Fitness to Drive in Older Adults:
Do We Know When to Say When?

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DISCLOSURES (2015-Present)
• Funding Support
  • National Institute on Aging (NIA)
  • Missouri Department of Transportation
  • State Farm
• Consulting Relationships
  • TIRF
  • Medscape
  • AAAFTS
  • American Geriatric Society
  • University of Toronto
• Medical Director
  • Parc Provence/TRISL
• Drug Industry Sponsored Trials/Investment-Stock-Equity
  • None

PRESENTATION OBJECTIVES
Review the safety and crash statistics around older drivers
Review current approaches and tools that assist fitness to drive decisions in older drivers
(FIVE STEPS TO FITNESS TO DRIVE)
Meeting new challenges of technologies:
Vehicle interventions to improve safety
Question #1: True or False?
The majority of older adults no longer have an active driver’s license in the US after age 85 years due to medical impairments (e.g. stroke, dementia)….  

FALSE: But Barely….  
• Aging Demographics  
  • 40 Million Older Adults (5.5 >85)  
  • 34 Million Licensed Drivers (3>85)  
• Motor Vehicle Crashes  
  • 2010  
  • 4,079 older adults were killed 183,000 were injured  
  • 15 older adults killed and 500 injured in crashes on average every day  
https://www.fhwa.dot.gov/policyinformation/pubs/pl/pl11028/chapter4.cfm  
http://www.iihs.org/iihs/topics/t/older-drivers/fatalityfacts/older-people

Question #2: True or False?
The average medically impaired driver has an increased motor vehicle crash risk when compared to other age groups….
Question #3: True or False?
The risk of a medically impaired driver over 70 years of being injured in a crash has decreased over the past decade, likely due to better cars and roadways...

TRUE...
MOTOR VEHICLE CRASH VULNERABILITY BY AGE
**Question #4: True or False?**

Medically impaired drivers that put the most miles per year on the road are at the highest risk for a crash due to increased exposure...

FALSE, although the risk remains low...

Langford J. et al. 2006 Accident Analysis and Prevention, 28(3), pp. 574-578

**Question #5: True or False?**

The majority of older women remain active behind the wheel with very little time at the end of life without the ability to drive a car...

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Division of Geriatrics and Nutritional Sciences/Knight ADRC
FALSE...there is quite a time without wheels
Men over age 70 have about 6 yrs without driving. women 10 yrs
Older women at increased risk of serious injury in MVC, tend to lack confidence, higher risk for premature driving cessation
Osley et al, Monash University, Older Women and Driving, 2004

DEMENTIA AND DRIVING CESSION
• DESIGN: Retrospective cohort data from a community-based study of incident dementia. The Honolulu Heart Program and the Honolulu-Asia Aging Study.
• PARTICIPANTS: A total of 643 men who were evaluated for the incidence of Alzheimer's disease or other dementia between the fourth and the fifth examination of the Honolulu Heart Program.
• CONCLUSIONS: Dementia is a major cause of driving cessation.

SUMMARY OF DRIVING STATISTICS OLDER ADULTS
• Increasing Numbers of Older Drivers
• Increasing Prevalence of Chronic Disease and Demented Drivers
• More Potential Drivers with Multiple Medical Diseases/Meds
• Increased Morbidity and Mortality Rates in MVC's
• Increasing Exposure or Miles per Year for Aging Cohort
• The Most Vulnerable are Likely Low Mileage Drivers
• Low Mileage Drivers include those with physical/cognitive frailty
• Many older adults retire from driving
• Growing transportation burden for families, caregivers, and society to provide trips

http://www.iihs.org/iihs/topics/t/older-drivers/fatalitYfacts/older-people/2010
Which Lobes are Key For Driving?


How does CNS disease impact driving?

Ott BR and Daniels LA. Aging Health 2010; 6: 77-85

CLUES TO SPECIFIC NEURODEGENERATIVE DISEASES

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FITNES-TO-DRIVE
STAKEHOLDERS

- Patient
- Family and Friends
- Health Professionals
- Organizations
- Patrol Officers
- State DMV
- Insurance
- Community
- Federal/NHTSA

Driving Outcomes

- Cessation/Retirement
- Crashes
- Road Tests
- Simulators
- Others

Driving Outcomes:
Are Crashes All They Are Cracked Up To Be?
Case-Based Approach

- An 83 year old female presents with early AD
- Daughter raises concerns about driving given mother’s slowed reaction time, medications, and other medical conditions
- PMH: HTN, Type II DM, Anxiety Disorder (GAD)
- Medications:
  - Atenolol 50mg BID
  - Metformin 500g BID
  - Alprazolam .25 TID
  - Sertraline 25mg QD

Algorithm: Evaluating Driving Risk

- Evaluate for risk factors
- Level B evidence: Level C evidence
- Co-Morbidities
- Physical Examination
- Rate Primary Disease Severity
- Referral, Rehab, and/or Counseling

Fitness to Drive Steps

- Step 1: Driving History and Med Review
- Step 2: Examine Co-Morbidities
- Step 3: Physical Examination
- Step 4: Rate Primary Disease Severity
- Step 5: Referral, Rehab, and/or Counseling
Signs of Unsafe Driving: At the Crossroads (*stop driving immediately)

http://www.thehartford.com/advance50/publications-on-aging

Step 1a: Driving History
- Driving Behaviors (lost x 1)
- Informant Rating (fair)
- Exposure (low)
- Personality (no change)
- Violations (none)
- Crashes (none)
- Cognitive Impairment
- Functional Impairment
- Others


Step 1b: MEDICATION REVIEW
- Narcotics
- Barbituates
- Benzo’s (present)*
- Antihistamines
- Antidepressants
- Antipsychotics
- Hypnotics
- Alcohol
- Muscle Relaxants
- Antiemetics
- Antiepileptic
Step 2: Co-Morbid Conditions
Clinician Medical Guidelines
Updated, Evidenced-Based
Also Refer to Your Own State Laws/Statutes

Hypersomnolence/Epworth Sleepiness Scale >10,
Depression/PHQ >10, Visual Acuity OU 20/40 , HHIE>26
OUR CASE: ESS 8, PHQ 12, VA 20/40 corr, HHIE 10, HgbA1C 6.5

Step 3a: Physical Examination
- Visual Acuity
- Visual Fields
- Contrast Sensitivity
- Motor Examination
  - Muscle Strength
  - Range of Motion
- Cognitive/Functional Testing
  - Clock Drawing Task
  - Trail Making Tests A
- Functional Exam
  - AD-8

Step 3b: Cognitive/Functional Screens
Trails A  AD-8  Clock Drawing
Trailmaking Test A

Example A

Trail Making Test Part A

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.

Time: One hand points to 2 (or symbol representative of 2)

Numbers: Inside the clock circle

Spacing: Numbers spaced equally or nearly equally from each other


Alzheimer’s Detection: AD8

TOTAL AD8 SCORE

Remember: “Yes, a change” indicates that you think there has been a change in the last several years caused by cognitive (thinking and memory) problems.
**Probability Calculator of Failing Road Test: Dementia**

<table>
<thead>
<tr>
<th>Probability of Failing Driver Test</th>
<th>t/β</th>
<th>AD8TOT</th>
<th>CDTf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.7594</td>
<td>0.0233</td>
<td>0.3663</td>
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</table>

**Observed Value**

<table>
<thead>
<tr>
<th>Score</th>
<th>Probability</th>
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<tr>
<td>0.0313</td>
<td>0.5208222</td>
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</table>

**Our Case:**

- Trail Making Test A (TrlA) of 57 secs
- AD-8 Total (AD8TOT) score of 3
- Clock Drawing Task-Freund (CDTf) of 4

**Probability of Road Test Failure:** 51%

Carr DB, et al. JAGS, 2011

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**STEP 4: Rating Dementia Severity**

<table>
<thead>
<tr>
<th>非常轻度</th>
<th>弱度</th>
<th>中度</th>
<th>严重度</th>
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<tbody>
<tr>
<td>Diagnostic Criteria</td>
<td>MMSE 26+</td>
<td>21-25</td>
<td>14-20</td>
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<tr>
<td>Functional Impairment</td>
<td>无</td>
<td>轻度</td>
<td>中度</td>
</tr>
<tr>
<td>社会功能</td>
<td>轻度</td>
<td>中度</td>
<td>严重</td>
</tr>
<tr>
<td>交流功能</td>
<td>轻度</td>
<td>中度</td>
<td>严重</td>
</tr>
<tr>
<td>认知功能</td>
<td>轻度</td>
<td>中度</td>
<td>严重</td>
</tr>
<tr>
<td>其他功能</td>
<td>轻度</td>
<td>中度</td>
<td>严重</td>
</tr>
</tbody>
</table>

**Our Case:** MMSE 24, Short Blessed Test 6, CDR=0.5

**Very Mild Dementia**

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**What Are The Next Steps?**

- **Green Light**
  - No red flags
  - Monitor at intervals
  - Full speed ahead!
- **Yellow Light**
  - Red flags/co-morbid illnesses
  - Decline in traffic skills
  - Deficits on office screening
  - Consider referral and caution!
- **Red Light**
  - Driving Retirement/Counseling
  - Stop!
Step 5: REFERRAL SOURCES

- Primary Care Physician
- Subspecialist
- Neuropsychologist
- Occupational Therapists
- Physical Therapists
- Speech Therapists
- Case Managers
- Others

Driving ability after a stroke: evaluation and recovery. [Review]
Murie-Fernandez M; Iturralde S; Cenoz M; Casado M; Teasell R.

A Driver Rehabilitation Specialist

- One who plans develops, coordinates and implements driving services for individuals with disabilities
- These individuals are often Occupational Therapists with specialized training in driver assessment and rehabilitation

Case cont.

- No history of prior poor driving performance
- She has a very mild dementia, CDR=0.5
- It is expected to progress
- Alprazolam was tapered off and sertraline
- Visual acuity was 20/40 corrected/no field cuts
- She passed her initial OT/CDRS road test
- She was scheduled for a f/u at 6 months with nurse practitioner, one year with physician
- At six months there was no change in status
Case cont. f/u one year

• She had one minor crash when backing into a car in a parking lot
• The daughter noted more cognitive and functional decline (higher order IADL’s)
• The probability calculator for predicting road test failure was performed
• Based on the history of progression, calculator score and history of at-fault crash, driving retirement was suggested
• Patient resistant to driving cessation
• Consider referral to social services/DMV

Probability Calculator of Failing Road Test: Dementia
One year follow up

<table>
<thead>
<tr>
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<th>Intercept</th>
<th>AD8TOT</th>
<th>CDTf</th>
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</thead>
<tbody>
<tr>
<td>coefficient</td>
<td>0.7596</td>
<td>0.0283</td>
<td>0.3643</td>
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<tr>
<td>Observed Value</td>
<td>73</td>
<td>5</td>
<td>2</td>
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</table>

Our Case:
- Trail Making Test A (TrlA) of 72 secs
- AD-8 Total (AD8TOT) score of 5
- Clock Drawing Task-Freund (CDTf) of 2
- Probability of Road Test Failure: 91%

Carr DB, et al. JAGS, 2001

REMOVING THE RESISTANT DRIVER

• Ask physician to "prescribe" driving retirement orally/writing
• Focus on other medical conditions as the reason to stop driving
  • (e.g. vision too impaired, reaction time too slow)
• Use a contract (see THE HARTFORD At the Crossroads guide)
• Vehicle-Related Tactics
  • Hiding/locking down keys
  • Replacing keys
  • Do not repair the car/ send car for "repairs" but do not return
  • Remove the car by loaning, giving or selling
  • Disable the car
• Discuss financial implications of crash or injury
• Revoke license
When Should You Refer to the Licensing Authorities?

Missouri has voluntary reporting law, anonymity, confidentiality. Know your own state law and statutes. Consider your own policy with legal advice.

The Importance of the Automobile

- The Transportation Method of Choice
- Autonomy
- Identity
- Social Connectedness
- Psychological and Physical Health Correlates
- Private cars account for over 90% of trips made by seniors

Mobility Counseling

Transportation Alternatives

- St. Louis Options
- Social Work Referral
- CORP
- Call-A-Ride
- Good Shepherd
- Metro
- Bus
- Taxi
- ITNAmerica
- Other
SUMMARY: STEPS TO CONSIDER

- Consider driving in the context of the disease
- Consider involving your physician or specialist
- Consider referral to a driving clinic
- Consider referral to the state DMV’s
- Consider list of resources/handouts
- Consider self-help courses (AARP, AAA, etc)
- Consider transportation alternatives

A MODEL OF DRIVING BEHAVIOR

MyCarDoesWhat.org National Safety Council

- Back up Camera
- Anti-lock brake system
- Blind Spot Monitor
- Automatic Braking
- Lane Departure
- Tire Pressure Monitor
- Adaptive Cruise Control
- Auto Parallel Parking
- Back-up Warning
- Bike/Ped Detection
- Brake Assist
- Push Button Start
- Rear Cross Alert
- Curve Speed Warning
- Drowsiness Alert
- Electronic Stability Control
- Forward Collision Warning
- High Speed Alert
- Hill Descent Assist
- Hill Start Assist
- Lane Keeping Assist
- Left Turn Crash Avoidance
- Obstacle Detection
- Parking Sensors
- Sideview Camera
- Traction Control

https://mycardoeswhat.org
Rearview Camera Technology

200 people killed each year when reversing
15,000 injured
Sadly, most events are parents and their kids
NHTSA made it mandatory for new cars May 2018
Requires 10 foot x 20 foot zone behind vehicle
Automakers did not fight this one...cost modest
$50 for camera or $150 for camera and screen
Less than 1% of purchase price
Spurred on my law suit from Consumers Union and Kids
Transportation Safety Act of 2007


Ergonomics

Comfort Technology

Adjustable steering wheels
Adjustable pedals
Keyless entry and ignition
Multiposition heated and cooled power seats with memory
Customize instrument panel and reduce clutter
Motorized trunk lids and liftgates
Top Technologies for Mature Drivers: AARP
http://www.aarp.org/home-family/getting-around/driving-resource-center/top-ten-tech/
Smart features for older drivers: AAA
http://seniordriving.aaa.com/SmartFeatures


Questions Posed by Dr. Coughlin

- How do we safely introduce these increasingly intelligent ‘autonomous systems’ to the driver?
- What is the impact on insurer underwriting that must address the possible paradox of active safety systems introducing new risks?
- Is driver education not just for kids anymore - do new vehicle technologies demand lifelong driver education?
- How do vehicle designers and engineers manage the marriage between consumer electronics and the dashboard to give drivers the mobile lifestyles they may desire but not the distractions they may introduce?

Top Technologies Requested by Older Drivers

Blind Spot Warning Systems
Crash Warning Systems
Emergency Response Assistance Systems
Drowsy Driver Alerts
Reverse Monitoring Systems

Only 1/3 in survey report they have these technologies

Understanding the Future of Mobility

Three trends shaping personal and commercial mobility
1. On-Demand Mobility
2. Driverless/Electric Vehicles

On-Demand Mobility
- based on mobile app/ease of scheduling and payment
- ride sharing/car sharing global shift away from personal ownership to shared in-demand model
- cost of ownership, commute times, limits on infrastructure expansion, converse resources, cut greenhouse gases, millennial relationship with cars
- India, only 5% own cars and roads are already jammed

https://techcrunch.com/2019/01/08/understanding-the-future-of-mobility/
https://www.zacks.com/stock/news/207881/who-are-ubers-biggest-competitors
Understanding the Future of Mobility

Three trends shaping personal and commercial mobility
1. On-Demand Mobility 2. Driverless/Electric Vehicles

Driverless Vehicles
- Google, Apple, Tesla, Volvo, Mercedes, Ford
- Not consumer driven but economic on-demand mobility
- Uber CEO put in order for 500,000 Tesla cars
- Removing driver in on-demand model less expensive
- Safety regulations and crash data will slow progress
- Cost initially will limit availability
- Insurance coverage another barrier

https://techcrunch.com/2015/08/08/understanding-the-future-of-mobility/

Understanding the Future of Mobility

Three trends shaping personal and commercial mobility
1. On-Demand Mobility 2. Electric Vehicles

Electric Vehicles
- Concerns about greenhouse gas emissions
- Gas price volatility
- Advances in battery and electric motor technologies
- Driving by on-demand mobility
- Electric motors far more dependable, less maintenance, longer life expectancies, cheaper to operate
- Designed to operate 24/7/365, not sit in a garage

https://techcrunch.com/2015/08/08/understanding-the-future-of-mobility/

Autonomous Driving

Smart Cars
Super Cruise-Cadillac
Traffic Jam Assist-Ford
Google Car-Lexus
Compact Electric Cars-Nissan, BMW
Urban Transport Cars-London, Dubai

Understanding the Future of Mobility

Benefits
- 80% reduction in cost of transportation
- Reduced pollution
- Reduced stress and road rage
- Dramatic decrease in accidents and traffic deaths
- Gaining back lost time to commuting
- Increase productivity
- Freeing up lanes by eliminating park cars
- Reclaiming home space allocated to home garages
- Leaders of on-demand mobility need to build trust with; consumers, regulators, insurers, investors

https://techcrunch.com/2015/08/08/understanding-the-future-of-mobility/

Different Perspectives

http://www.garageconversion.org/garage-conversion-gallery/design-to-energy/

Why is the need for research urgent?

Baby Boomers are Coming!!!
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<tr>
<td>MoDOT Funded Team WUSTL</td>
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<tr>
<td>Peggy Barco, MS, OTR/L, BSW</td>
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<tr>
<td>PI and Co-PI WUSM</td>
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<tr>
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<tr>
<td>Program of Occupational Therapy</td>
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<tr>
<td>Mike Wallendorf, PhD</td>
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<td>James Stowe, PhD</td>
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<td>• David Carr, MD</td>
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<tr>
<td><a href="mailto:dcarr@wustl.edu">dcarr@wustl.edu</a></td>
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