Medical Fitness to Drive: Driving the Evidence Forward

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Disclosures

Peggy P. Barco
Grant Funding
- National Institute of Health (NIH)
- National Institute of Mental Health (NIMH/OBSSR)
- Missouri Department of Transportation

Consulting
- Merck Manual
- Transportation Injury Research Foundation (TIRF)
- Medscape

The Rehabilitation Institute of St. Louis
University Missouri in Columbia
University of Illinois at Chicago

Acknowledge the "Team"

- Driving and Community Mobility (DCM) Team:
  - Katie R undecki, OT/ (Research Assistant)
  - Joanne Morrissey (Research Assistant)
  - Julia Sciarra, OTR/L (Study Coordinator)
  - Gabby Blenden, OTR/L (Study Coordinator)

- Graduate Occupational Therapy Students (past/present)
  - Fitness to Drive Studies: David Carr, MD, and Michael Wallendorf PhD
  - Glaucoma and Driving Errors Study: Anjali Bhorade, MD, Monica Perlmutter, OTD/L, Tracy Raben, Mae Gordon, PhD
  - Program in Occupational Therapy
  - The Rehabilitation Institute of St. Louis
  - Memory and Diagnostic Center (MDC) (Cassandra Ward, ANP)
  - Washington University Physicians and Clinics
  - Tiffany Rounsville MPH, Lily Hu MS, Bill Bauer, Stephanie Martino

- OUR PARTICIPANTS and THEIR FAMILIES

Objectives

- To realize the strengths and limitations of the driving evaluation process in relationship to older adults with cognitive impairment

- To apply evidenced based clinical screens (inclusive of the probability calculator) in case study applications of determination of fitness to drive in older adults with dementia.

Older Adults and the IADL of Driving

Figure 1: Purpose of Parade Vehicle Trips by Persons Age 65 and Older, 2001

- Driving only: 4%
- Passenger, 2%
- Pedestrian, 1%
- School, Church, Family, Elderly, 3%
- Health, Medical, 17%

"Source: National Highway Traffic Fatality"
Medical Conditions and Driving in Older Adults

**Progressive**
- Alzheimer’s Disease
- Parkinson’s Disease

**Non-Progressive**
- Traumatic Brain Injury
- Stroke

Driving Evaluation focused on – safety with continuation of driving
Driving Evaluation focused on – when/if driving can safely be resumed.

Alzheimer's Dementia Prevalence in the U.S.A
(Association for Alzheimer's Disease, 2018)

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>5.7 million</td>
</tr>
<tr>
<td>2025</td>
<td>7.1 million</td>
</tr>
<tr>
<td>2050</td>
<td>13.8 million</td>
</tr>
</tbody>
</table>

Dementia Forecast Worldwide
(Prince et al., 2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>46.8 million</td>
</tr>
<tr>
<td>2030</td>
<td>74.7 million</td>
</tr>
<tr>
<td>2050</td>
<td>131.5 million</td>
</tr>
</tbody>
</table>

National Guidelines on Driving and Dementia (Rapoport, et al 2018)

1. Diagnosis of dementia alone is not sufficient to withdraw driving privileges.
2. Individuals in the moderate phase of dementia are unlikely to be safe drivers.
3. Persons with dementia with progressive loss of 2 or more IADLs due to cognition (but no basic ADL loss) are at higher risk of driving impairment.
4. Persons with IADL loss (above) should have a formal assessment and ongoing monitoring of driving if they wish to continue to drive.

5. No in-office test or battery of tests including global cognitive screens (MMSE, MoCA) have sufficient sensitivity or specificity to be used as SOLE determinants of driving ability in all cases.
6. Abnormalities on cognitive screens may indicate a driver at risk who is need of further assessment.
7. Persons with dementia who are deemed fit to continue driving should be re-evaluated every 6 to 12 months (or sooner if indicated).
8. Caregiver concerns should be taken seriously.

What stage/s of dementia are most important to monitor/evaluate for driving safety?
- a. Pre-clinical dementia
- b. Very mild dementia
- c. Mild dementia
- d. Moderate dementia
- e. Severe dementia

How do we consistently define these levels of dementia?

Dementia Characteristics

<table>
<thead>
<tr>
<th>NONE</th>
<th>Very Mild Dementia (questionable)</th>
<th>Mild Dementia</th>
<th>Moderate to Severe Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>#6</td>
<td>#2</td>
<td>#3</td>
<td>#5</td>
</tr>
</tbody>
</table>

1. Needs help putting on clothes
2. Some mild difficulties with problem solving and memory – daily life slightly impaired
3. Requires assistance in more complex IADLs: Bill Paying, Traveling
4. Can no longer walk or sit up
5. Moderate loss of memory (especially for recent events)
6. Personal awareness of mild changes in memory (names, where familiar objects were left), no changes in functioning
Dementia Rating Scales

**Global Deterioration Scale (Reisberg, 1982)**
- 7 levels of impairment of dementia: none, very mild cognitive decline, mild cognitive decline, moderate cognitive decline (mild dementia), moderate severe cognitive decline (moderate dementia), severe cognitive decline (moderately severe dementia), very severe cognitive decline (severe dementia)

**Functional Assessment Staging Test (FAST) (Reisberg, 1984)**
- 7 levels (broken down more by function).
- For example: Level 4 mild dementia: IADLs
- Level 6 moderate severe dementia: ADLs


### Comprehensive Driving Evaluations (CDE)

**Process**
- Interview/questionnaires
- **Clinical Assessment:** Vision, Motor Skills, Cognitive screens related to fitness to drive.
- **Performance Based On-Road Test**
- **Recommendations meeting**
- **Follow up services**

### Clinical Reasoning Process

**Clinical Results:** Vision, Motor, Cognitive, Driving Behaviors

**On-Road Assessment**
Most difficult:

On-Road Assessment

Clinical Results: Vision, Motor, Cognitive, Driving Behaviors

Performance Based On-Road Assessment

Strengths

- Has been associated with drivers who have had a recent history of at fault crashes
  
  (De Raedt & Punjaert-Kristofferson, 2001; Dawson, Anderson, UC, Dastrup & Rizzo, 2009).

Real Traffic Situations

- Provide direct examples of driving
- Outcome measure of many of our evidenced based research studies

Understanding the Performance Based On-road Assessment

Limitations

- Safety concerns
- There are not many OT DRS
- Testing environment may not coincide with their own driving environment
- Anxiety

There is a lack of specific criteria that determines who passes or fails.

It is also unclear what type of errors made on the road test influence the ultimate driving recommendations and how these driving errors are operationally measured.

The Measurement of Driving Errors

- Trend is qualitatively and quantitatively describing driving performance
- Both approaches have subjectivity
- Lack of objective, standardized measurement tools to measure driving errors

Subjective

"standardized" – but conditions change

Errors: not always clearly operationally defined

Lane Positioning Error?

Scanning Error?

Dangerous Action?

Scoring: Pass, Marginal, Fail

Scoring Systems: 1 2 3 4 5

What type of errors can occur when driving? How many can you come up with?

How many of these errors are clearly separated?
Can some errors occur at the same time?
How are these defined?
Does everybody have the same knowledge of state driving laws?

Question #1

Can we develop a reliable and standardized way to measure driving errors that occur on performance based road tests for use with researchers and clinicians?
On-Road Assessment

Examples:
- Using Controls
- Left turn Errors
- Right turn Errors
- Attending to signs
- Lane Positioning
- Turn Lanes
- Speed/Reaction Time
- Visual Scanning
- Lane Changes
- Complex Intersections
- Rules of the Road
- Self Directed Driving
- Stopping at stop signs
- Forgets the instructions
- Can’t find way out of a parking lot

Development: Record of Driving Errors (RODE)

Operationally defined driving errors
Standardized scoring procedure
Strong inter-rater reliability (0.84-0.97 ICC)
Limitation: Training Time

- RODE has/is being used as one of the main outcome variables in a NIH Study investigations.
- Pilot work at University of Connecticut (Kevin Manning, PhD)
- Fitness to Drive Studies at Washington University


Multi-Domain Strategies (examples)

The 4 C’s:

N=161, hospital based driving evaluation program, outcome marginal and fail on road test. Mixed diagnosis in older adults with cognitive impairment, AD, PD, Stroke, Sleep Apnea...

O’Connor MG, et al. JAGS 2010; 58: 1104-8

Results

Scores of 9 or greater on the 4Cs identified 84% of participants who were at risk for poor performance. ROC=0.81 for pass vs. marginal and fail, 0.70 comparing pass and marginal to fail.

Question #2

Can we develop a brief combination of “clinician screens” for persons with dementia to predict who might pass/fail an on-road assessment and who may need to be referred on to CDE?

Study Design: Predicting Road Test Performance in Dementia (Probability Calculator)

Recruit and telephone screen Dementia sample n=99
Perform on the Road Assessment with outcome of pass/fail
Determine clinical test Predictors and predictive model for the individuals with dementia

Testing Protocol

Clinical Testing for Driving

Vision Assessment
Motor Assessment
Cognitive Screens
On-Road Assessment

Outcome Measure Road Evaluation 1 hour

[Carri, D. B., et al., 2011]
Demographics of Dementia Sample Based on Road Test Outcome

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Sample (N=99)</th>
<th>Pass Road Test (N=74)</th>
<th>Fail Road Test (N=25)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>74.2±2.9 (52.51)</td>
<td>73.4±3.9 (52.84)</td>
<td>74.7±2.9 (52.76)</td>
<td>0.49</td>
</tr>
<tr>
<td>Gender (%) M</td>
<td>63% Male</td>
<td>68%</td>
<td>61%</td>
<td>0.56</td>
</tr>
<tr>
<td>Education (years)</td>
<td>14±3.3 (8.20)</td>
<td>15.1±2.8 (8.20)</td>
<td>14.6±3.5 (8.20)</td>
<td>0.50</td>
</tr>
<tr>
<td>Race (%) AA</td>
<td>12% Mainly Caucasian</td>
<td>10%</td>
<td>13%</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Psychometric Measures of Dementia Sample Based on Road Test Outcome

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total Sample (N=99)</th>
<th>Pass Road Test (N=74)</th>
<th>Fail Road Test (N=25)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails B* (secs)</td>
<td>196.9±30.0 (42.29)</td>
<td>151.8±73.5 (42.51)</td>
<td>236.9±95.6 (41.51)</td>
<td>0.0002*</td>
</tr>
<tr>
<td>Ab-B Total* (N=99)</td>
<td>5.3±1.7 (2.8)</td>
<td>4.3±1.5 (2.7)</td>
<td>5.8±1.6 (3.8)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>MFVPT (# incorrect)</td>
<td>3.9±2.8</td>
<td>3.1±2.7</td>
<td>4.5±2.8</td>
<td>0.16</td>
</tr>
<tr>
<td>URB (msec)*) (N=56)</td>
<td>276.4±148.1</td>
<td>216.8±129.0</td>
<td>342.9±136.5</td>
<td>0.012*</td>
</tr>
</tbody>
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Clock Drawing Task (CDT)

Subjects are verbally instructed to draw a clock, put all the numbers in, and set the time at ten minutes after eleven. The instruction is also written and visible at the top of the page in 16-point font. Instructions may be repeated verbatim as needed. No cues are allowed. When the subject indicates they are finished, the question "Now tell me what time this clock says?" is asked. Self-correction is permitted.

AD8 Dementia Screening Interview

<table>
<thead>
<tr>
<th>Item</th>
<th>YES: A change</th>
<th>NO: No change</th>
<th>N/A: Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems with judgment (e.g. fails to; simple financial decisions, has difficulty remembering appointments)</td>
<td></td>
<td></td>
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<tr>
<td>Reduced interest in hobbies/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seeks questions, stories or statements</td>
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<td></td>
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<tr>
<td>Trouble learning how to use a tool, appliance or gadget (e.g. VCR, computer, microwave, remote control)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forgets correct month or year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty handling complicated financial affairs (e.g. balancing checkbook, income taxes, paying bills)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Difficulty remembering appointments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistent problems with thinking and/or memory</td>
<td></td>
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TOTAL AD8 SCORE

AD8 is a copyrighted instrument of the Alzheimer’s Disease Research Center, Washington University, St. Louis, Mo. The AD8 is a validated tool for clinical judgment.

ROC CURVE for Trails A, AD-8, CDT (AUC=.84 blinded n=99)
Fred

- Fred has mild AD. He is independent in his ADLs, and with meal preparation. He needs some assistance with his medications and has never been responsible for paying the bills of the house. He lives with his wife.
- Case Details:

Fred: Clinical Testing

Cognitive

Vision

Motor

Performance Base Road Assessment (Fred)
Betty

- Betty has dementia.
- She needs some assistance with her medications and for paying the bills of the house. She lives with her husband.
- Case Details:

Wilma

- Wilma has dementia. She is independent in her ADLs, and with meal preparation. She needs some assistance with her medications and has never been responsible for paying the bills of the house. She lives with her daughter.
- Case details:

Probability Calculator

Program in Occupational Therapy

Betty: Clinical Testing

Vision

Cognitive

Motor

Performance Base Road Assessment (Betty)

Probability Calculator

Program in Occupational Therapy

Should Betty have a driving assessment?

Should Wilma have a driving assessment?
Wilma: Clinical Testing

Vision

Cognitive

Motor

Performance Base Road Assessment (Wilma)

Extending into the Population Level

We are beginning to work with the state of Missouri Department of Motor Vehicles to improve testing (and standardized approaches) during licensure renewal for all drivers.

More to come......

References


Thought on Integrating Research, Clinical Practice, and Education.....

_Not everything that can be counted counts, and not everything that counts can be counted._

Albert Einstein