

University of Groningen

## Fitness to drive of older drivers with cognitive impairments

Piersma, Dafne

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2018

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Piersma, D. (2018). *Fitness to drive of older drivers with cognitive impairments*. [Thesis fully internal (DIV), University of Groningen]. Rijksuniversiteit Groningen.

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

## Summary

The topic of this thesis is fitness to drive of older drivers with cognitive impairments. *Chapter 1* illustrates that cognitive disorders are a risk factor for unsafe driving behaviour, but also that some patients with cognitive impairments still drive safely. It is therefore important to investigate on a patient-by-patient basis whether someone can continue to drive. In the Netherlands, this usually happens on the basis of an on-road driving assessment performed by the Dutch driving licence authority. Previous studies using on-road driving assessments found large individual differences in driving performance. These individual differences are difficult to explain on the basis of clinical features and judgments of patients, family members and caregivers. The goal of this PhD thesis is to study how different factors contribute to variations in fitness to drive between patients with cognitive impairment. In this thesis, differences in diagnoses, severity and nature of symptoms are considered. In addition to classical neuropsychological tests, traffic-specific knowledge and skills are assessed using computerized tests and a driving simulator. A comprehensive approach, incorporating all these types of assessments, is used to predict fitness to drive as determined in an on-road driving assessment. This research will result in a procedure for the assessment of fitness to drive in patients with cognitive impairment in a clinical setting. Furthermore, it was studied whether patients with cognitive impairment adhere to driving advice given after a fitness-to-drive assessment and how it impacts on their mobility.

*Chapter 2* presents a literature study on differences in driving behaviour between patients with different types of dementia. Patients with different types of dementia vary in early symptoms and prognoses, which may influence the likelihood of patients with different dementia diagnoses still being able to drive safely. It is expected that patients with only language disorders have a higher likelihood to be able to drive safely than patients with severe visual or behavioural disorders. However, little research has been done on driving with other types of dementia than the most common classical form of Alzheimer's disease. Therefore, we can only hypothesize about which problems patients with different types of dementia experience while driving, for example, wayfinding difficulties in Alzheimer's disease and impaired judgement of hazardous traffic situations in frontotemporal dementia. In the aging society, more and more older drivers develop a form of dementia. As a result, there is a need for a strategy to investigate fitness to

drive in a clinical setting. Despite the fact that assessment strategies have been proposed by other researchers, it is still unclear which fitness-to-drive tests should be conducted in the clinical setting.

*Chapter 3* describes a study in which a new assessment strategy has been developed to investigate fitness to drive of patients with Alzheimer's disease in a clinical setting. The utility of three different types of assessments was investigated; clinical interviews with both the patient and a relative, neuropsychological assessment and rides in a driving simulator. Based on information obtained from these different types of assessments, fitness to drive was predicted. This prediction was compared with the outcome of an on-road driving assessment. Of the patients with Alzheimer's disease ( $n = 81$ ), 43% passed the on-road driving assessment. The results showed that the neuropsychological assessment was the best predictor of the three types of assessments, but the clinical interviews and driving simulator rides were also predictive of on-road driving performance. When all three types of assessments were taken together the most valid prediction of fitness to drive was achieved, which corresponded with the outcome of the on-road driving assessment in over 90% of the patients. A limitation of this study was that the prediction model was developed and tested in the same group of patients with Alzheimer's disease, therefore it is still unclear whether the assessment strategy is valid and also predictive of fitness to drive in other groups of patients with cognitive impairment.

*Chapter 4* represents a validation study to verify that the assessment strategy as derived in *Chapter 3* can also predict fitness to drive in another and independent group of patients with cognitive impairment. This group involved 18 patients with mild cognitive impairment (MCI). Fitness to drive was again determined in an on-road driving assessment which was passed by 67% of the patients with MCI. Similar to the results of patients with Alzheimer's disease, the assessment strategy with clinical interviews, neuropsychological assessment and driving simulator rides could predict fitness to drive in this group of patients with MCI. The separate analyses of the three types of assessments indicated that the neuropsychological assessment and driving simulator rides successfully predicted fitness to drive while the clinical interviews alone were not significantly predictive of fitness to drive of patients with MCI. Further research is required in an independent group of patients with Alzheimer's disease to determine if the predictive value of clinical interviews, as reported in *Chapter 3*, was a chance finding, or if they are actually a useful part of the fitness-to-drive assessment

for patients with Alzheimer's disease. Overall, the proposed assessment strategy seems useful to investigate fitness to drive of patients with MCI.

*Chapter 5* examines the utility of the proposed assessment strategy in patients with other types of dementia than Alzheimer's disease (non-AD dementia). These include patients with vascular dementia, frontotemporal dementia, and Lewy body dementia. In the group of patients with non-AD dementia ( $n = 34$ ), 41% passed the on-road driving assessment. Unlike the results in patients with Alzheimer's disease and MCI, the proposed methodology with the three types of assessments combined could not predict fitness to drive of patients with non-AD dementia. The variables of clinical interviews and driving simulator rides were not predictive for fitness to drive of patients with non-AD dementia, but the used neuropsychological assessment was. These results show that an assessment strategy that works for one type of dementia does not necessarily work for other types of dementia. One may therefore assume that different types of dementia require different assessment strategies to predict fitness to drive. A new fitness-to-drive assessment strategy for non-AD dementia could consist of a neuropsychological assessment with specific traffic tests, which is embedded in a larger assessment battery consisting of self-reports, cognitive tests and features of a driving simulator ride that are of particular importance to a specific form of dementia.

*Chapter 6* regards a follow-up study that evaluated the adherence to driving advice and impact on transport mobility. After the fitness-to-drive assessment, patients with cognitive disorders ( $n = 172$ ) received a driving advice. This driving advice was either (1) continue driving or (2) taking driving lessons and an official on-road driving assessment or (3) cease driving. Approximately seven months after the fitness-to-drive assessment, most participants adhered to the driving advice, which accounted for 92% of patients with positive driving advice and 79% of patients with negative driving advice. Of the patients with a driving lessons advice, 42% stopped driving. Of the patients with the driving lessons advice that still drove, 72% at least partially followed the driving advice, by taking driving lessons or an official on-road driving assessment (or both). Driving cessation occurred more frequently in female patients, with relatively severe cognitive impairment, who experienced a decline in their health and were advised to stop driving. Although the vast majority of patients adhered to their driving advice, it is a matter of concern that some patients continue to drive after a negative driving advice. Patients who ceased driving used less alternative modes of transport (such as

walking, cycling, public transport) than patients who were still driving, which may indicate that patients who ceased driving were not only less automobile, but also less mobile in other ways. However, it was also found that 40% of the patients who cycled or used public transport increased their use of these modes of transport after driving cessation. This indicates that some of the patients who need to stop driving can compensate for this by cycling and / or by using public transport. Some of the patients with cognitive disorders are still very mobile, but there are also patients who rarely leave their home after driving cessation.

*Chapter 7* integrates the findings as presented in the preceding chapters in a general discussion. In this thesis, an assessment strategy has been proposed to investigate fitness to drive of patients with Alzheimer's disease using clinical interviews, a neuropsychological assessment and driving simulator rides. All three types of assessments have advantages and disadvantages. In the first type of assessment, clinical interviews, the determination of the severity of cognitive impairment seems to be of paramount importance, but one must note that the responses of patients and their families are of a subjective nature and could be biased. The second type of assessment, a neuropsychological examination, should contain multiple neuropsychological tests that are strongly related to driving skills, such as response time and hazard perception, because a single test for general cognition does not provide sufficient information about fitness to drive. In the third type of assessment, driving simulator rides provide a safe environment to observe driving behaviour, but this information cannot be collected in all patients because simulator sickness (dizziness / nausea due to driving in the driving simulator) is relatively common in older patients with cognitive impairment. If it is possible to perform all three types of assessments, the information can be combined to provide the best prediction of fitness to drive. Although it would be practical to have one procedure in the clinic to investigate fitness to drive of all patients with cognitive impairments, this may not be feasible. Patients with other types of dementia than Alzheimer's disease require different assessment strategies to investigate fitness to drive in the clinical setting. For the development of new assessment strategies, one has to consider the different effects that different types of dementia have on driving. It is important to offer accurate driving advice to as many patients as possible, because this promotes driving continuation in patients who are still fit to drive and driving cessation in patients who are no longer fit to drive. Future research is required that explores whether fitness-to-drive assessments can prevent traffic accidents and improve transport mobility of patients with

cognitive impairments. Due to the progressive course of neurodegenerative diseases, many patients with cognitive impairments will have to stop driving on a certain moment, therefore alternative transport should be accessible to these patients to sustain their mobility.

