Driving Under the Influence of Dementia

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Older drivers: Why the concern?

- Older adults are generally safe drivers
  - On average, older adults drive fewer miles per year than other age groups.
  - Less exposure means less crash risk.
  - Many older adults limit driving exposure voluntarily (e.g., by avoiding travel during rush hour or bad weather, driving in daylight only)

1/6/14: Walpole, MA. 83-year-old Driver

2/17/15: 92 y.o Driver Hits 9 Vehicles
Mayville, Wisconsin
Aging brings the following changes that affect driving:

- **Vision and visual perception**
- **Physical function**
- **Cognition**

### Cognition and Safe Driving

- **Memory**
  - May result in failure to find destinations, but not an accident risk in itself
- **Visual attention and perception**
  - Limited field of view and visual perception problems increase traffic accident risk
- **Executive function**
  - Impaired judgment and decision making increases traffic accident risk

### Incipient AD and Motor Vehicle Crashes

- **Autopsy studies**
  - 50% and 72% of drivers aged 65-75y and 75y+, respectively, had neuritic plaques
  - Among older drivers who died in car accidents, 47%-53% (depending on cutpoint used) had neuritic plaque scores indicating/suggesting histologic AD.
  - 57% drivers who died in an accident had sparse neuritic plaque pathology vs. 25% of controls who died of other causes.

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Preclinical AD

- Clinically assessed as nondemented during life, but neuropathological AD at autopsy.1,2
- Signature brain lesions of AD: plaques (amyloid-beta, Aβ) & tangles (tau)
- Preclinical AD measured during life using biomarkers
- ~30% in U.S. aged 65y+ have preclinical AD, based on autopsy or biomarker evidence AD.3,4

Katzman et al., 1988.
Crystal et al., 1988.
Morris et al., 2010.
Jansen et al., 2015.

Driving Outcomes in Pre-Clinical AD

- Survey study of 104 older drivers with and without dementia over past 3 years who had undergone amyloid PET1
  - Driving risk (MVAs and violations) is strongly related to accumulating amyloid on positron emission tomography, and that this trend is evident in the preclinical stage of AD.
- Road test study of 129 older drivers (104 longitudinally over 2-4 yrs) with and without preclinical AD
  - At baseline, CSF biomarkers of amyloid and tau as well as brain amyloid burden on PET were associated with more driving errors.2
  - CSF biomarkers of amyloid and tau predicted time to a rating of marginal or fail on the driving test over 2-4 years.3

Roe CM. Alz Assoc Disorders. 31:69-72, 2017
Roe CM. Alz Dem. 3:74-82, 2017

Alzheimer’s Disease and Hazardous Driving: Tip of the Iceberg?

Mild Cognitive Impairment
Preclinical AD

Driving under the Influence of Dementia

<table>
<thead>
<tr>
<th>Crash Risk Associated with Selected Medical Conditions: Relative risk of crashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dementia</td>
</tr>
<tr>
<td>Alcohol abuse &amp; dependence</td>
</tr>
<tr>
<td>Schizophrenia</td>
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<tr>
<td>Sleep apnea</td>
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<tr>
<td>Epilepsy</td>
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<tr>
<td>Cardiovascular disease</td>
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<tr>
<td>Psychotic disorder</td>
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<tr>
<td>Diabetes mellitus</td>
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<tr>
<td>Musculoskeletal/ motor disability</td>
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<tr>
<td>Vision disorder</td>
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</tbody>
</table>

Charlton J. Monash Clin Acc Res Center Report, 2004

Crash Risk Associated with Selected Medical Conditions: Relative risk of crashing
Driving under the Influence of Dementia

DRIVING WITH ALZHEIMER’S DISEASE: HOW MUCH OF A PROBLEM IS IT?
Common Driving Errors in Alzheimer’s Disease

- Forgetting where driving
- Difficulty navigating
- Failure to anticipate traffic situations
- Reduced problem-solving around complex driving situation
- Poor lane keeping
- Failure to check blind spots

Alzheimer’s Association Position Statement on Driving

- “The diagnosis of Alzheimer’s disease is not, in its own, a sufficient reason to withdraw driving privileges.”
- “The determining factor in withdrawing driving privileges should be an individual’s driving ability.”

Driving and Dementia: State Policies

<table>
<thead>
<tr>
<th></th>
<th>Rhode Island</th>
<th>California</th>
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</thead>
<tbody>
<tr>
<td>Age based renewal policy</td>
<td>Age 75+ in person every 2 years instead of 5</td>
<td>Age 70+ in person every 5 years</td>
</tr>
<tr>
<td>Mandatory medical reporting</td>
<td>No</td>
<td>Yes (to health dept. --&gt; DMV)</td>
</tr>
<tr>
<td>Immunity</td>
<td>Yes</td>
<td>Yes; liable if does not report</td>
</tr>
<tr>
<td>Anonymity</td>
<td>Yes/No</td>
<td>Yes/?No</td>
</tr>
</tbody>
</table>

Reuben DB. WJM 164:111-121, 1996
Effectiveness of Mandatory Reporting Statutes

- In a survey of California emergency physicians, when asked how often they would report patients described as having symptoms of dementia and episode of LOC, 83% responded "never." 1
- A retrospective (2004-2009) study identified 176,066 older driver crash-related hospitalizations 2
  "No evidence of the benefits of mandatory physician reporting requirements on driver crash hospitalizations, suggesting that physician mandates do not yet yield significant older driver safety benefits, possibly to the detriment of older driver's well-being and independence." 1

2. Agimi A. Gerontologist Jan 9 Epub, 2017

Steps to Driving Cessation

- Discuss the risks, but also recognize the loss of independence in candid discussion with driver
- Get support from family
- Arrange alternative transportation
- Reduce the need to drive
  - Medicine and groceries delivered
  - Have hairdresser make home visits
  - Schedule people to visit regularly
  - Arrange for friends to transport to church, social events

Enforcement of Decision

- Three standard methods – none actually prevent driving
  - License revocation
  - Vehicle registration revocation
  - Insurance cancellation
- If the individual refuses to stop
  - Disable the car
  - File down the keys
  - Take away the car
  - Notify the Department of Motor Vehicles.
- Ethical concerns: Violation of doctor patient relationship
- Legal concerns: State obligations and protections

STANDARDS FOR MONITORING DRIVING SAFETY

1. Dementia and Driving. Go to: http://www.alz.org/care/alzheimers-dementia-and-driving.asp#planning
Longitudinal Studies of Drivers With Dementia

- Converging evidence from two longitudinal studies of drivers with dementia\(^1,2\) suggest that:
  - Many patients with mild dementia can pass a road test.
  - 42/61 (69%) based on combined data.
  - Close monitoring and regular assessment (q 6 months) of driving competence.
  - Patients with mild dementia may continue to drive safely for up to a year.
  - Plan for early and gradual cessation rather than immediate termination of driving privileges in this group.


Monitoring: Caregiver

- Education / www.thehartford.com/talkwitholderdrivers
- Begin the conversation early and repeat periodically.
- Create opportunities to observe driving.
- Keep a record of driving habits.
- Discuss concerns with your healthcare provider.
- Actively pursue driving evaluations.

Risk Reduction: Physician Role

- Maximize functioning
  - Vision
  - Hearing
  - Joint mobility
- Medication review
  - Avoid sedating medications.
- Driver safety courses
  - AAA
  - AARP
- Cognitive training
  - AAA: Drivesharp program
- Referral to driving rehabilitation specialist

The Road Test

- Closed course in specially fitted vehicle vs open road.
- Administered by a professional
  - Driving rehabilitation specialist/occupational therapist
  - Driving school instructor.
  - State motor vehicle registry official.
- "Gold standard" but valid test of driving skill in which situation?
  - Most patients with Mild Cognitive Impairment or mild Alzheimer’s disease pass.
  - Good predictor of crashes?
  - Unable to see how individual reacts to dangerous situations.
  - Impact of anxiety/unfamiliarity with car and course on performance.

Driving Safety Research Methods

- Provides ordinal
  - crash risk info
  - Precise knowledge
  - about crash risk
  - Information about important
  - situations that lead to crashes
- Empirical
  - Data Collection
  - (test tracks & simulators)
  - "Natural" driver behavior
  - Detailed pre-crash/crash info
  - Distraction
  - Drowsiness
  - Aggressive driving
  - Driver errors
  - Vehicle dynamics
  - Potential validation of surrogate measures
- Naturalistic
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\(0.05 \text{ re-test with wife in car (AD subject)}\)

\((\text{Control subject})\)
Comparisons of Crash Frequency Per Mile Over Past Three years

- Crash frequency = 14/103 drivers
  - .05 crashes per driver per year
- Crashes per mile per year compared to road test score
  - $R^2 = .12, p = .0001$
- Crashes per mile per year compared to home driving CDAS score
  - $R^2 = .01, p = .44$

Summary

- Alzheimer’s disease affects skills necessary for driving, even at the earliest stages of the disease, but many can continue to drive safely for a period of time.
- Road test performance is a reasonable proxy for estimating fitness to drive for older individuals.
- There is no “gold standard” for assessment of risk, so we must still rely on monitoring by health practitioners and family.
- Plan for gradual cessation and alternative transportation

Video Feedback Intervention to Enhance the Safety of Older Drivers With Cognitive Impairment

Braun R, Ott, Jennifer D. Davis, Kimberly Baddley

OBJECTIVE. To evaluate the use of a technology to assess driving performance and provide feedback to drivers in an effort to reduce crashes among older drivers.

METHOD. A randomized, controlled trial involving 46 older drivers was conducted in a simulated driving laboratory. The drivers were assigned to either the intervention or control group, and they drove the same courses twice, once without intervention and once with intervention.

RESULTS. The intervention group had fewer crashes than the control group, with a significant reduction in crashes among individuals with cognitive impairment.

CONCLUSION. The technology used in this study may be a valuable tool for enhancing safety among older drivers with cognitive impairment.

What is DriveCam®?
Unsafe Driving Events

**Event Triggers**
- Acceleration
- Braking
- Cornering
- Uneven Road
- Other

**Risk Categories**
- Distractions
- Poor Awareness
- Driver Conduct Fundamentals
- Following Too Close
- Drive Condition
- Traffic Violation
- Other Concerns

- Not Looking Far Ahead (4)
- Not Scanning Intersection (3)
- Mirrors Not Checked (3)
- Rolling Stop (3)
- Stop Sign (5)
- Red Light (5)
- Speeding (5)

Rating System

- 0: Triggered by an uneven road OR good driving behavior
- 1-5: No risk; normal driving behavior
- 6-10: Risky behavior
- >10: Extremely Risky

Study Design

- Screening
- Consent/Office Visit
- Camera Installation
- Monitoring: Months 7-9 (no feedback)
- Intervention: Months 4-6 (DVD, letters, and phone call feedback)
- Baseline: Months 0-3 (no feedback)
- Final Summary Report
- Camera Un-installation

Sample Videos:
Positive and Negative Events

Mean Total Unsafe Driving Events (per 1,000 miles)

- Low risk drivers with <5 unsafe driving events/week: 3 events/1k miles = 4
- High risk drivers with >3 unsafe driving events/week: 5-6 events/1k miles = 7

Driving Interventions: Risk Reduction

- In-car video monitoring and feedback shows promise for helping drivers with mild cognitive impairment and Alzheimer’s disease
- Monitoring for safety to help determine need for driving cessation
- Improving driving safety for those who continue to drive
- Current controlled trial of monitoring only vs. monitoring with feedback
- Funded by the Alzheimer’s Association
- Three year study of 60 drivers with MCI or mild AD followed over 1 year
Thank you and safe driving!