



Meta-analysis of cognitive screening tools for predicting unsafe behaviour among elderly drivers

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Overview

> Introduction

- » Elderly drivers
- » Cognitive screening tools
- » Study purpose

> Method

- » Meta-analysis

> Results

> Conclusion



Elderly drivers

- > Canada's population is aging and seniors represent the fastest growing population group in Canada.
- > Population of elderly drivers will also grow.
- > Elderly drivers are at an increased risk of suffering from late-life cognitive impairment and dementia which affect driving ability.



Cognitive screening tools

- > Research has consistently shown that driving is dependent on brain/cognitive skills.
- > Therefore, testing of these skills is important to assist in assessing driving fitness.
- > Such tests can broaden the information available to help identify unsafe drivers and to accurately refer these drivers to the road test, which is still considered the gold standard.



Cognitive screening tools

- > There is no single tool that can accurately identify an unfit driver with absolute certainty.
- > There is also no agreement about which cognitive abilities should be assessed with respect to driving performance and which tests should be used to assess these abilities.
- > Research that examines elderly adults show correlations with cognitive tools and impaired driving outcomes, but the associations for single tests are relatively weak.



Commonly used screening tools

- > Research has associated the Useful Field of View Test (UFOV), Trail Making B, Delayed Recall, and the Motor Free Visual Perception Test (MFVPT) with an increased detection of crash risk.
- > A meta-analysis concluded that the Ergovision test, the UFOV, as well as tests such as Paper Folding and Dot Counting were best predictors of on-road driving.



Study purpose

- > Determine which pencil-and-paper cognitive screening tools were predictive of driving impairment.
- > Inform the selection of a cognitive screening tool to be adopted by the Ontario's Ministry of Transportation's (MTO) 80 and Above License Renewal Program.



Ontario driver licence renewal program

- > **Ontario's Ministry of Transportation's (MTO) 80 and Above License Renewal Program:**
 - > Mandatory biennial license renewal cycle starting at 80 years of age;
 - > Vision testing, a written test, an educational session and review of the older adult's driver license record;
 - > A road test, if driver appears to pose a risk to road safety.



Methods: Meta-analysis

- > **Systematic review of studies that evaluated cognitive screening tools and their predictive value of safe driving using:**
 - > a driving simulator
 - > on-road driving tests
 - > crash data
- > **Studies identified and selected from journals, conference proceedings, search engines, on-line catalogues, and different libraries using keywords.**



Methods: Meta-analysis

- > **Summarize and statistically analyze data – quantitative summary:**
 - » Identifying available studies using MTO inclusion criteria – e.g., group administration, no expensive hardware;
 - » Calculating outcome measure for each study on same scale; and,
 - » Translating methodological features of studies and tools into variables for analysis.

A literature review is conducted: **446** relevant articles are pulled.

From these 446 articles, **68** are selected which evaluate a cognitive tool(s) in relation to driving ability.

There are **142** data points (tool evaluations) which evaluate **42** tools. Some articles evaluate more than one tool and some tools have more than one data point.

After MTO criteria are applied to the 142 data points, **27** data points remain.

Data points with incomplete data are removed: **15** data points remain.

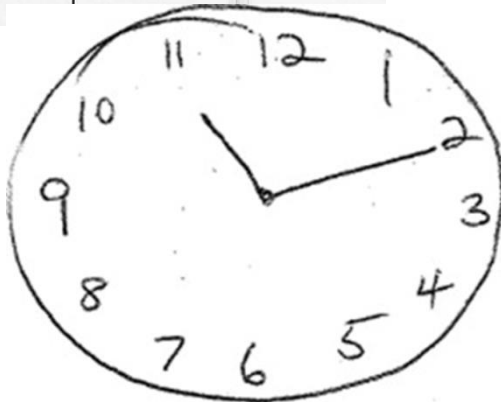
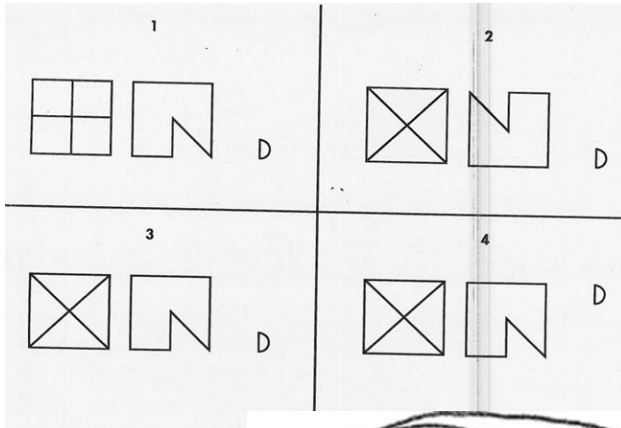
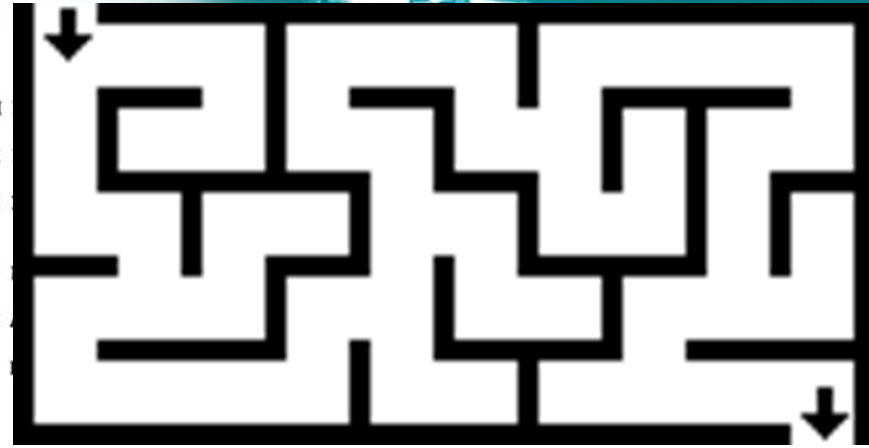
The 15 remaining data points combined evaluate **10** different tools.



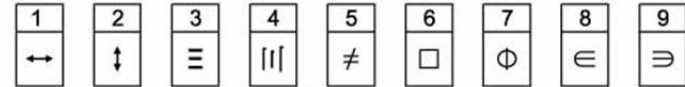
10 Cognitive Screening Tools

- > Clock Drawing Test
- > Traffic Sign Recognition Test (TSRT)
- > Charron Test
- > Single Letter Cancellation Test (SLC)
- > Double Letter Cancellation Test (DLC)
- > Rey-Osterrieth Complex Figure Test (ROCT)
- > Maze Task Test
- > Wechsler Digit Symbol Substitution Test (DSST)
- > Visual Form Discrimination Test
- > Eight Item Informant Questionnaire

B H D F C H C F H G I H C H I H B D A H C F B H D E H D A F H I C H F H B A F H E H
 H E G H F E H D H F H C B F H A D H C E H I H G D H G E B H E G H I H C H E H F C I
 H B H A E H B H C F A H F H G H C G D H C B A H G D E H C H B E H D G H D A F H B I
 H D G A H C H F B H A F H E B F H C D H F H G E H B H D H F A C H C H F D I H C B I
 E H B H G B I H C E H A F H I H E B H G F B H F A H E B G H G F E H D B H B H C F H
 H D C B H E D G H A D F H B H I G E H G H D E H C G H D H E B A H F B H C D A H G B



Digit symbol substitution test

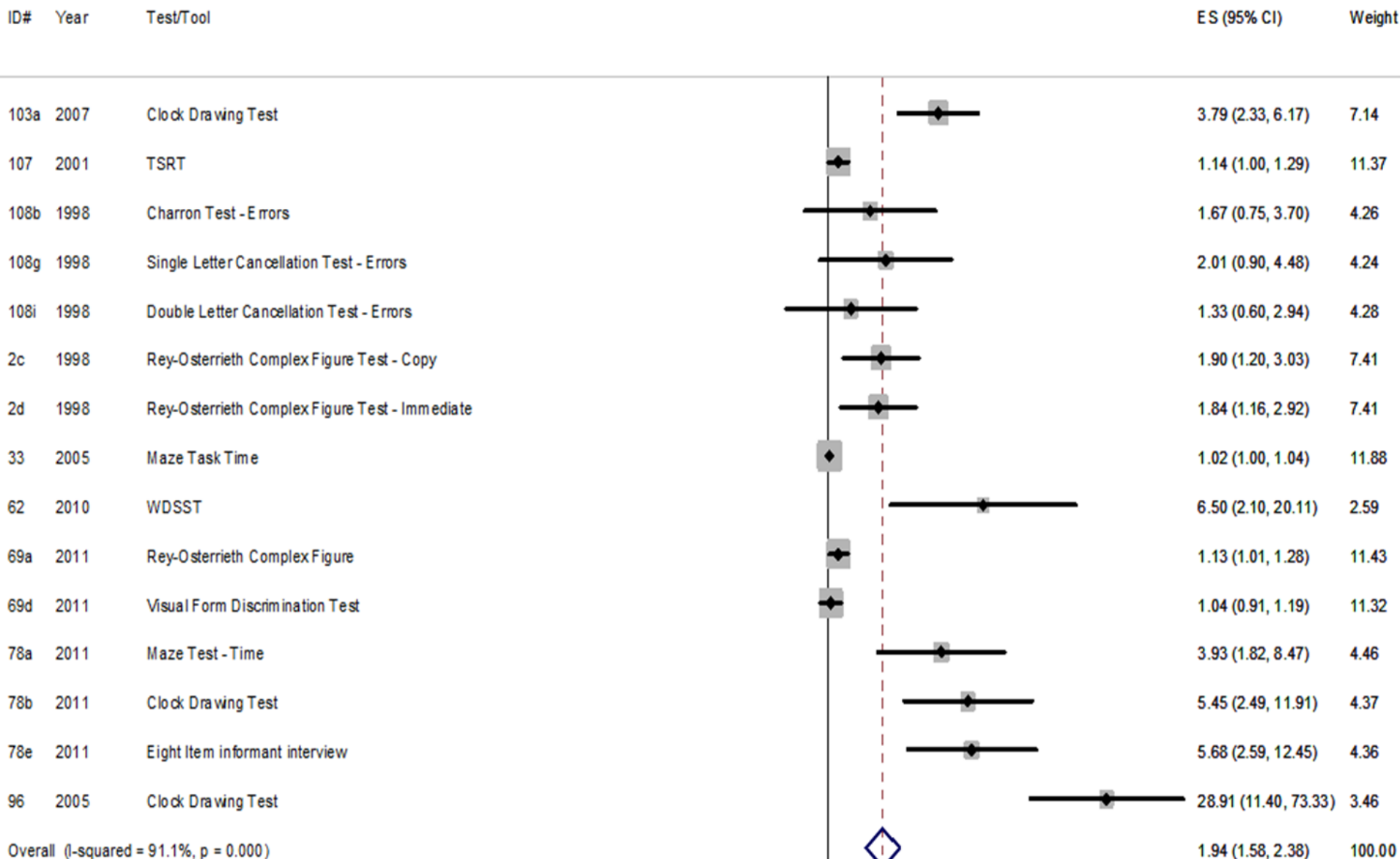


2	9	2	9	4	9	4	9	1	8	9	3	1	7	2	3	6	4	8	3	1	7	8	2	5
4	7	1	7	5	8	4	1	5	2	6	9	9	5	6	7	6	2	9	4	8	7	2	8	6
8	6	2	8	2	9	4	7	4	8	6	7	3	1	6	2	1	8	7	4	3	1	6	2	9
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3	9	7	1	7	1	3	5	7	6	1	6	5	9	1	3	1	3	9	8	9	7	3	4	3

TRAFFIC INJURY RESEARCH FOUNDATION

Publication Cognitive

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NOTE: Weights are from random effects analysis



Results: Meta-analysis

- > Evidence suggesting that cognitive screening tools that meet MTO's requirements for GES can be used to predict driving performance.
- > On average, when cognitive screening tools predict a driver is unsafe, there is a 94% greater chance that this driver will indeed exhibit unsafe driving behavior.
- > This is a significant, small to medium-sized effect.



Conclusion

- > The pencil-and-paper cognitive screening tools included in this meta-analysis can be used effectively to predict driving performance of older drivers.
- > It was possible to establish a rank ordering of predictive ability of these screening tools but unable to identify a single-best, or worst, tool.
- > Use rank ordering in combination with other information (e.g., data on sensitivity, specificity, preferably likelihood ratios) when available.



Conclusion

- > The cognitive tests included in this study are inexpensive, brief, easily administered, require minimal training and could be considered as an adjunct to other screening methods in a variety of settings.
- > These results may be useful to licensing agencies which are in need of an easy to administer screening tool that is a cost-efficient addition to current elderly driver license renewal processes.



Update

- > **MTO has modified their GES and now require participants to complete two brief, non-computerized in-class screening assessments:**
 - » Clock drawing test;
 - » Letter cancellation test.



Any questions...





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