“TRAILS & Tribulations”

Choosing between common fitness-to-drive office-based screening tests

Dr. Frank Molnar

- CanDRIVE (www.candrive.ca )
- Co-Chair, Champlain Dementia Network (www.champlaindementianetwork.org )
- Medical Director, Regional Geriatric Program of Eastern Ontario (www.rgpeo.com )
- Associate Professor of Medicine, University of Ottawa and Staff Geriatrician, Division of Geriatric Medicine, The Ottawa Hospital
Conflict of interests

- None
  - No Pharmaceutical Industry support
  - More relevant to driving
    - No Automotive Insurance Industry support
Objectives

- To highlight the complexity of the assessment of fitness to drive

- To compare commonly promoted screening tests (MMSE, Clock, MOCA, Trails B, SIMARD)

- To provide a practical approach to assessing fitness to drive in dementia
Projections

Projected Change in Collisions by Driver Age (2006-2026)

Projected Increase in Casualty Crashes by Age (2006-2026)

Source: L’Écuyer et al. (2006). Transport Canada
A Major Public Health Concern

- When involved in a crash, seniors are over 4 times more likely to be seriously injured and hospitalized than are drivers 16-24 years of age.
- Treatment of injuries to seniors is more costly, recovery slower, less complete.
- Majority of crash-injured seniors were driving the vehicle.
- Most (3 of 4) crashes involving older drivers are multiple vehicle crashes (e.g. merging into traffic, left hand turns across oncoming traffic).
Assessment of Fitness-to-Drive

The Complexity of the Medical Driving Evaluation
Medical conditions and medications are the primary cause of declines in older driver competence.
- Can make even the best of drivers unsafe to drive.
- Can affect drivers of any age: Increasingly likely as we age due to the cumulative effect of multiple diseases.

- Not merely the presence but severity and/or instability of conditions +/- high doses and/or changing doses of medications

Medical community best placed to first recognize possibly impairing medical conditions / medications.
Medical conditions that when **severe, poorly controlled** or **changing rapidly** can impact on driving

- 3Ds: Dementia / Delirium / Depression
- Diabetes
- vision and hearing
- cardiac disease
- Stroke
- Parkinson’s
- Arthritis
- Sleep apnea
- etc
Medications / substances that can affect driving during dose changes (period of acclimatization) or at high doses (above threshold at which one can acclimatize)

- Benzodiazepines
- Narcotics
- Anticholinergic medications
  - e.g.: tricyclic antidepressants, antipsychotics, oxybutynin, detrol, gravol
- Antihistaminines
- Seizure meds
  - e.g.: phenytoin, phnobarbital, Gabapentin / pregabalin, clobazam
- Parkinson’s meds (Sinemet...)
- Alcohol
- Cannabis
- etc
Effects of Medical Conditions and Medications

Multiple Domains can be affected:

**Physical**: weakness; slow / limited movement

**Sensory**: vision loss; limited feeling in limbs

**Cognitive/Perceptual**: slowed thinking; decreased attention

**Emotional**: anxiety, panic reactions
Effect of Behavior

Factors Involved in Driving

Hierarchical Control Levels in Driving

- **Strategical Level**: general plans, Time Constant: long, Level of Risk: Accepting Risk
- **Maneuvering Level (tactical)**: controlled action, Time Constant: seconds, Level of Risk: Taking Risk
- **Control (operational)**: automatic action, Time Constant: milliseconds, Level of Risk: Dealing with Acute Danger
Realistic Conclusions

- No screening or assessment protocol will ever predict 100% of risk of Motor Vehicle Crash (MVC)
  - Only test stable intrinsic features
    - operational > tactical, strategic
    - Miss new or fluctuating illness, or behavior in non-testing real life situations
  - Cannot predict extrinsic factors
    - weather, other drivers, road conditions, car malfunction
  - Full complexity cannot be fully addressed with time available in front-line clinical settings

Therefore objective is to improve not to perfect the assessment of fitness to drive
Let’s focus on Dementia
Estimated Numbers of Drivers with Dementia in Ontario\textsuperscript{1}

\begin{itemize}
  \item 1986: 14,909
  \item 1992: 21,803
  \item 1994: 24,083
  \item 1998: 30,642
  \item 1999: 32,373
  \item 2000: 34,105
  \item 2028: 98,032
\end{itemize}

\textsuperscript{1} from Hopkins, et al., (2004)
Conclusions of Consensus Guidelines regarding Driving and Dementia

- Recognize limitations of data
  - those with moderate to severe dementia should not drive
    - Canadian Medical Association: Moderate = 1 ADL or 2 iADLs impaired due to cognition (CMA guidelines currently being revised)
  - individual assessment for those with mild dementia
    - What does this really mean??
  - “gold standard” is comprehensive on-road assessment
    - ≠ Ministry on road
“Individualized Assessment”

- Based on expert opinion recommend tests such as MMSE, Clock Drawing, Trails B

- Lack of operating instructions (i.e. lack of guidance regarding how to interpret the results of the tests)
  - Do not provide guidance regarding HOW physicians are to apply such tests (e.g. how to respond to different scores, what cut-offs to use, which errors = automatic failure ...)

Screening (detection of a potential problem);
Folstein Mini-Mental State Exam (MMSE)

- Limited sensitivity - misses cases of mild dementia or Mild Cognitive Impairment.
  - Higher False Negative Rate

- Good specificity – less likely to label people with normal cognition as impaired

- Copyrighted (we should be paying to use it)

- Large body of supportive literature

- Does not test Executive function

Montreal Cognitive Assessment Test (MOCA)

- Great website – see www.mocatest.org

- Great sensitivity – picks up cases of mild dementia or Mild Cognitive Impairment.

- Limited specificity
  - Labels some people with normal cognition as impaired (Higher False Positive Rate)

- Copyrighted but do not charge to use

- Limited body of supporting literature and validation studies flawed.
Lack of evidence-based cut-offs

- Clinical Utility of Office-Based Cognitive Predictors of Fitness to Drive in Persons with Dementia: A Systematic Review. (Molnar, Marshall, Man-Son-Hing et al., JAGS 2006; 54:1809–1824)

  - No cognitive tests that could potentially be used in an office-setting had cut-off scores validated in persons with dementia!
  - That does NOT mean the tests cannot be useful

- BUT haven’t cut-offs been recommended for **Trails B**?
TRAILS B

Work of Dr. Mononita Roy, Geriatric Fellow
University of Ottawa

•Presented at Canadian Geriatrics Society national meeting April 2011
Trails A
Trails B
Trails B: 180 second cut-off?

- A time of over 180 sec for completion of Trails B is often recommended as a cut-off for intervention.

- The origin of this 180 sec cut-off comes from the following non driving-related studies:
  - Fals-Stewart 1992
  - Franzen 1996
  - Tombaugh 2004

- Presented normative data for Trails A and B for 911 community-dwelling individuals aged 18-89 years.

- Performance on both Trails A and B decreased with increasing age and lower levels of education.
  - Q? Do people get more time to stop a car just because they are older?
  - Q? If not, does being within the boundaries of normative data really mean someone is safe to drive?

- Based on these results, the norms were stratified for age (11 groups) and education levels (2 groups – 0-12 years and 12+ years).
Tombaugh 2004: Normative Data for Trails A and B

- Method
  - Convenience sample
    - Subjects were selected from participants in other studies.
    - These may be individuals who are more willing to participate, more confident etc.
    - May not be a representative sample, thus introducing bias.

- Is this truly a “disease-free” sample?
  - Self-reported medical and psychiatric hx.
  - Medical hx and dx of “absence of cognitive impairment” may not be up-to-date as done when recruiting for previous studies.
  - All subjects had MMSE >23 (mean 28.6, SD 1.5) and GDS <14 (mean 4.1, SD 3.4) with fairly tight confidence intervals.
    - But, MMSE does not test executive function.
    - At lower end of MMSE score and GDS, could still have some subjects with mild cognitive impairment or depressive sx who were included in the study.
- Scores on Trails A and B increased with increasing age and fewer years of education.
- All mean times for Trails B were under 180 seconds, so it seems that the 3 minute cut-off does mean something.
Table 3: Percentiles for Trails A and B scores for each normative group

-Even as age increases, most people still are able to complete Trails B in <180 sec, with the lowest percentiles taking longer than 180 sec.
-Again, suggests 180 sec as a threshold?
-Our job is to identify these individuals who are outliers and forward them on for further neuropsychology testing or on-road driving evaluation.
Our conclusions from Tombaugh 2004 article

- This convenience sample may not have been representative of completely healthy, cognitively intact individuals.
- Many groups had small sample sizes, so use caution in interpreting these scores (especially age group 85-89).
- Mean time to complete Trails B is under 180 seconds for all age groups, so this may indicate that this is a meaningful threshold.
- However, even if these are true norms for healthy people, being in a normative range may not necessarily mean the patient is safe to drive.
- As age increases, outliers in the lowest percentiles take longer than 180 seconds to complete Trails B
  - Our job is to identify these individuals and refer them on for further testing.
Trails B and Driving

Trails B
- Number of studies – 31 out of total 32
- Positive association (p<0.05) = 20 studies
- No association (p>0.05) = 11 studies
  - True negatives + false Negatives (due to small sample size)

- Cut-off scores
  - Very sparse evidence based support.
    - Ball 2006 147 seconds
    - Staplin 2003 180 seconds
    - Mazer 1998 < 3 errors

  - Cut-offs reported (justification unclear)
    - Marottoli 1998 133 seconds
    - Wang 2003 180 seconds
Trails B and Driving

• **This does not** mean Trails B is useless
  – As performance progressively worsens with longer and longer times and / or more errors (not due to language or education) then clinicians can become increasingly comfortable stating a patient has a functional impairment that may increase risk of crash

  • E.g. 10 minutes and 10 errors – unlikely any MD would allow such a person to drive.

  • This follows the principle of the Ontario Highway Traffic Act where MDs must report drivers who have findings that *may indicate lack of fitness to drive.*

  • Where to set the borderline cut-off (3 minutes and 3 errors?) requires further research and discussion.
### Administration Instructions

The screening test consists of 4 separate tasks: 2 memory tasks for words; a number conversion task in which numbers have to be converted into words; and a verbal fluency task in which the patient has one minute to name objects that can be bought in a supermarket.

**WORD LIST (Immediate Recall)**  

*“Do not indicate in any way there will be a delayed recall component later in the test.”*

The examiner instructs the patient: "I will now slowly read you a list of 10 words. When I have finished, please repeat as many of these words as possible. The order does not matter.*

- Check off each word that the patient recalls.
- Prompts (if necessary): "Tell me as many of those words as you can, please."
- "Can you recall any more?"

The examiner then gives the patient the following instructions: "Thank you. Now I will read you the same words again. Again, please repeat as many of these words as possible when I have finished."

- Check off each word that the patient recalls.
- Again, provide prompts, as necessary, as listed above.

**SCORING:** No score is awarded; however, the immediate recall component of the word list is necessary for the delayed recall component of the SIMARD MD (i.e., Repeat of the Word List).

**NUMBER CONVERSION**

Give the reverse side of the testing form to the patient for completion.

Show the patient the example at the top of the page. Say to the patient: "As you can see from this example, we can write the number 5 as the word ‘five’. This task is like writing out a cheque. Please write the numbers in words."

**SCORING:** Each correct conversion scores one point. Isolated spelling mistakes (e.g., hundred, seventy) are marked as correct. No marks will be awarded for any other conversion mistakes such as the wrong number system (e.g., 209 = 2hundreds) or omissions (e.g., 209 = two hundred) [Maximum of 2 points].

**SUPERMARKET TASK**

Say to the patient: "Please name as many things as possible that you can buy in a supermarket. You have one minute to do this. Are you ready? Please begin." Please time the minute exactly (a stopwatch with a second hand is sufficient).

**SCORING:** Give one point for each object named [Maximum of 30 points].

**REPEAT OF THE WORD LIST (Delayed Recall)**

Say to the patient: "At the beginning of this test I read you 10 words. Tell me as many of those words as you can, please." (May give prompts as in the Word List task above.)

**SCORING:** Give one point for each word that the patient recalls [Maximum of 10 points].

**INTERPRETATION**

See Scoring Guide at the bottom of the testing form to calculate the SIMARD MD total score.

- A total score of ≤ 30: High probability of failing a driving assessment.
- A total score of 31-70: Referral for a driving assessment recommended.
- A total score of > 70: Low probability of failing a driving assessment.

---

*Based on items from the DemTect (Kalbe et al., 2004) and used with permission. Selection of items and scoring system based on research using driving evaluation outcome as the criterion.*

SIMARD

- Cut-offs were 30 and 70
  - Those who scored 30 or less
    - 85.7% failed the on-road test
    - 14.3% passed on-road
  - Those who scored 31 to 69
    - 44.9% failed on-road test
    - 55.1% passed on-road test
  - Those who scored 70 or more
    - 16.1% failed on-road test
    - 83.7% passed on-road test
THE FUTURE

- CanDRIVE Prospective Cohort Study
  www.candrive.ca
- 1000 older drivers followed for 5 years to attempt to derive better screening and assessment tests for fitness-to-drive
  - Will look at MMSE, Clock, MOCA, Trails, SIMARD + develop new tests
Using Tests Intelligently

- The MMSE, Clock, MOCA, Trails B and SIMARD can provide a rough framework for assessing driving safety.
  - Like any screening tool they can generate false results if not applied appropriately
  - The information obtained from them can also be optimized through intelligent application
Is the Test result consistent with other evidence?

- Are the results of the test consistent with (what you would expect to find given)
  - History provided by patient, caregiver, family
  - Other tests
    - Do the results fit with other tests done?
    - OR is this single test an outlier and possibly not reflective of the patient’s true functional ability
Make certain you know what you are really measuring

- Make certain low scores are not due to confounding variables:
  - language barrier
  - low education
  - performance anxiety
  - sensory deficits
Consider TRAJECTORY

- Consider whether the patient’s function is:
  - Expected to improve;
    - Delirium, recent head injury, recent stroke etc.
  - Expected to remain stable;
    - stable head injury, stable stroke etc.
  - Expected to decline;
    - Dementia, Parkinson's, recurrent delirium etc.
Understand your role

- The role of Health Care Professionals is **NOT** to determine fitness-to-drive.

- The role is to report drivers who have clinical findings that *may indicate lack of fitness to drive*.
  - Ontario Highway Traffic Act
  - The Ministry of Transportation makes the decision regarding fitness-to-drive in part based on accurate, fair and timely information from Health Care Professionals.
Use common sense

- Sometimes it is obvious a patient is not safe to drive
  - Very low valid test scores
  - Very dangerous behaviours
  - Very significant physical limitations
  - Very significant functional impairment

“Don’t start looking for your glasses at 80 mph.”
Understand cut-off scores

- For many health care measures, there is significant overlap between the scores of "normals" vs. the scores of those who are "impaired"
- This makes reliance on a single cut-off score challenging if not impossible.
Overlapping Cognitive Scores (Dichotomization)

Unsafe drivers’ scores

Safe drivers’ scores

single cut-off

%

Fail  Pass  Cognitive score

Trichotomization

uncertain, needs further testing

Fail  Pass

%  Cognitive score
Applying Trichotomization

- Given the results of the cognitive test would you get in the car with the patient driving?
  - Would you let a loved one get in a car with the patient driving?
  - Would you want to be crossing a street (or have a loved one cross a street) in front of a car with the patient driving?

- These questions help you “get off the fence”. 3 answers are possible
  - Yes (no concerns to trigger further testing)
  - Uncertain (need more testing)
  - Absolutely not (risk is clear)
Putting it all together – the approach
Use Tests in the context of a more detailed approach (i.e. tests do not stand alone)

- [www.rgpeo.com](http://www.rgpeo.com)
- Health Care Practitioners
  - Resources
    - Safety and Security – Driving
      - [The Driving and Dementia Toolkit for Health Professionals](http://www.rgpeo.com/en/health-care-practitioners/resources/driving.aspx)
      - Right click and Open Hyperlink
    - Dr. Anna Byszewski et al (Toolkit overall)
    - Dr. Bill Dalziel (10 step approach)
The Driving and Dementia Toolkit for Health Professionals

1. Dementia Type
   - Generally, Lewy body dementia (fluctuations, hallucinations, visuospatial problems) and frontotemporal dementias (if associated behaviour or judgment issues) are unsafe.

2. Functional Impact of the Dementia - According to CMA guidelines, unsafe if:
   - Impairment of >1 IADL due to cognition (IADLs mnemonic = SHAFT: Shopping, Housework/Hobbies, Accounting [banking, bills, taxes], Food preparation, Telephone / Tools / Transportation [driving])
   - OR impairment of 1 or more personal ADLs due to cognition (ADLs mnemonic = DEATH: Dressing, Eating, Ambulation, Toileting, Transfers, Hygiene)

3. Family Concerns (Ask in a room separate from the patient)
   - Family feels safe/unsafe (make sure family has recently been in the car with the person driving).
   - The granddaughter question—Would you feel it was safe if a 5-year-old granddaughter was in the car alone with the person driving? (Often different response from family’s answer to previous question)
   - Generally if the family feels the person is unsafe to drive, they are unsafe. If the family feels the person is safe to drive, they may still be unsafe as family may be unaware or may be protecting the patient.

4. Visuospatial Issues (Intersecting pentagons/clock-drawing test)
   - If major abnormalities, likely unsafe.

5. Physical Inability to Operate a Car (Often a “physical” reason is better accepted)
   - Medical/physical concerns such as musculoskeletal problems, weakness/multiple medical conditions (neckturn, problems in the use of steering wheel/pedals), cardiac/neurological problems (episodic “spells”).
The Driving and Dementia Toolkit for Health Professionals

6. Vision/Visual Fields
   - Significant problems including visual acuity, field of vision.

7. Drugs (If associated with side effects—drowsiness, slow reaction time, lack of focus)
   - Alcohol, benzodiazepines, narcotics, neuroleptics, sedatives, Anticholinergic—antiparkinsonian drugs, muscle relaxants, tricyclics, antihistamine (OTC), antiemetics, antipruritics, antispasmodics, others

   - Trail Making A: Unsafe = >2 minutes or 2 or more errors
   - Trail Making B:
     - Safe = <2 minutes and <2 errors (0 or 1 error)
     - Unsure = 2–3 minutes or 2 errors (consider qualitative dynamic information regarding how the test was performed—slowness, hesitation, anxiety or panic attacks, impulsive or perseverative behaviour, lack of focus, multiple corrections, forgetting instructions, inability to understand test, etc.)
     - Unsafe = >3 minutes or 3 or more errors

   - The bottom end of a 12 inch (30-cm) ruler is placed between thumb and index finger (1/2 inch [1 cm] apart) - let go and person tries to catch ruler (normal = 6-9 inches (15–22 cm); abnormal = 2 failed trials)

10. Judgment/Insight (Ask the person):
    - What would you do if you were driving and saw a ball roll out on the street ahead of you?
    - With your diagnosis of dementia, do you think at some time you will need to stop driving?
YOUR HOMEWORK!!!!
(Right click and Open Hyperlink)

[1] Link to and review the Dementia and Driving Toolkit

[2] Read about another approach based on Dr. Dalziel’s 10 steps
- Approach to assessing fitness to drive in patients with cardiac and cognitive conditions
  (Canadian Family Physician 2010;56:1123-9)
  - http://www.cfp.ca/content/56/11/1123.full.pdf+html?sid=78c25ba8-3cd8-4e80-94a0-26a92130d55b

[3] Go to Alzheimer Knowledge Exchange
(http://www.akeresourcecentre.org/_Index ) Dementia and Driving Resources
- http://www.akeresourcecentre.org/DrivingPhys
- http://www.akeresourcecentre.org/DrivingModule