Screening and Assessment Tools Determining Fitness-to-Drive of Older Adults

East Carolina University
Anne E. Dickerson, PhD, OTR/L, FAOTA
Research for the Older Adult Driver Initiative
Danielle Brown, OTS
Cyrus Ridenour, OTS
Kristen Davis, OTS

Question: What is the evidence supporting the use of clinical assessments (vision, cognition, physical function) and performance-based assessments (simulated and on-the-road) for determining driving safety/competence and driving cessation for older adults.

• Predictive or Concurrent Validity
• Studies from 1995 to present.
• Outcomes:
  – Behind-the-Wheel Driving Assessment,
  – Crashes,
  – Driving Cessation

Process

• Citations reviewed from all searches by
  – One student and faculty member
• 128 abstracts reviewed by one student and faculty member.
  – Team met and discussed all abstracts
  – Three students completed CAP for two manuscripts.
• 80 full manuscripts reviewed by one student and faculty member.
  – Several recent studies added
• Final number of studies included = 59

Number of studies for 3 outcomes

<table>
<thead>
<tr>
<th></th>
<th>Crashes</th>
<th>On Road Assessment</th>
<th>Cessation of driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meta Analysis – 2 total</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Systematic Review</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Randomized Control Study</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-randomized controlled trial: Prospective study; two group</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Retrospective, time series, case control, cohort/ cross sectional study</td>
<td>7</td>
<td>43</td>
<td>4</td>
</tr>
</tbody>
</table>

Level 1 Evidence: 2 Meta Analysis; 2 Systematic Reviews

• Mathias & Lucas, 2009 – 21 studies
  – Outcome: driver assessment on road, simulator, driver problems
  – Attention most frequently assessed, then cognition, perception, memory
  – All who failed, did poorly on cognition
  – Variation on how test was compared to outcomes
• Clay et al. 2005 – 8 studies only on UFOV
  – Outcome: driver assessment on road, simulator, crash
  – Poor UFOV scores – poor driving performance

Level 1 Evidence: 2 Systematic Reviews

• Martin, Marottoli, & O’Neil, 2009, Cochrane Review – no studies met criteria
• Marshall, et al. 2007 – 17 studies
  – Focused on Stroke
  – Different measures for different outcomes (on road vs. cessation
  – Trails A&B and Rey-Osterreith complex figure
  – MVPT – not predictive,
  – UFOV for visual perception

http://dx.doi.org/10.5014/ajot.2014.686005
14 Studies Focused on a Single Tool or Battery of Tools

- Driving Simulation – 2 studies studied driving simulation alone; 3 others used simulation in addition to usual vision, cognition, motor.
- Battery - ADReS, SDSA or NorSDSA
- Individual Tool – AMPS, 4C’s, Driving Decision Workbook, DriveAble, Attention Network Test, Adelaide Self Efficacy, DriveSafe, DriveAware, Road Law & Road Craft, Melbourne Slide Test, New South Wales Visual Recognition Slide Test

Most Studies Used Multiple Assessments

<table>
<thead>
<tr>
<th>Cognition</th>
<th>Perception</th>
<th>Vision</th>
<th>Physical/Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 42</td>
<td>N = 31</td>
<td>N = 23</td>
<td>N = 21</td>
</tr>
<tr>
<td>Trail Making A &amp; B</td>
<td>UFOV</td>
<td>Acuity</td>
<td>Range of Motion</td>
</tr>
<tr>
<td>MMSE</td>
<td>Visual attention</td>
<td>Contrast Sensitivity</td>
<td>Rapid Pace Walk</td>
</tr>
<tr>
<td>Digit Symbol</td>
<td>MVPT</td>
<td>Visual Fields</td>
<td>Manual muscle test</td>
</tr>
<tr>
<td>Block Design</td>
<td>Visual neglect</td>
<td>Depth perception</td>
<td>Finger tapping</td>
</tr>
<tr>
<td>Clock Drawing</td>
<td>Grip strength</td>
<td>Rey-Osterrieth Figure</td>
<td>Reaction time</td>
</tr>
<tr>
<td>Maze Tests</td>
<td>Letter/number cancellation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 3 studies also compared performance in a driving simulator. Some assessment tools overlap in cognitive/perceptual/visual abilities.

Results: Key Concepts

1. No single tool
2. Tools most researched
3. Different outcome, different measures
4. Diagnostic Dependent
5. Sophistication of measurement
6. Move from single tool to “battery”
7. Driving simulation

Results: Key Concepts

1. No evidence for a single tool will be the one and only for either screening or assessment.
2. Tools most frequently researched
   - Commonly tools used in research:
     - MMSE – 13
     - Trail Making A and B – 19
     - Useful Field of View – 17
     - Contrast Sensitivity – 9
     - Acuity - 11

Results: Key Concepts

3. Different outcome, different measures
   - Cessation versus BTW versus crashes.
   - Measures are not used consistently.
   - Need to be diligent in reviewing how assessment tools results were measured against outcomes.
   - All BTW assessments are not alike.

Results: Key Concepts

2. Tools most researched
   - MMSE – Useful for identifying moderate or severe dementia, should not drive.
   - Trail Making A and B – Trails B is related to outcomes.
   - Useful Field of View – Significant research; subtest 2 related to outcomes; Some inconsistent
   - Contrast Sensitivity – Clear evidence for crashes with poor Contrast Sensitivity
   - Acuity – Not related to outcomes.
Results: Key Concepts

4. Diagnostic Dependent - Strong research groups for specific diagnostic groups.
   - Classen & colleagues – Parkinson’s Disease
   - UFOV 2 & Rapid Pace Walk
   - Uc, Rizzo, & colleagues – Neurological conditions
     - Trails A, Complex figure, Block design
   - Akinwuntan & colleagues – Stroke
     - Visual field, Rey figure, lesion location
   - Carr & colleagues – Dementia
     - Interview, clock drawing, Trails A or Snellgrove maze

Results: Key Concepts

5. Sophistication of measurement
   - Early studies – 1995 – 2005 used correlations
   - Moved into regression studies
   - Most recent research recognized the need for
     - Receiving Operating Curves – ROC
     - Looking at “area under the curve”
     - Sensitivity – the proportion who are unfit to drive that are correctly identified as unfit by the test.
     - Specificity – the proportion who are truly fit to drive that are correctly identified as fit by the test.

Results: Key Concepts

6. Move from single tool to “battery”
   - Recognition that one tool cannot measure all components.
   - Different components are important for different diagnostic
   - Research needs to demonstrate the groups of tools that meet the measurement outcome.

Results: Key Concepts

7. Driving simulation
   - No conclusive evidence for assessment
     - Some beginning evidence
     - Wide variety of driving simulators
     - Even with same model, different scenarios
     - Problem with simulation sickness

Implications for Practice

- Therapists have an array of tools that might be used in areas of vision, cognition, and motor.
  - Clinical judgment needed.
  - Careful of tools with no independent evidence.
- Consider the older driver, particularly the medically-at-risk driver’s condition.
  - Determine what should be assessed.

Implications for Research

- Much more needs to be done!
- Diagnostic categories
- Groups of assessment tools
- Sensitivity/Specificity
- How a tool works as for screening versus assessment.
Implications for Education

- Assessment tools for vision, cognition, motor, perception may be same for the IADL driving.
  - Apply the tool to the IADL of Driving and community mobility
  - Example: AMPS
- Teach the appropriate use of screening and assessment tools.
- Marketing versus evidence.

Thank you!

Anne Dickerson, PhD, OTR/L, FAOTA
East Carolina University
Director of ROADI
dickersona@ecu.edu