Will a Driverless Ms. Daisy Make Medical Fitness to Drive Obsolete?

David B. Carr, M.D
Alan A. and Edith L. Wolff Professor of Geriatric Medicine
Department of Medicine and Neurology
Washington University at St. Louis
Medical Director, The Rehabilitation Institute of St. Louis

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 are available to 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
  - 2015
    - 46 Million Older Adults (5.5 >85)
    - 40 Million Licensed Drivers (3>85)
  - 2050
    - 86 Million Older Adults
    - 66 Million Licensed Drivers

- Motor Vehicle Crashes
  - 2014
    - 5,700 older adults were killed
    - 236,000 were injured
    - 15 older adults killed and 500 injured in crashes on average every day


Question #2: True or False?

The average medically impaired driver has an increased motor vehicle crash risk when compared to other age groups....
FALSE: DEPENDING ON YOUR PERSPECTIVE


Department of Medicine and Neurology
Division of Geriatrics and Nutritional Science/Knight ADRC

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

http://www.iihs.org/iihs/topics/t/older-drivers/fatalityfacts/older-people/2010
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...

Nasvadi GC and Wister A. Do Restricted Driver’s License Lower Crash Risk Among Older Drivers. The Gerontologist 2008 49; 474-484.

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...
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
Oxley et al, Morningside University, Older Women and Driving, 2004

DEMENTIA AND DRIVING CESSATION

• 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
• 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 Daniello LA. Aging Health 2010; 6: 77-85

CLUES TO SPECIFIC NEURODEGENERATIVE DISEASES

Alzheimer’s Disease

Rapidly evolving dementias

Vascular dementia

Lewy body dementia

Frontotemporal dementias

Temporal lobe dysfunction

Speech, Frontal Gyrus

Cognitive decline

Behavioral changes
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

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
DRIVING HISTORY

- SEATBELT USE
- CRASH WORTHY CAR
- LEFT HAND TURNS
- MULTI-TASKING
- VIGILANCE
- AVOIDING RUSH HOUR
- AVOIDING POOR WEATHER
- AVOIDING NIGHT TIME DRIVING
- AVOIDING HIGH RISK INTERSECTIONS
- RISK OF HAVING PASSENGERS
- ALCOHOL and AGING

Signs of Unsafe Driving: At the Crossroads (*stop driving immediately)

- Difficulty recognizing a stop sign
- Confusion at ends
- Falling off
- Violating traffic signs
- Confusing the gas and brake pedals

Step 1a: Driving History

- Driving Behaviors (lostx1)
- 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 (current)
- Antihistamines
- Anti-depressants
- 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**

---

**Trails A**

- **Alzheimer's Detection: ADB**

---

**Clock Drawing**

- **Numbers**
  - Inside the clock circle
  - Only numbers 1-12, no duplicates or omissions

---

---

---
Alzheimer’s Detection: AD8

Reference: Yes, a change, indicates that you think there has been a change in the last several years caused by cognitive (thinking and memory) problems.

Field A: Reduced interest in hobbies/activities.

Field B: Difficulty handling complex financial affairs (e.g., balancing checkbook, filing income tax returns).

Field C: Difficulty remembering appointments.

Field D: Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control).

Field E: Forgets correct month or year.

Field F: Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control).

Field G: Consistent problems with thinking and/or memory.

TOTAL AD8 SCORE

Probability Calculator of Failing Road Test: Dementia

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%

STEP 4: Rating Dementia Severity

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

Very Mild Dementia
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; Casado M; T 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
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 added
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

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

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%

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
**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/filing 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
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
• Uber
• 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

### 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
  - www.aarp.org/home-family/getting-around/driving-resource-center/top-ten-tech/
- Smart features for older drivers: AAA
  - seniors.aaa.com/mobility-independence/car-buying-maintenance-assistive-accessories/

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

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?
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

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

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
**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/garage-to-room/
Why is the need for research urgent?

Fitness-to-Drive in Older Adults
Funded by the Division of Highway Safety/MoDOT 2007-2018

MoDOT Funded Team WUSTL
Peggy Barco, MS, OTR/L, BSW
PI and Co-PI WUSM
Assistant Professor
Program of Occupational Therapy
Mike Wallendorf, PhD
Senior Statistical Analyst
Annie Harmon, PhD
Instructor of Medicine
NIH: Roe, Bhorade, Betz, Ott

MoDOT Funded Team WUSTL
Annie Johnson
Project Coordinator, CCS
Katie Rutowski, BS, OTR/L, RA
Lily Hu, PhD
System Analyst and RedCap Database
Program of Occupational Therapy
TRISL
Kathy Dolan, OTR/L
Independent Drivers, LLC
Stephen Ice, MOT/L, CDRS

Contact Information/Discussion
See Handouts by Table
Geriatric Assessment Clinic 314-286-2700
Memory Diagnostic Center 314-286-1967
Memory and Aging Project 314-286-2885
DrivingConnections Clinic 314-658-5800