=.45, p=.772 \]

Normal Group (\(Mean=1.78, SD=.28\)) vs MCI Group (\(Mean=1.89, SD=.46\))

\[ t(28)=.80, p=.43 \]
The role of sleeping abnormalities on the driving performance of individuals with Mild Cognitive Impairment


- 27 cognitively intact individuals (Age: 63.4±7.2 years)
- 33 individuals with MCI (Age: 66.4±7.4 years)

Figure 1. Correlation coefficients between driving indexes and sleeping abnormalities in the control and MCI group

- The current findings indicate a stronger association between sleeping abnormalities and driving behavior in the MCI group as compared to the group of cognitively intact individuals
- In the MCI group, sleepiness was positively associated with lateral position variation and average speed, and negatively associated with average headway distance
- In the MCI group, insomnia symptoms were positively associated with lateral position variation, and negatively with the average wheel position
Driving in Mild Cognitive Impairment: The role of depressive symptoms.

Beratis IN1, Andronas N1, Kontaxopoulou D1, Fraqkiadaki S1, Pavlou D2, Papatriantafyllou J1, Economou A3, Yannis G2, Papageorgiou SG1.

Abstract

OBJECTIVES: Previous studies indicate a negative association between depression and driving fitness in the general population. Our goal was to cover a gap in the literature and to explore the link between depressive symptoms and driving behavior in individuals with Mild Cognitive Impairment (MCI) through the use of a driving simulator experiment.

METHODS: Twenty-four individuals with MCI (Age: Mean = 67.42, SD = 7.13) and 23 cognitively healthy individuals (Age: Mean = 65.13, SD = 7.21) were introduced in the study. A valid driving license and regular car use served as main inclusion criteria. Data collection included a neurological/neuropsychological assessment and a driving simulator evaluation. Depressive symptomatology was assessed with the Patient Health Questionnaire (PHQ-9).

RESULTS: Significant interaction effects indicating a greater negative impact of depressive symptoms in drivers with MCI than in cognitively healthy drivers were observed in the case of various driving indexes, namely average speed, accident risk, side bar hits, headway distance, headway distance variation, and lateral position variation. The associations between depressive symptoms and driving behavior remained significant after controlling for daytime sleepiness and cognition.

CONCLUSIONS: Depressive symptoms could be a factor explaining why certain patients with MCI present altered driving skills. Therefore, interventions for treating the depressive symptoms of individuals with MCI could prove to be beneficial regarding their driving performance.
The mixed ANOVA revealed a greater effect of distraction on MCI patients.

Specifically, the use of mobile phone induced a more pronounced impact on reaction time and accident probability in the group of patients, as compared to healthy controls.

Also, a greater negative effect of "conversing with passenger" was observed in the group of drivers with MCI, but of a lesser extent than in the case of the mobile-phone condition.

Notably, the aforementioned findings were observed despite the effort of the drivers with MCI to apply a compensatory strategy by reducing significantly their speed.
AD & driving: current findings
Mini Mental State Examination and Montreal Cognitive Assessment: which is the best predictor of driving ability?

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12nd University Department of Psychiatry, Aristotelian University, General Hospital of Thessaloniki, Department of Psychiatric Nursing and Mental Health Services, Thessaloniki, Greece. 
2nd Department of Psychiatry, Aristotelian University, General Hospital of Thessaloniki, Department of Psychiatric Nursing and Mental Health Services, Thessaloniki, Greece.

INTRODUCTION

The Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) are two commonly used screening tests for evaluating general cognitive ability. Previous research suggests that MMSE and MoCA could be used as predictors of driving ability.

In regards to MMSE, previous studies which have investigated performance on the MMSE in relation to driving abilities have reported mixed results. Although the diagnostic utility of the MMSE as a predictor of driving ability is shown in a number of studies (Adler et al., 2006; Leis et al., 2002; Racine et al., 2003), some studies have failed to establish a consistent relationship between the two (Leis et al., 2002).

MoCA was examined by two other studies (Deves et al., 2002) in order to predict driving performance. The findings of these studies suggested that MoCA was a useful screening tool for identifying individuals with cognitive impairment who are at risk of driving a car.

AIM

The present study compared the capacity MMSE and MoCA to predict specific driving indexes in patients with aMCI, mild AD and healthy individuals.

METHODS

Participants:

- 44 patients with aMCI
- 22 patients with mild AD
- 44 healthy individuals

The diagnosis of aMCI was made by the investigator (S. Frangoulidou et al., 2002) while the diagnosis of mild AD was made by the Michaelides et al. (2001) criteria.

Inclusion & Exclusion Criteria:

- Have a valid driving license
- Regular drivers
- CDRI: MCI = 3.5, AD = 4
- No history of significant psychiatric disorder
- No history of significant medical disorder

Procedure:

(a) All the participants underwent a complete neuropsychological, neuropsychological and psychological assessment. General cognitive ability was measured by the administration of MMSE & MoCA.
(b) The participants went through a driving simulation experiment:

Phase 1: Four driving sessions (about 20-30 min.) on a computer

Phase 2: Two driving sessions (about 20 min.) on a computer

- In each phase, two sessions were conducted, with different types of stimuli presented.
- The simulation environment was a realistic driving simulator, with different conditions.

Driving Indexes:

- Average speed
- Lateral position
- Headway distance
- Reaction time
- Accident probability
- Speed limit violations

RESULTS

Table 1: Correlations between MMSE, MoCA and Driving Indexes in aMCI patients

<table>
<thead>
<tr>
<th>Driving Indexes</th>
<th>Rural Area</th>
<th>Urban Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average speed</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Lateral position</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Headway distance</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Reaction time</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Accident probability</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Speed limit violations</td>
<td>p-value</td>
<td>p-value</td>
</tr>
</tbody>
</table>

Table 2: Correlations between MMSE, MoCA and Driving Indexes in mild AD patients

<table>
<thead>
<tr>
<th>Driving Indexes</th>
<th>Rural Area</th>
<th>Urban Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average speed</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Lateral position</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Headway distance</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Reaction time</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Accident probability</td>
<td>p-value</td>
<td>p-value</td>
</tr>
<tr>
<td>Speed limit violations</td>
<td>p-value</td>
<td>p-value</td>
</tr>
</tbody>
</table>

CONCLUSION

- Our findings indicate that both MMSE and MoCA are associated with various driving indexes and with usefulness of scoring measures to assess driving ability.

- Both the cognitive and physical tests were correlated with the ability to drive in a safe manner and accident probability in the group of drivers with MCI and AD.

- In the mild AD group, both the MMSE and MoCA achieved similar levels of predicted capacity in terms of driving efficacy. Thus, the aforementioned scoring tools could be differently used in order to obtain an index of the driving efficiency with mild AD.

- However, in the case of aMCI, MoCA was correlated with more driving variables than the MMSE.

Thus, MoCA seems to be more useful in cases of dementia for calendar driving decisions about aMCI and mild AD. This finding could be linked with the fact that MoCA has been positioned to be a more sensitive measure of dementia patients with AD (Ding et al., 2012).

REFERENCES/ACKNOWLEDGEMENTS


## Control vs. AD Group on Driving Indexes

### Rural Area - Condition Without Distraction

<table>
<thead>
<tr>
<th></th>
<th>AD group</th>
<th>Control group</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Average Speed</td>
<td>32.8</td>
<td>7.8</td>
<td>40.3</td>
</tr>
<tr>
<td>Average Speed Variation</td>
<td>9.7</td>
<td>3.8</td>
<td>10.7</td>
</tr>
<tr>
<td>Lateral Position</td>
<td>1.5</td>
<td>.17</td>
<td>1.5</td>
</tr>
<tr>
<td>Lateral Position Variation</td>
<td>.29</td>
<td>.05</td>
<td>.27</td>
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<tr>
<td>Headway Average</td>
<td>610.8</td>
<td>181.2</td>
<td>503.5</td>
</tr>
<tr>
<td>Headway Average Variation</td>
<td>273.8</td>
<td>100.8</td>
<td>222.1</td>
</tr>
<tr>
<td>Wheel Average</td>
<td>-1.3</td>
<td>1.5</td>
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<tr>
<td>Wheel Average Variation</td>
<td>16.9</td>
<td>2.5</td>
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<tr>
<td>Reaction Time</td>
<td>2457.6</td>
<td>967.8</td>
<td>1511.9</td>
</tr>
<tr>
<td>Number of Crashes</td>
<td>.53</td>
<td>.77</td>
<td>.09</td>
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<tr>
<td>Speed Limit Violation</td>
<td>.05</td>
<td>.23</td>
<td>.09</td>
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</table>
## Control vs. AD Group on Driving Indexes

### Urban Area - Condition Without Distraction

<table>
<thead>
<tr>
<th></th>
<th>AD group</th>
<th></th>
<th>Control group</th>
<th></th>
<th>t-test</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>T</td>
<td>p</td>
</tr>
<tr>
<td>Average Speed</td>
<td>24.7</td>
<td>6.7</td>
<td>27.9</td>
<td>5.3</td>
<td>1.45</td>
<td>.158</td>
</tr>
<tr>
<td>Average Speed Variation</td>
<td>9.2</td>
<td>2.4</td>
<td>11.5</td>
<td>2.9</td>
<td>2.31</td>
<td>.028*</td>
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<tr>
<td>Lateral Position</td>
<td>3.2</td>
<td>.63</td>
<td>2.9</td>
<td>.74</td>
<td>-1.32</td>
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<tr>
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<td>.54</td>
<td>1.5</td>
<td>.65</td>
<td>-1.07</td>
<td>.292</td>
</tr>
<tr>
<td>Headway Average</td>
<td>125.3</td>
<td>26.1</td>
<td>129.2</td>
<td>36.1</td>
<td>.35</td>
<td>.732</td>
</tr>
<tr>
<td>Headway Average Variation</td>
<td>56.9</td>
<td>8.4</td>
<td>54.2</td>
<td>11.6</td>
<td>-.770</td>
<td>.448</td>
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<tr>
<td>Wheel Average</td>
<td>7.6</td>
<td>1.4</td>
<td>6.3</td>
<td>1.6</td>
<td>-2.28</td>
<td>.030*</td>
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<tr>
<td>Wheel Average Variation</td>
<td>24.6</td>
<td>11.1</td>
<td>27.3</td>
<td>11.4</td>
<td>.67</td>
<td>.508</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>1683.6</td>
<td>460.5</td>
<td>1196.8</td>
<td>427.9</td>
<td>-2.85</td>
<td>.008**</td>
</tr>
<tr>
<td>Number of Crashes</td>
<td>.62</td>
<td>.81</td>
<td>.00</td>
<td>.00</td>
<td>-2.67</td>
<td>.013*</td>
</tr>
</tbody>
</table>
Percentage of AD drivers that exhibited similar driving performance to the Control group

**Average Speed**

- 47% of AD patients were on the range (±1SD) of normal performance

<table>
<thead>
<tr>
<th></th>
<th>AD (normal performance) N=8</th>
<th>AD (impaired performance) N=10</th>
<th>t-test</th>
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</thead>
<tbody>
<tr>
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<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>MMSE</td>
<td>24.6</td>
<td>3.2</td>
<td>21.6</td>
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<tr>
<td>CTMT1</td>
<td>103.8</td>
<td>29.6</td>
<td>176.9</td>
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<tr>
<td>CTMT2</td>
<td>106.5</td>
<td>43.2</td>
<td>214.3</td>
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<td>CTMT3</td>
<td>122.1</td>
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<td>CTMT4</td>
<td>134.7</td>
<td>61.7</td>
<td>246.4</td>
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<td>CTMT5</td>
<td>246.6</td>
<td>52.1</td>
<td>315.7</td>
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<tr>
<td>Incidental memory</td>
<td>4.7</td>
<td>1.1</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Conclusions
Does the diagnosis of Alzheimer's Disease imply immediate revocation of a driving license?

Sokratis G. Papageorgiou¹, Ion N. Beratis¹, Dionysia Kontaxopoulou¹, Stella Fragkiadaki¹, Dimosthenis Pavlou², and George Yannis²

Abstract

Driving competence is strongly related to the autonomy and the feelings of self-worth of advanced agers. At present, older drivers appear to retain their driving license for longer periods of time as well as to drive more commonly and to cover longer distances as compared to the past. Nonetheless, according to epidemiological data, older individuals appear to be a vulnerable driving group that manifests increased rates of road fatalities. Along this vein, several lines of previous research have focused on exploring the driving behavior of individuals with two common cognitive disorders, namely Alzheimer-dementia (AD) and Mild Cognitive Impairment (MCI). Based on previous findings, patients with AD commonly present increased driving difficulties at a level that clearly supports the discontinuation of driving. Nonetheless, some patients with AD, especially in the mild stages, retain adequate driving skills that are similar to those of cognitively intact individuals of similar age. As concern the group of drivers with MCI, it seems that there is an accentuated risk to develop driving difficulties, but their performance is not consistently worse than that of healthy control drivers. Nonetheless, additional studies are warranted for detecting useful predictors of driving behavior in the specific clinical group. Under this perspective and by integrating the previous findings, we suggest the need for implementing a personalized approach when taking decisions about the driving competence of drivers with AD and MCI that is based on the effective synthesis of multimodal driving-related indexes by the specialties of neurology, neuropsychology and transportation engineering.

Keywords: Driving, Dementia, Alzheimer disease, Mild Cognitive Impairment, Driving behavior.
To drive or not to drive?

1. **Driving History** (accidents, complaints from the patient or the informant)
2. **Combined use of neurological, neuropsychological and driving measures** that have predictive value of driving competence according to the clinical diagnosis (MCI, AD)
3. **Synthesis and possessing** of relevant information by specialized neurologists and neuropsychologists

Also, **definition of specific restrictions** (speed, traffic conditions, driving at night) **based on specific characteristics of each driver** (disease, stage of the disease, age, performance on neuropsychological tests)

**Figure 1.** Proposed evaluation of drivers with AD or MCI.

AD = Alzheimer’s disease; MCI = Mild Cognitive Impairment
References


References II


Thank you for your attention!