



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

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*Department of Medicine and Neurology*

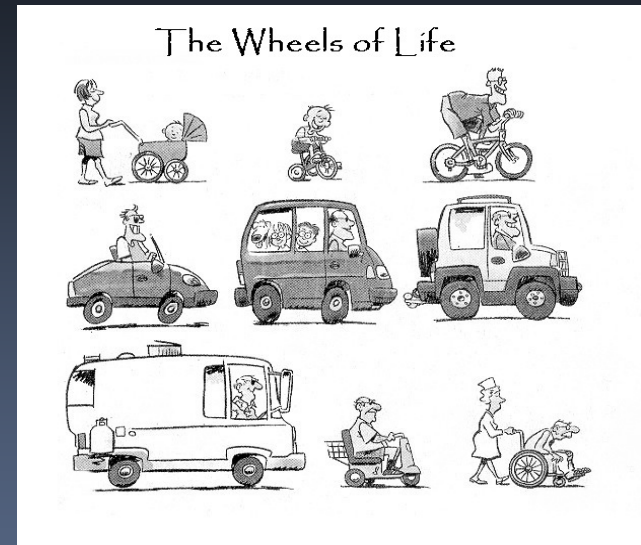
*Washington University at St. Louis*

*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
  - AAFTS
  - American Geriatric Society
  - University of Toronto
- Medical Director
  - Parc Provence/TRISL
- Drug Industry Sponsored Trials/Investment-Stock-Equity
  - None

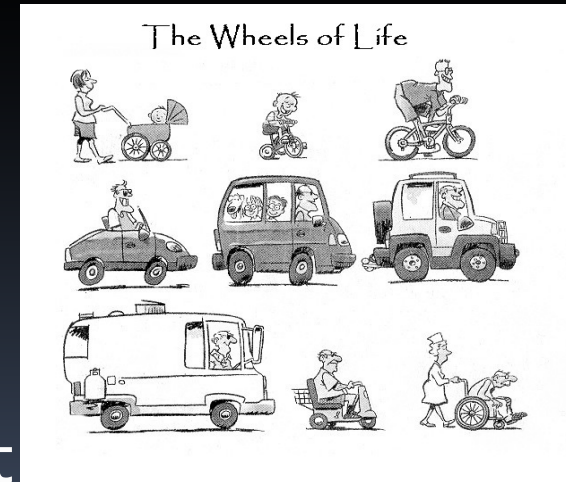


# PRESENTATION OBJECTIVES

Review the safety and crash statistics around older drivers

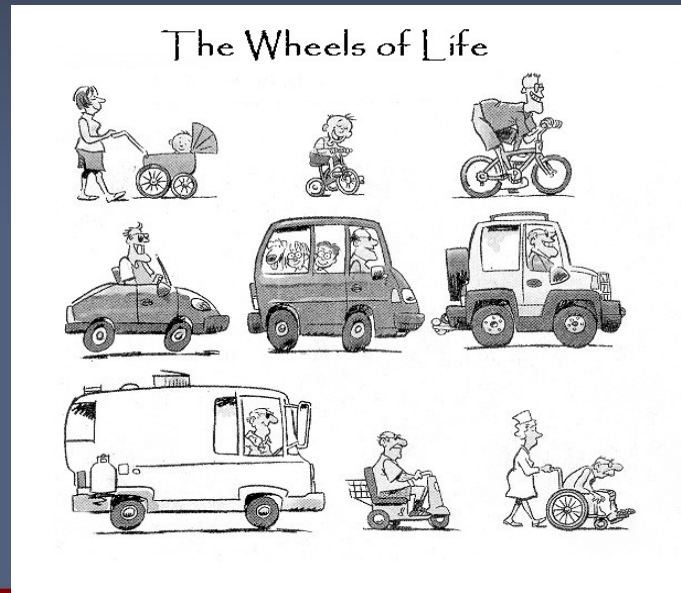
Review current approaches and tools that assist fitness to drive decisions in older drivers  
(FIVE STEPS TO FITNESS TO DRIVE)

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

- 2015

- 46 Million Older Adults (5.5 >85)
- 40 Million Licensed Drivers (3 >85)

- 2050

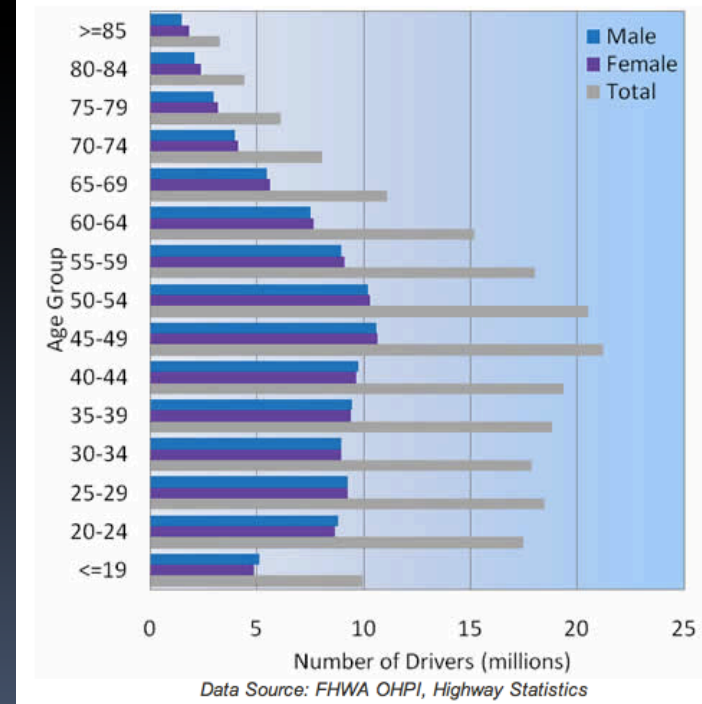
- 86 Million Older Adults
- 66 Million Licensed Drivers

## • 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

Figure 4-3: Licensed Drivers by Age and Gender: 2009



National Highway Traffic Safety Administration (NHTSA). Traffic Safety Facts 2010: Older Population. Washington, DC: USDOT; 2012. Available at:

<http://www-nrd.nhtsa.dot.gov/Pubs/811640.pdf>. Accessed August 13, 2012.

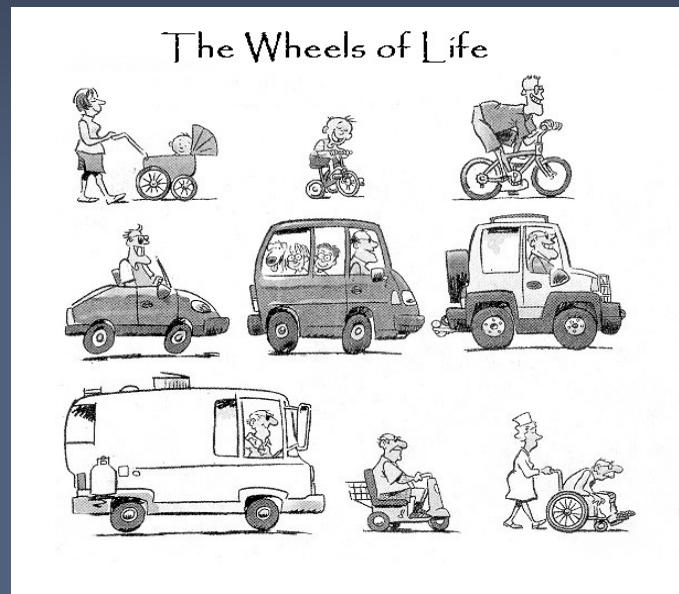
<https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter4.cfm>

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

[https://www.cdc.gov/motorvehiclesafety/older\\_adult\\_drivers/index.html](https://www.cdc.gov/motorvehiclesafety/older_adult_drivers/index.html)

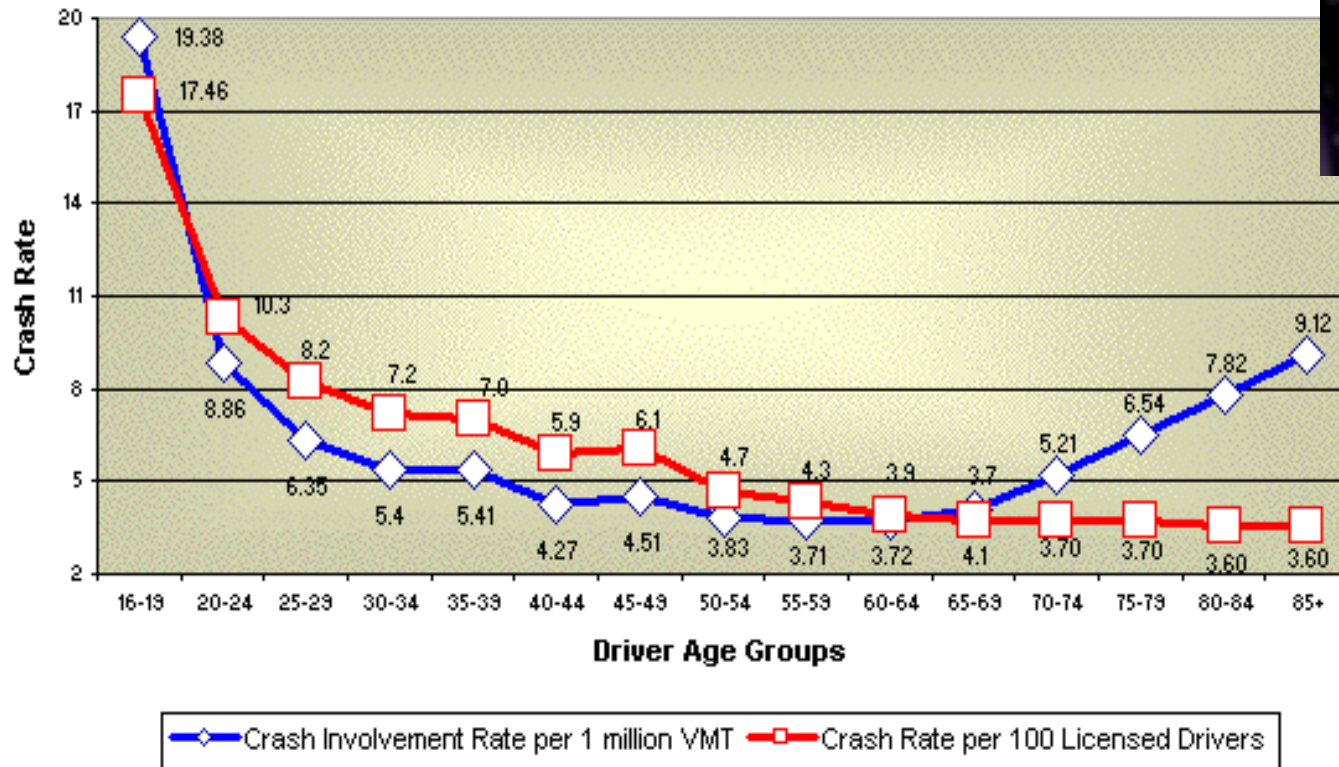
# Question #2: True or False?

The average medically impaired driver has an increased motor vehicle crash risk when compared to other age groups...



# FALSE: DEPENDING ON YOUR PERSPECTIVE

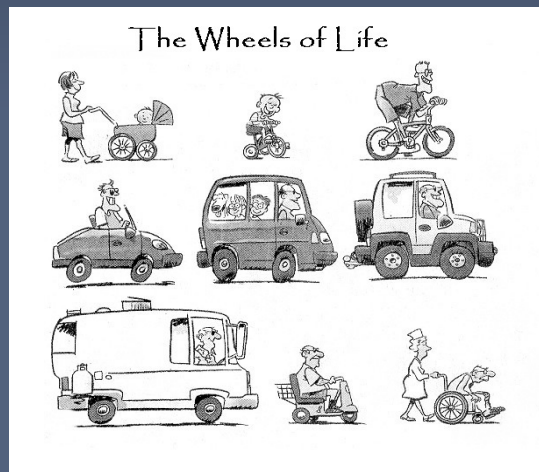
**Figure 3: Accident Involvement Rate Age Group Comparison by Licensed Drivers and Vehicle Miles Traveled**



[http://search.cga.state.ct.us/dtSearch\\_lpa.html](http://search.cga.state.ct.us/dtSearch_lpa.html)

# Question #3: True or False?

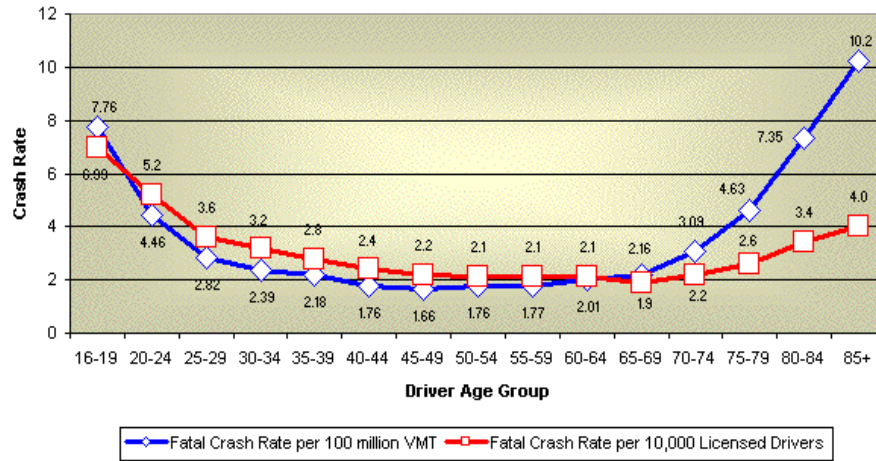
The risk of a medically impaired driver over 70 years of being injured in a crash has decreased over the past decade, likely due to better cars and roadways...





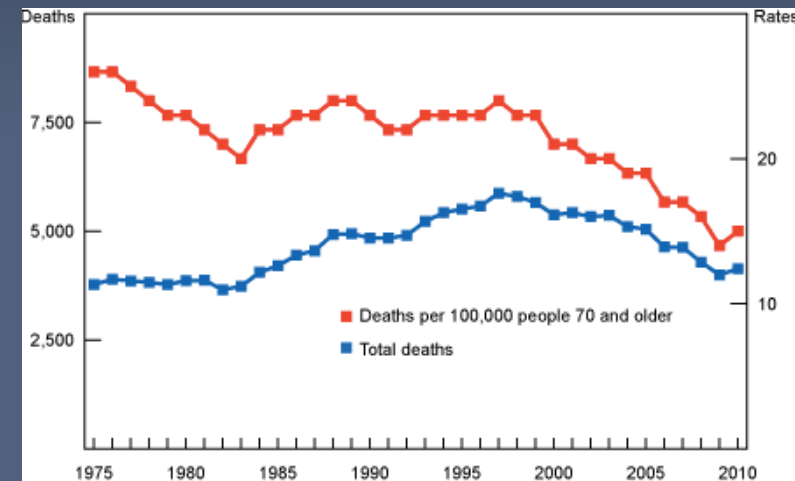
# TRUE... MOTOR VEHICLE CRASH VULNERABILITY BY AGE

Figure 4: Fatal Accident Rate Age Group Comparison by Licensed Drivers and Vehicle Miles Traveled



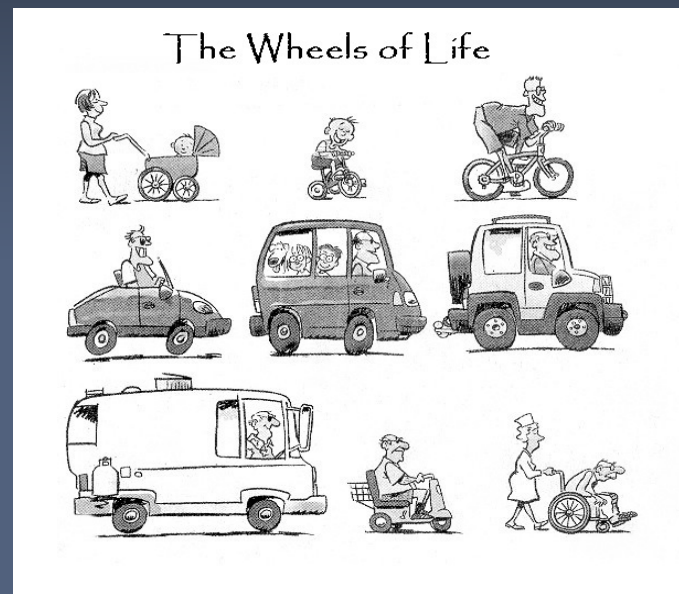
[http://search.cga.state.ct.us/dtSearch\\_lpa.html](http://search.cga.state.ct.us/dtSearch_lpa.html)

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

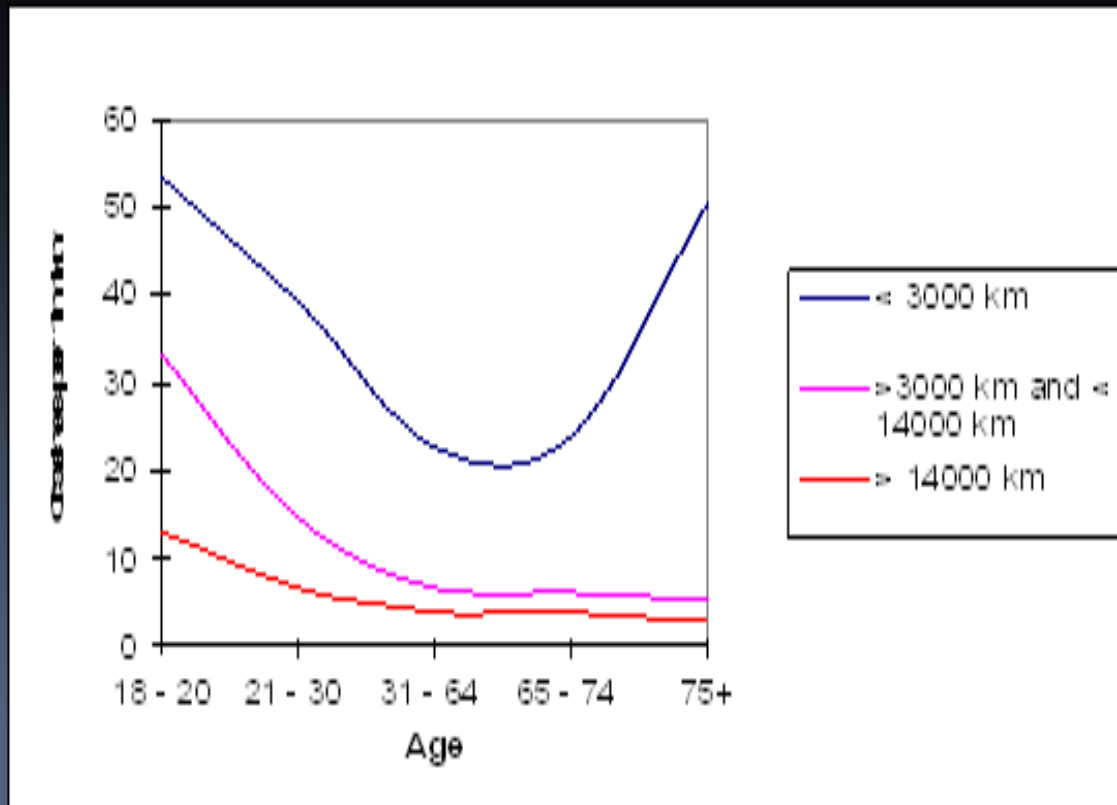


# Question #4: True or False?

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...



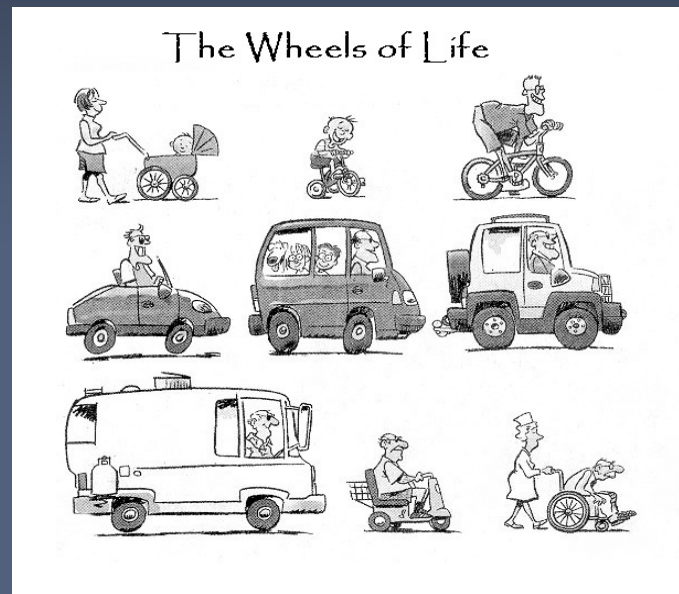
# FALSE, although the risk remains low...



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

Foley DJ, et al. Am J Public Health. 92:1284-9, 2002.

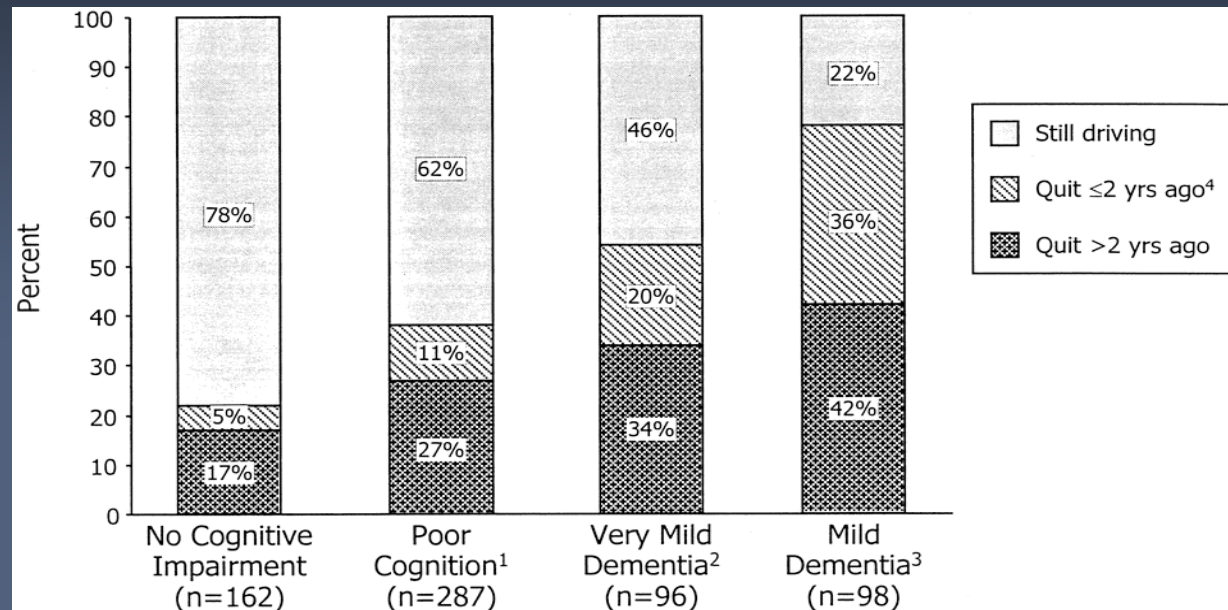
Older women at increased risk of serious injury in MVC, tend to lack confidence, higher risk for premature driving cessation

Oxley et al, Monsash 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.

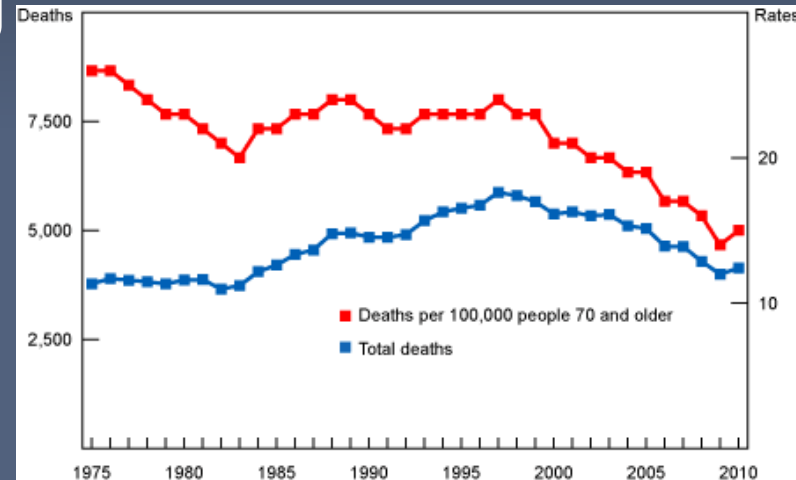


Foley DJ, et al. JAGS. 48(8):928-30, 2000.

# SUMMARY OF DRIVING STATISTICS OLDER ADULTS

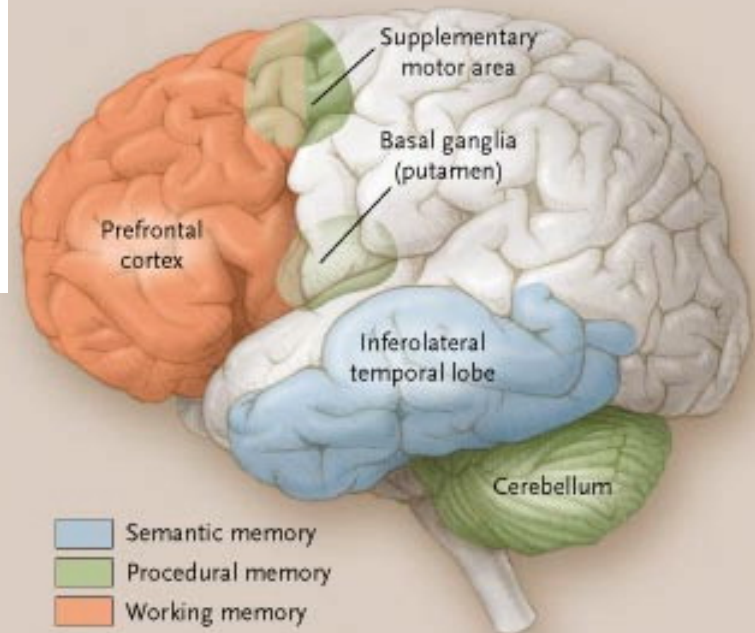
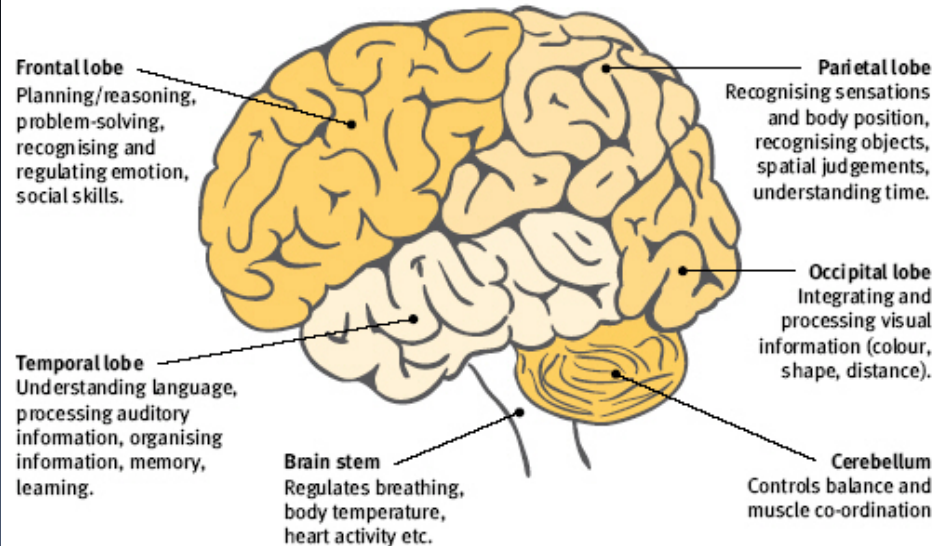
- Increasing Numbers of Older Drivers
- Increasing Prevalence of Chronic Disease and Demented Drivers
- More Potential Drivers with Multiple Medical Diseases/Meds
- Increased Morbidity and Mortality Rates in MVC's
- Increasing Exposure or Miles per Year for Aging Cohort
- The Most Vulnerable are Likely 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?

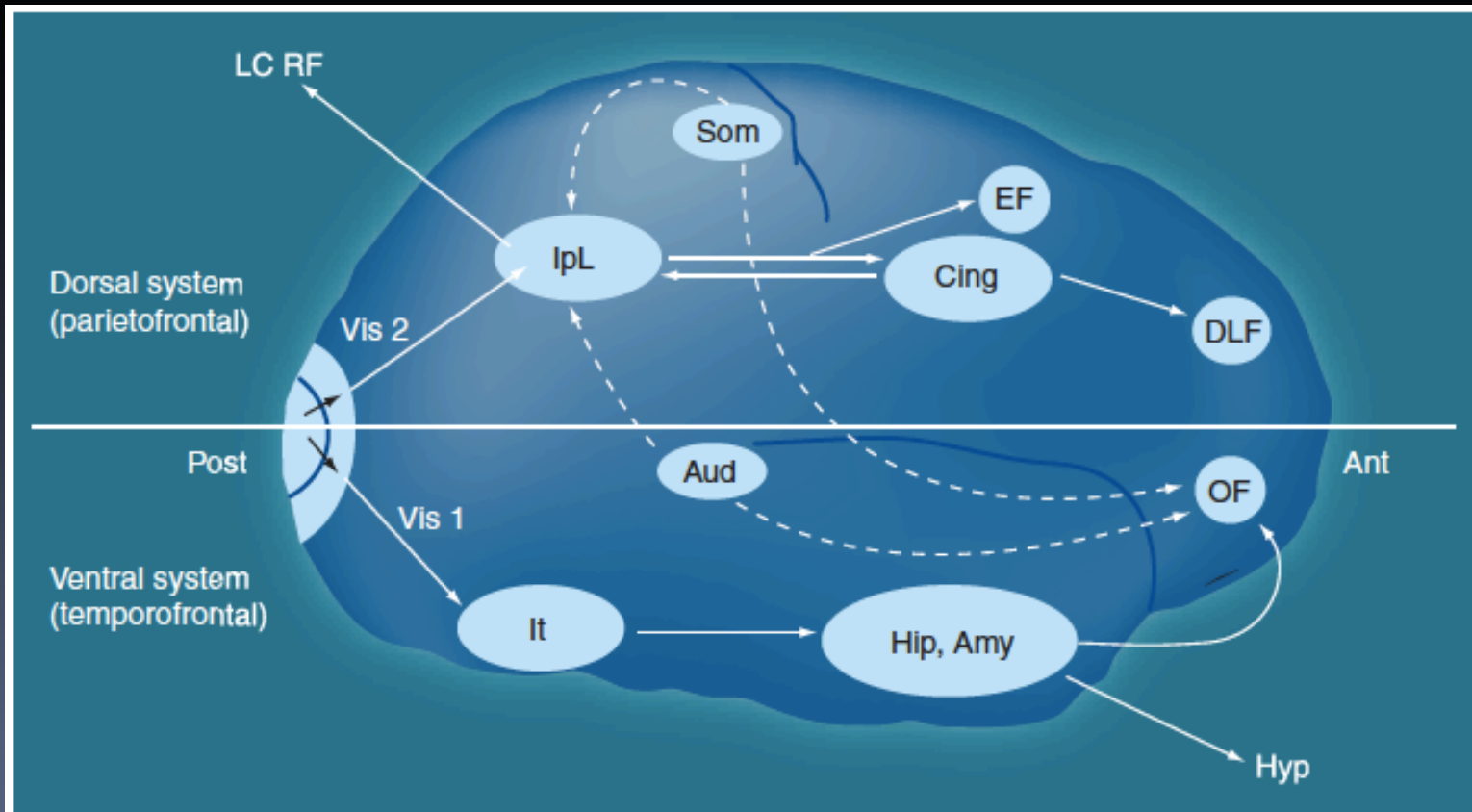
Areas of the brain (side view)



Budson AE, Price BH. Memory Dysfunction. NEJM 2005; 352: 692-9



# How does CNS disease impact driving?

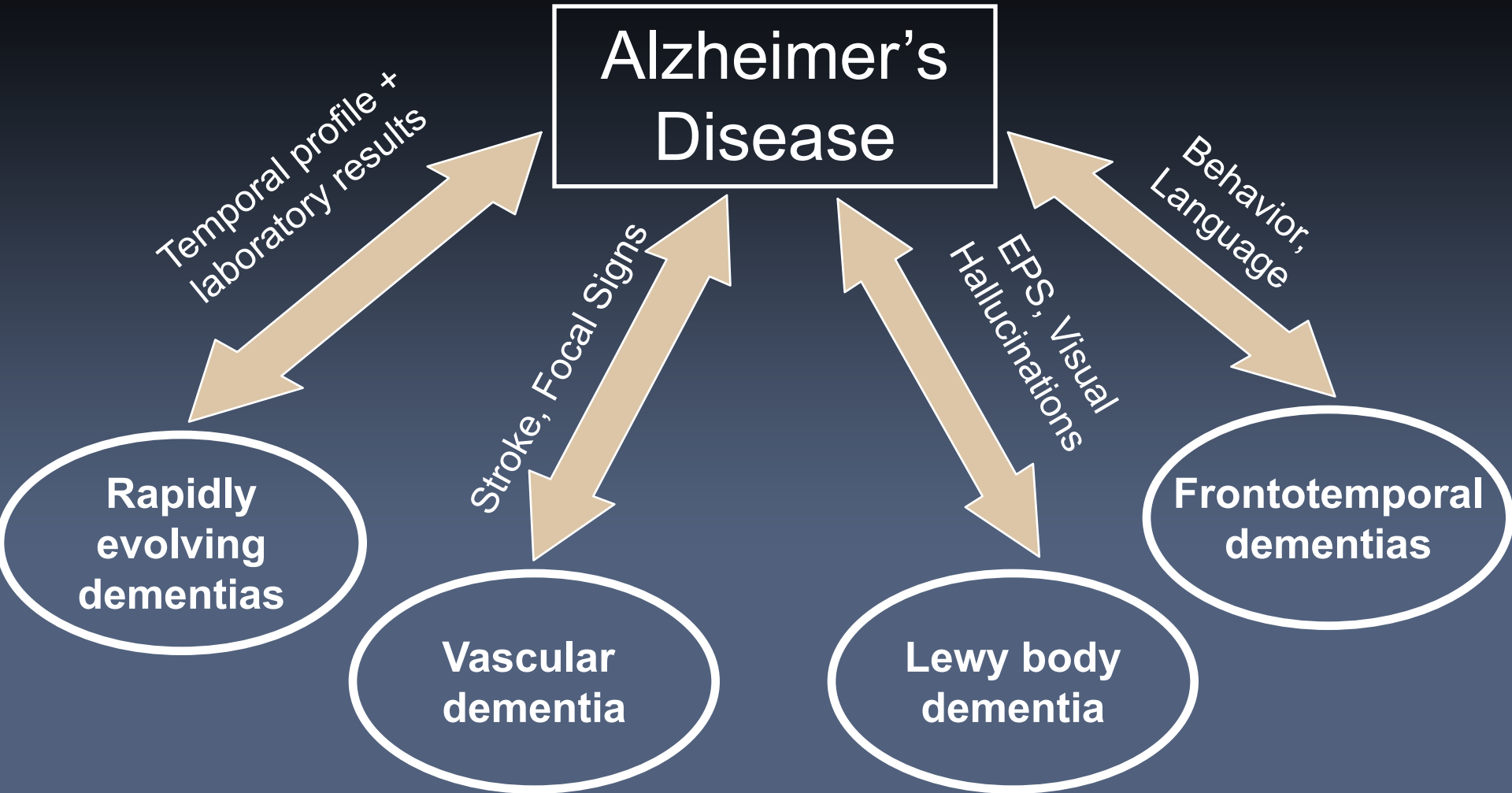


**Figure 1. Two major visual processing pathways of the brain.**

Amy: Amygdala; Ant: Anterior; Aud: Auditory pathway; Cing: Cingulate gyus; DLF: Dorsolateral frontal cortex; EF: Frontal eye fields; Hip: Hippocampus; Hyp: Hypothalamus; IpL: Inferior parietal lobule; It: Inferotemporal visual cortex; LC: Locus ceruleus; OF: Orbital frontal cortex; Post: Posterior; RF: Reticular formation; Som: Somasthetic pathway; Vis 1: Ventral visual pathway; Vis 2: Dorsal visual pathway. Reprinted with permission from [14].

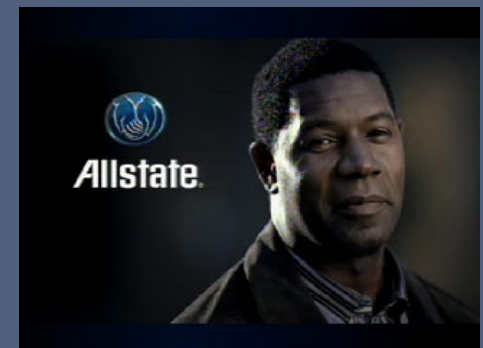
Ott BR and Daniello LA. Aging Health 2010; 6: 77-85

# CLUES TO SPECIFIC NEURODEGENERATIVE DISEASES



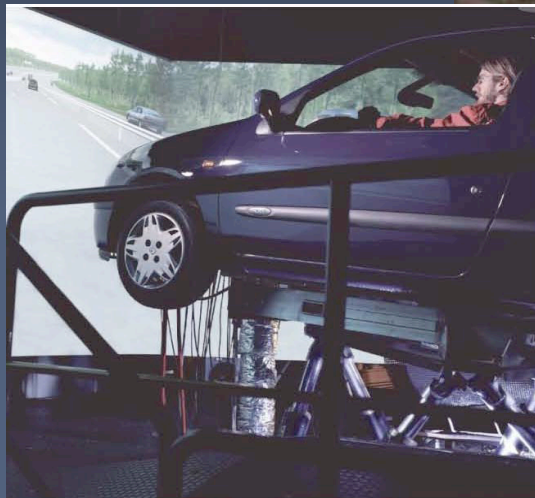
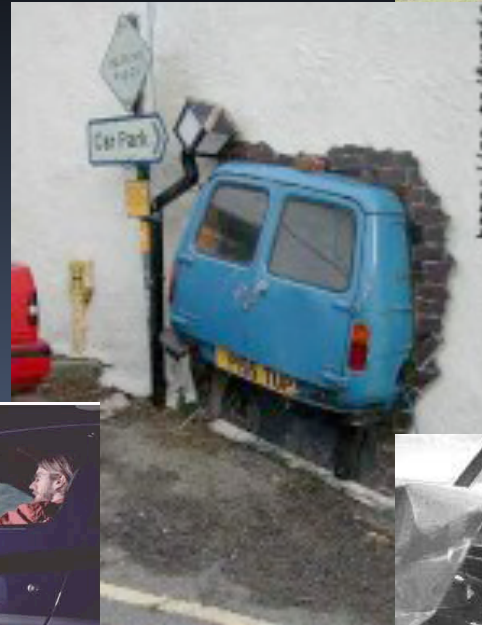
# FITNES-TO-DRIVE STAKEHOLDERS

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

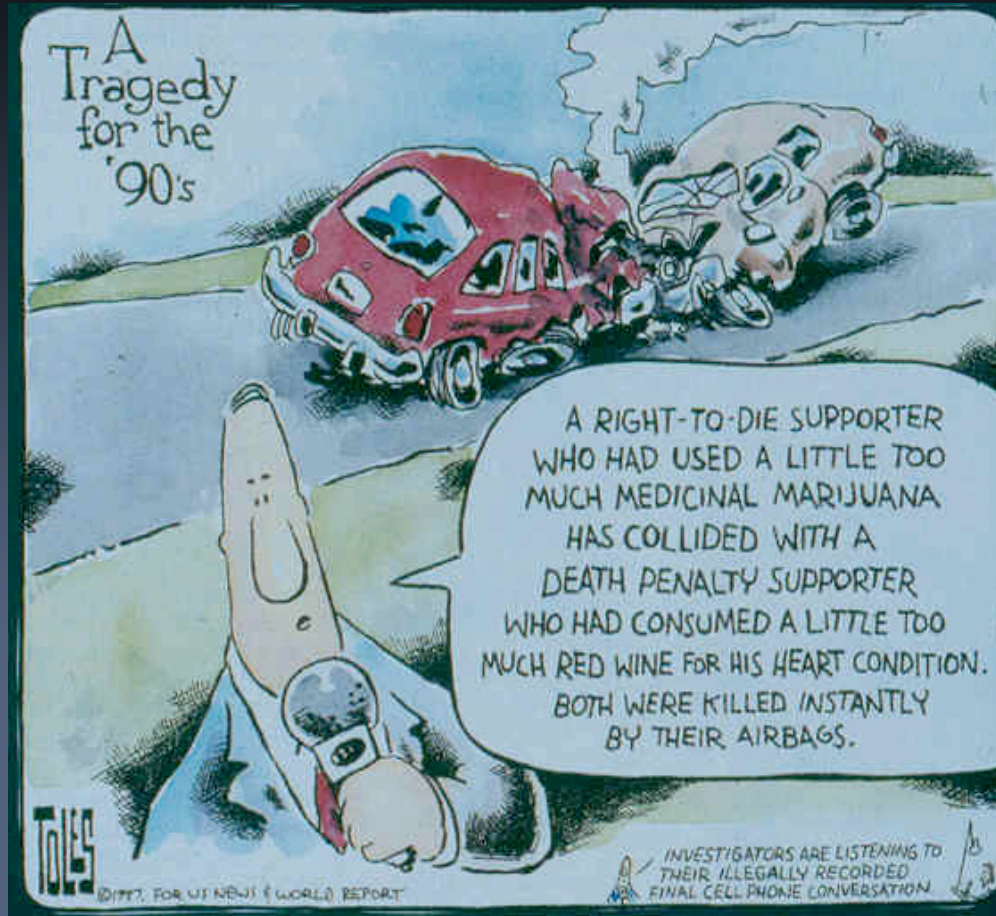


# Driving Outcomes

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



# Driving Outcomes: Are Crashes All They Are Cracked Up To Be?

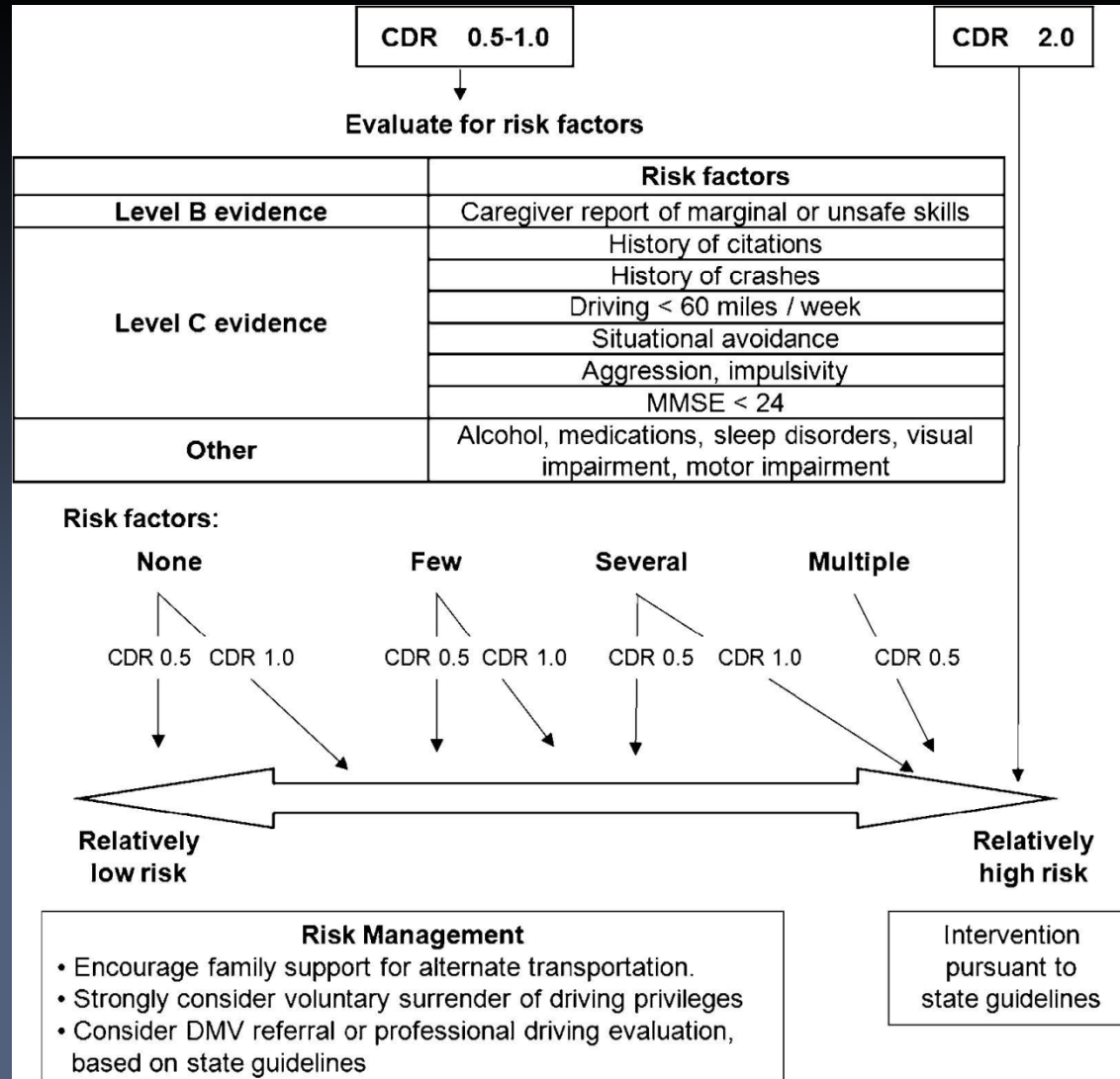


# Case-Based Approach

- An 83 year old female presents with early PD
- 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



Iverson DJ, et al Practice Parameter: Evaluation and Management of driving and dementia. Neurology 2010; 74: 1316-24

# 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



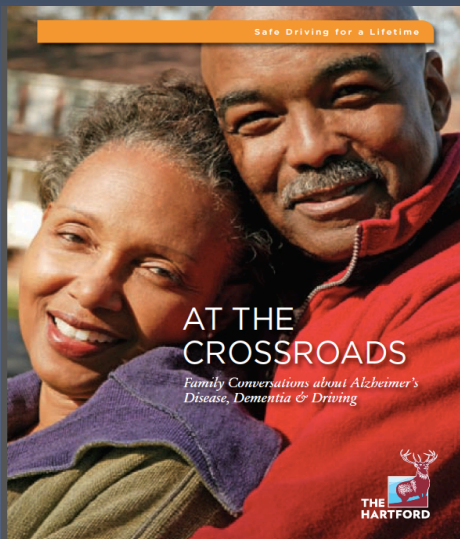


# DRIVING HISTORY

- 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)

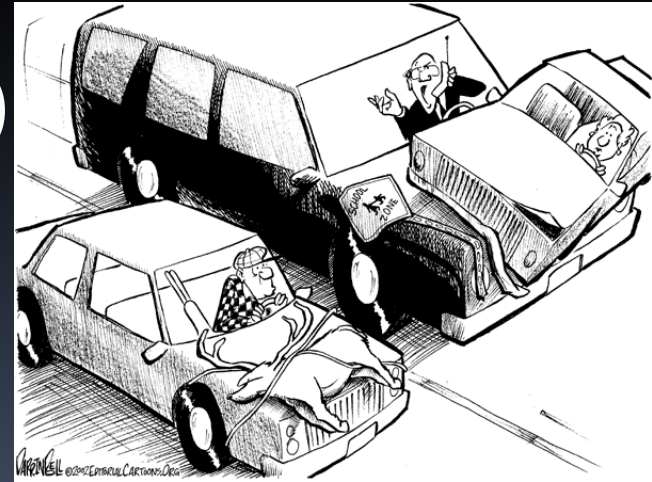


Driving Behavior Warning Signs - When Noticed, How Often	
1. Decrease in confidence while driving	16. Uses a "copilot"
2. Difficulty turning to see when backing up	17. Bad judgment on making left hand turns
3. Riding the brake	18. Near misses
4. Easily distracted while driving	19. Delayed response to unexpected situations
5. Other drivers often honk horns	20. Moving into wrong lane
6. Incorrect signaling	21. Difficulty maintaining lane position
7. Difficulty parking within a defined space	22. Confusion at exits
8. Hitting curbs	23. Ticketed moving violations or warnings
9. Scrapes or dents on the car, mailbox or garage	24. Getting lost in familiar places
10. Increased agitation or irritation when driving	25. Car accident
11. Failure to notice important activity on the side of the road	26. Failure to stop at stop sign or red light
12. Failure to notice traffic signs	27. Confusing the gas and brake pedals*
13. Trouble navigating turns	28. Stopping in traffic for no apparent reason*
14. Driving at inappropriate speeds	29. Other signs:
15. Not anticipating potential dangerous situations	

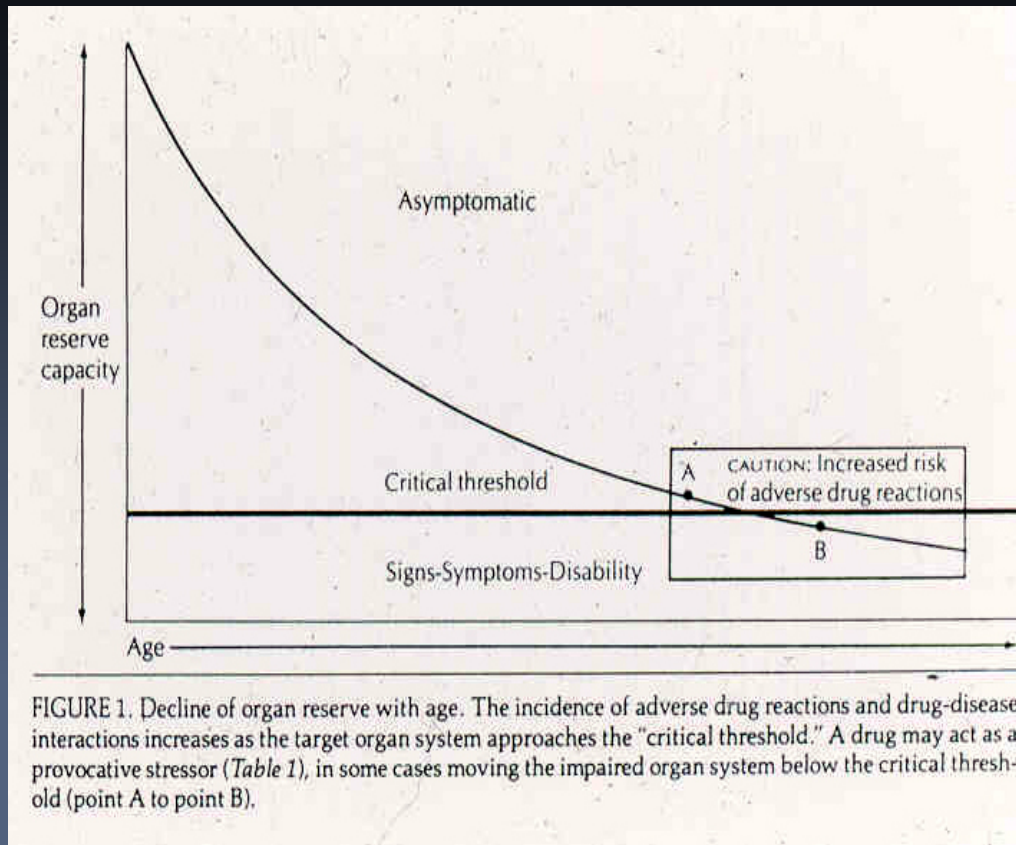
<http://www.thehartford.com/advance50/publications-on-aging>

# 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

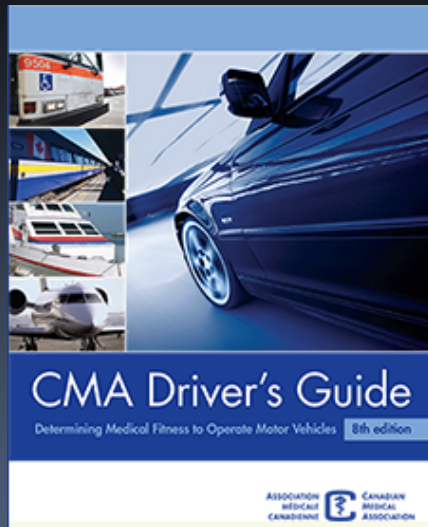


Hetland A, Carr DB. Medications and Impaired Driving. *Annals of Pharmacology* 2014; 48(4): 494-506

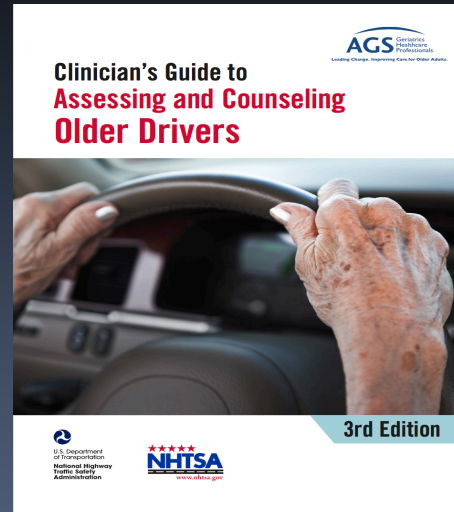
- Narcotics
- Barbituates
- Benzo's (present)\*
- Antihistamines
- Antidepressants
- Antipsychotics
- Hypnotics
- Alcohol
- Muscle Relaxants
- Antiemetics
- Antiepileptic

# Step 2: Co-Morbid Conditions Clinician Medical Guidelines

Updated, Evidenced-Based  
Also Refer to Your Own State Laws/Statutes



<http://www.cma.ca/driversguide>



<http://geriatriccareonline.org>



<http://www.austroads.com.au>

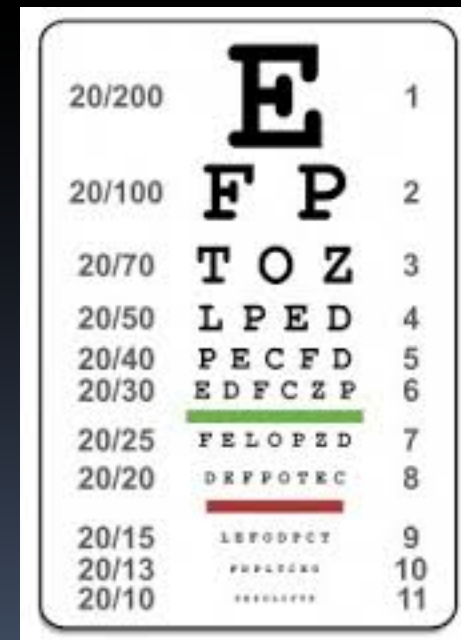
Hypersomnolence/Epworth Sleepiness Scale >10,

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

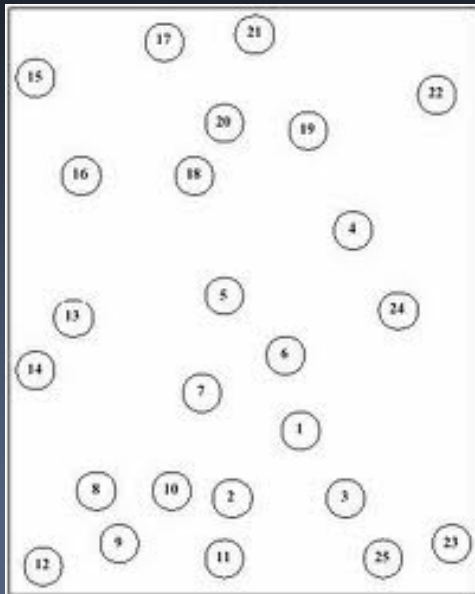
# Step 3a: Physical Examination

- 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

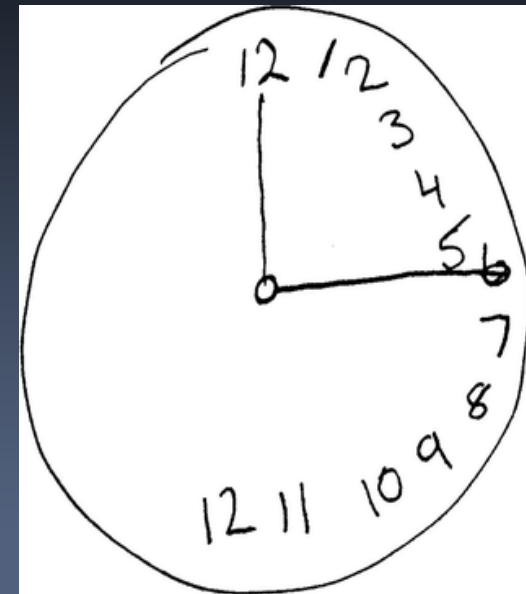


## AD-8

### Alzheimer's Detection: AD8

Remember, "Yes, a change" indicates that you think there has been a change in the last several years cause by cognitive (thinking and memory) problems	YES, A change	NO, No change	N/A, Don't know
Problems with judgment (e.g. falls for scams, bad financial decisions, buys gifts inappropriate for recipients)			
Reduced interest in hobbies/activities			
Repeats questions, stories or statements			
Trouble learning how to use a tool, appliance or gadget (e.g. VCR, computer, microwave, remote control)			
Forgets correct month or year			
Difficulty handling complicated financial affairs (e.g. balancing checkbook, income taxes, paying bills)			
Difficulty remembering appointments			
Consistent problems with thinking and/or memory			
<b>TOTAL AD8 SCORE</b>			

## Clock Drawing



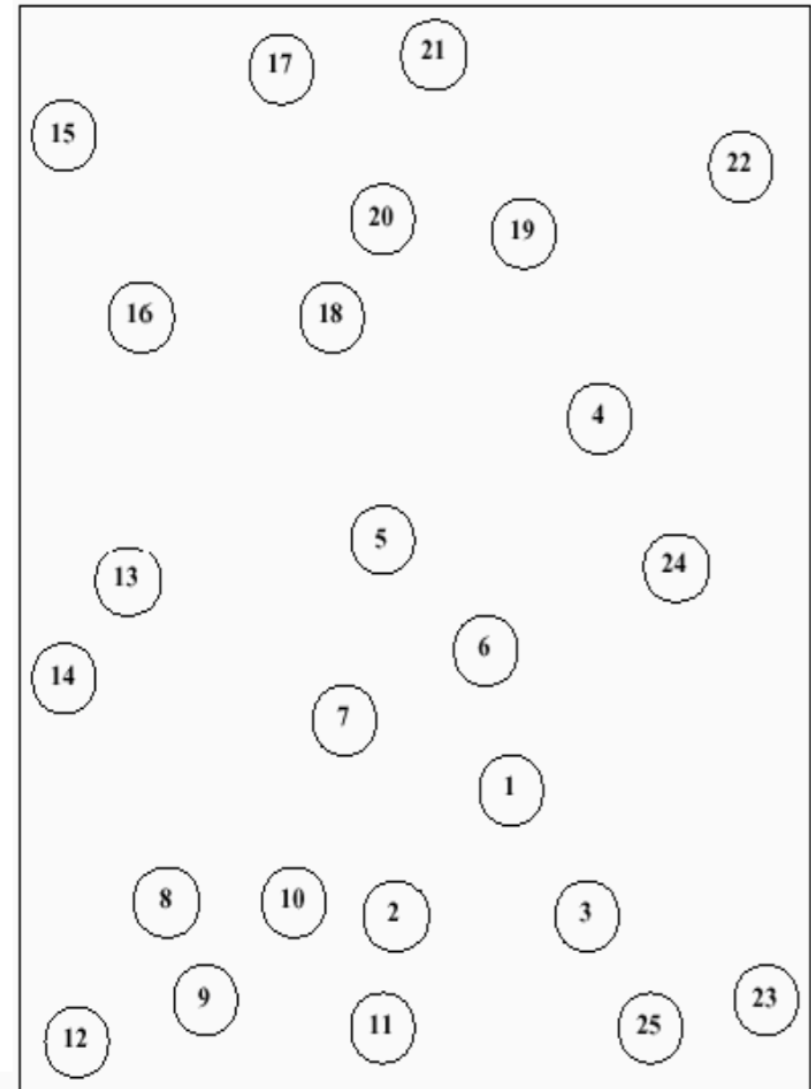
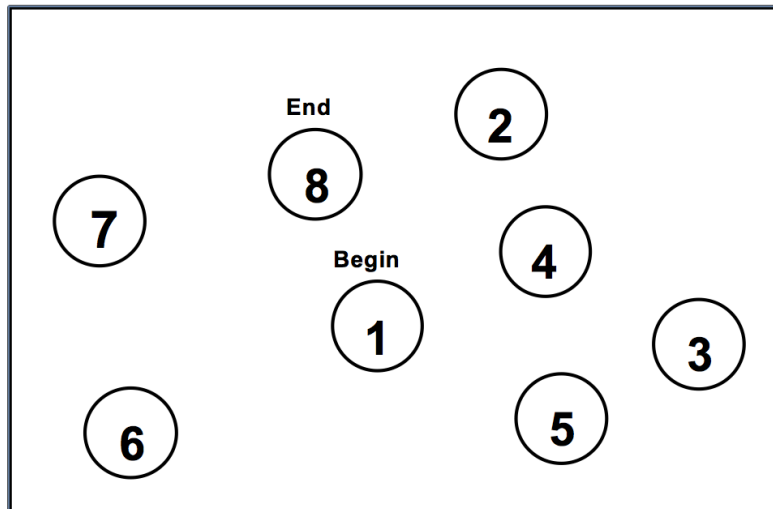
# Trailmaking Test A

## Trail Making Test Part A

Patient's Name: \_\_\_\_\_

Date: \_\_\_\_\_

Sample A



**Sources:**

- Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J Clin Psychol.* 1987;43(4):402-409.
- Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol.* 1995;17(4):529-535.
- Lezak MD, Howieson DB, Loring DW. *Neuropsychological Assessment.* 4th ed. New York: Oxford University Press; 2004.
- Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills.* 1958;8:271-276.



# 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

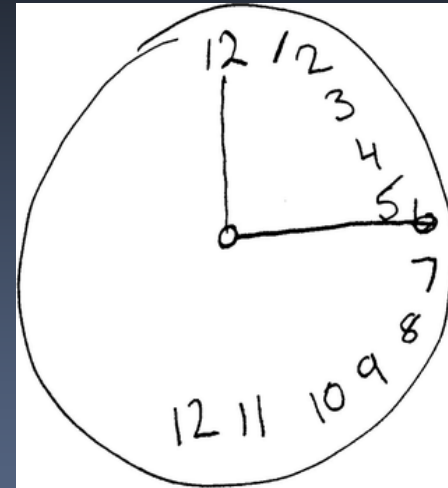
- \_\_\_\_\_ One hand points to 2 (or symbol representative of 2)
- \_\_\_\_\_ Exactly two hands
- \_\_\_\_\_ Give point if there are no intrusive marks

## Numbers

- \_\_\_\_\_ Inside the clock circle
- \_\_\_\_\_ Only numbers 1-12, no duplicates or omissions

## Spacing

- \_\_\_\_\_ Numbers spaced equally or nearly equally from each other
- \_\_\_\_\_ Numbers spaced equally or nearly equally from the edge of the circle



Freund, B., Gravenstein, S., Ferris, R., et al. Drawing clocks and driving cars.  
J Gen Intern Med. 2005; 20:240–244

# Alzheimer's Detection: AD8

Remember, "Yes, a change" indicates that you think there has been a change in the last several years cause by cognitive (thinking and memory) problems	YES, A change	NO, No change	N/A, Don't know
Problems with judgment (e.g. falls for scams, bad financial decisions, buys gifts inappropriate for recipients)			
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Trouble learning how to use a tool, appliance or gadget (e.g. VCR, computer, microwave, remote control)			
Forgets correct month or year			
Difficulty handling complicated financial affairs (e.g. balancing checkbook, income taxes, paying bills)			
Difficulty remembering appointments			
Consistent problems with thinking and/or memory			
<b>TOTAL AD8 SCORE</b>			

# Probability Calculator of Failing Road Test: Dementia

Probability of Failing Driver Test				
	Intercept	trlA	AD8TOT	CDTf
coefficient	-1.7594	0.0283	0.5516	-0.3643
Observed Value		57	3	4
Change values in box above.				
score		0.0513		
exp(score)		1.0526386		
probability		0.5128222		

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

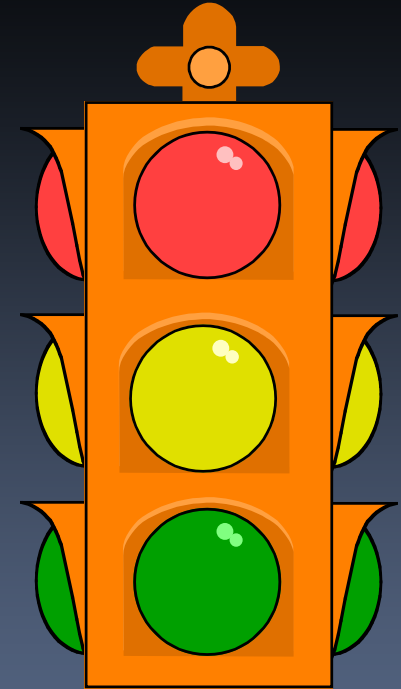
# STEP 4: Rating Dementia Severity

Clinical Measure of Dementia Severity	No Dementia (CDR=0)	Questionable or Very Mild Dementia (CDR=0.5)	Mild Dementia (CDR=1.0)	Moderate to Severe Dementia (CDR=2.0)
<b>For the Dementia Specialist:</b> Clinical Dementia Rating	No memory loss or inconsistent memory loss Fully oriented Judgment intact Function intact Personal care intact	Consistent slight forgetfulness Slight difficulty with orientation or judgment Slight impairment in community activities or home activities Personal care intact	Memory loss interferes with everyday activities Geographic disorientation Moderate impairment in judgment Mild but definite impairment of community or home activities Needs prompting for personal care	Severe memory loss Severe difficulty with time relationships and judgment No longer independent in activities Only simple chores preserved Needs assistance in personal effects
<b>For the Clinician:</b> Short Blessed Test Mini-Mental Status Exam	1.2 (1.9)* 28.9 (1.3)#	4.8 (5.9)## 23.1 (2.5)@	15.4 (5.2)# 20 (3.9)#	18.5 (5.5)# 16.1 (4.7)#
<b>For the Neuropsychologist:</b> Logical Memory	8.8 (2.9)*	4.3 (2.7)+	1.9 (1.7)+	1.5 (2.3)**
Block Design	30.1 (8.6)*	22.2 (9.8)	12.0 (9.6)	3.2 (6.6)++
Digit Symbol	45.6 (11.5)*	31.7 (13.6)	17.0 (13.3)+	8.3 (8.7)++
Trailmaking A	40.9 (20.0)*	70.2 (39.2)+	108.3 (50.5)+	XXX
Benton Copy	9.6 (.88)*	9.1 (1.6)+	7.3 (2.7)+	XXX

**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; Cenoz M; Casado M; Teasell R.

*Neurologia. 29(3):161-7, 2014 Apr.*

# 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 PD/dementia, CDR=0.5
- It is expected to progress
- Alprazolam was tapered off and sertraline  $\wedge$
- 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

Probability of Failing Driver Test				
	Intercept	trlA	AD8TOT	CDTf
coefficient	-1.7594	0.0283	0.5516	-0.3643
Observed Value		72	5	2
		Change values in box above.		
score		2.3076		
exp(score)		10.050275		
probability		0.9095045		

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, 2011

# 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 DEPARTMENT OF REVENUE  
 DRIVER LICENSE BUREAU, P.O. BOX 200  
 301 WEST HIGH STREET, ROOM 470  
 JEFFERSON CITY, MO 65105-0200  
**PHYSICIAN'S STATEMENT**

**Reset Form**

**Print Form**

TELEPHONE: (573) 751-2730  
 FAX: (573) 522-8174  
 WEB SITE: [www.dor.mo.gov](http://www.dor.mo.gov)

FORM  
**1528**  
 (REV. 10-2012)

<b>DRIVER OR PATIENT SECTION</b>	PATIENT NAME (LAST, FIRST, MIDDLE)	SOCIAL SECURITY NUMBER	DATE OF BIRTH (MM/DD/YYYY)	
	PATIENT'S MAILING ADDRESS	CITY	STATE	ZIP CODE

**I hereby authorize and accept that:**

- My physician will conduct a medical examination to determine my fitness to operate a motor vehicle safely and responsibly.
- My physician will respond to any additional questions from the Driver License Bureau (DLB) and, if necessary, he or she may submit copies of my medical records to the DLB.
- The DLB will make a final decision concerning my eligibility for driver licensure based on all available information.

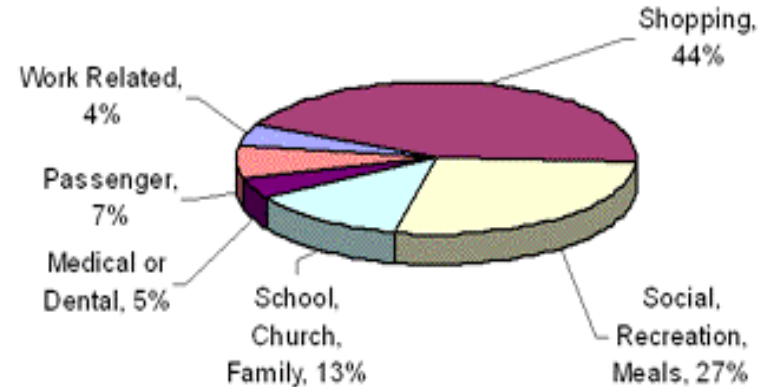
Signature of Driver or Patient \_\_\_\_\_ Date (MM/DD/YYYY) \_\_\_\_\_

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

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



Source: National Household Travel Survey, 2001.

Passenger trips are those made for the purpose of transporting another individual.

# Mobility Counseling Transportation Alternatives



- St. Louis Options
  - Social Work Referral
  - CORP
  - Call-A-Ride
  - Good Shepherd
  - Metro
  - Bus
  - Taxi
  - ITNAmerica
  - Uber
  - Other

Address <http://www.itnamerica.org/> Go Lit

**ITNAmerica™**  
Dignified Transportation for Seniors

Grants Available for New Affiliates

HOME | ABOUT | KEEP ME INFORMED | ONLINE GIVING | TAKE THE NEXT STEP... | ADDITIONAL RESOURCES

**News**

- New Links to ITN in the Media
- New ITNAmerica Presents Across the Nation
- New Report from the White House Conference on Aging
- New Ziv Tzedakah Seeds Scholarships
- New ITN Affiliate Communities: Report from the field
- Photo! International Study Tour Visits

WELCOME TO...

Power of the Model Independence

Community Helping Seniors Family

Keep Me Informed  
Donate To ITNAmerica™  
Visit the Portland ITN  
ITNAmerica™ Library  
ITN Affiliate Websites  
Become an ITN community

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[Contact us] [Administrator Login] [Forum]  
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# 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

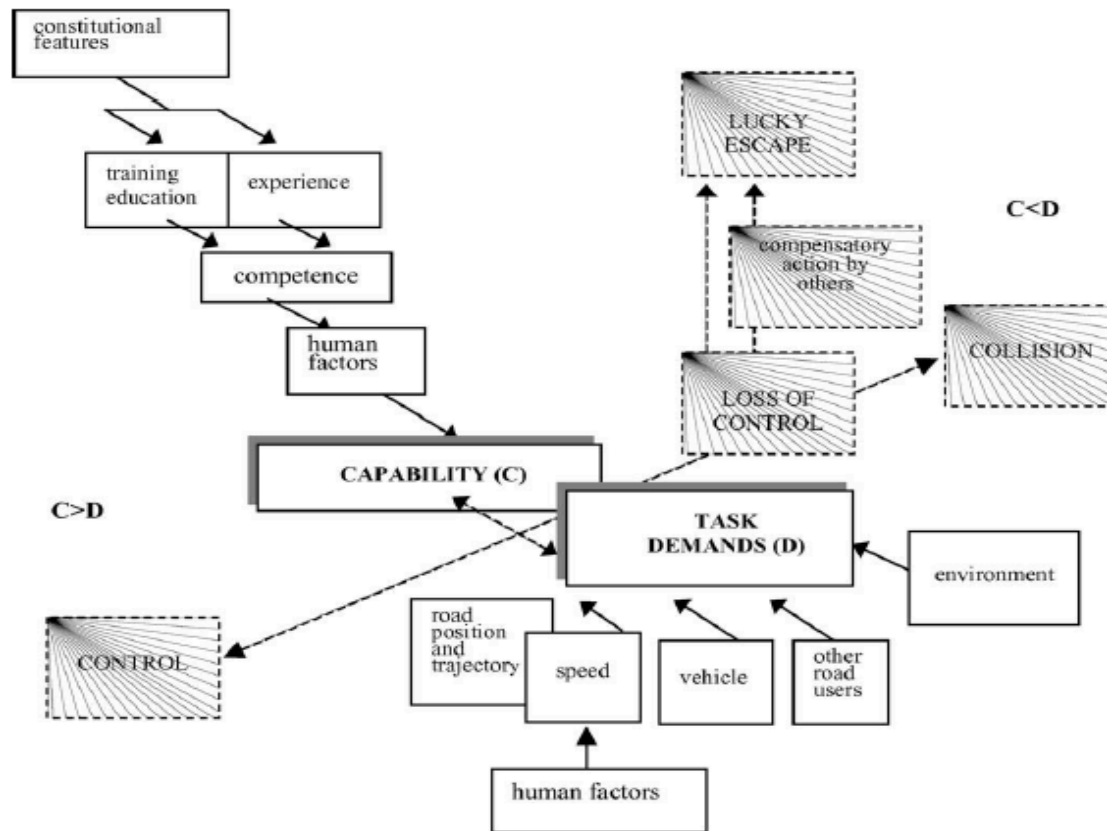


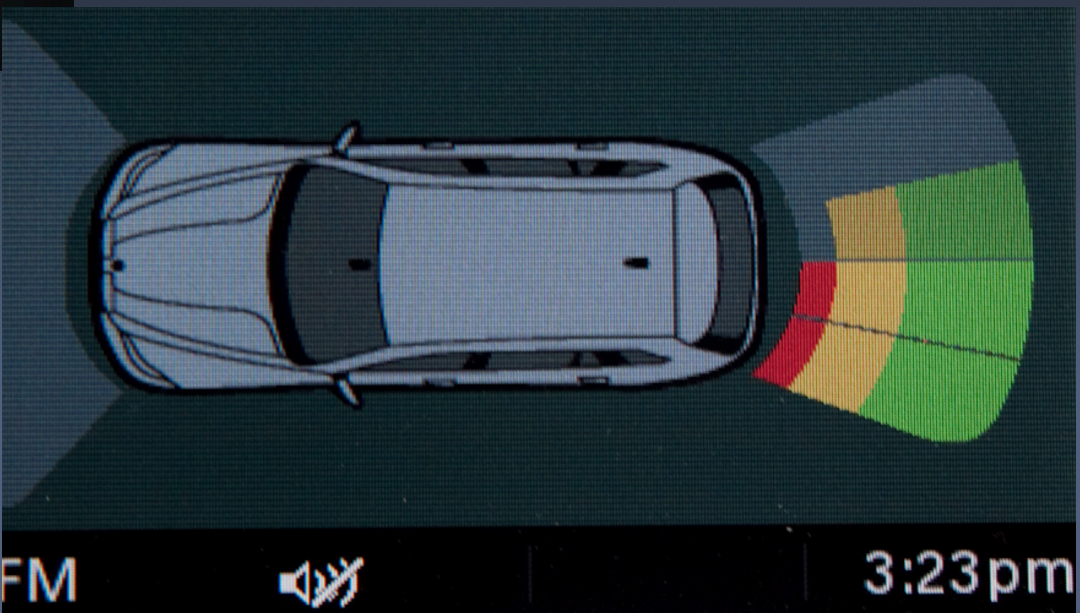
Fig. 2. The task-capability interface model.

Fuller R. Towards a general theory of driver behavior. AAP. 2005; 37: 461-472



# 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



<http://readwrite.com/2014/04/16/backup-cameras-law-2018-nhtsa-safety/>

<http://www.iihs.org/iihs/news/desktopnews/preventing-driveway-tragedies-rear-cameras-help-drivers-see-behind-them>

# 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

<http://readwrite.com/2014/04/16/backup-cameras-law-2018-nhtsa-safety/>

# Ergonomics Comfort Technology



<http://www.autotrader.com/car-tips/choosing-a-car-with-comfortable-seats-210732>

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>

<http://readwrite.com/2014/04/16/backup-cameras-law-2018-nhtsa-safety/>

# Top Technologies Requested by Older Drivers

Blind Spot Warning Systems

Crash Warning Systems

Emergency Response Assistance Systems

Drowsy Driver Alerts

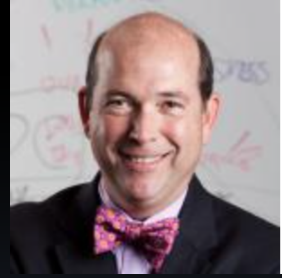
Reverse Monitoring Systems



Only 1/3 in survey report they have these technologies

<http://www.reuters.com/article/us-column-miller-cars-idUSBRE98G05I20130917>

# 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?

<file:///Users/DC/Desktop/WEEKEND/TALKS/COUGHLIN.pdf>.webarchive

# Understanding the Future of Mobility

Three trends shaping personal and commercial mobility

1. On-Demand Mobility 2, 3. 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/2015/08/08/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, 3. 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, 3. Driverless/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



<http://www.foxnews.com/tech/2013/11/27/five-future-transportation-technologies-that-will-actually-happen.html>

# Understanding the Future of Mobility

## Benefits

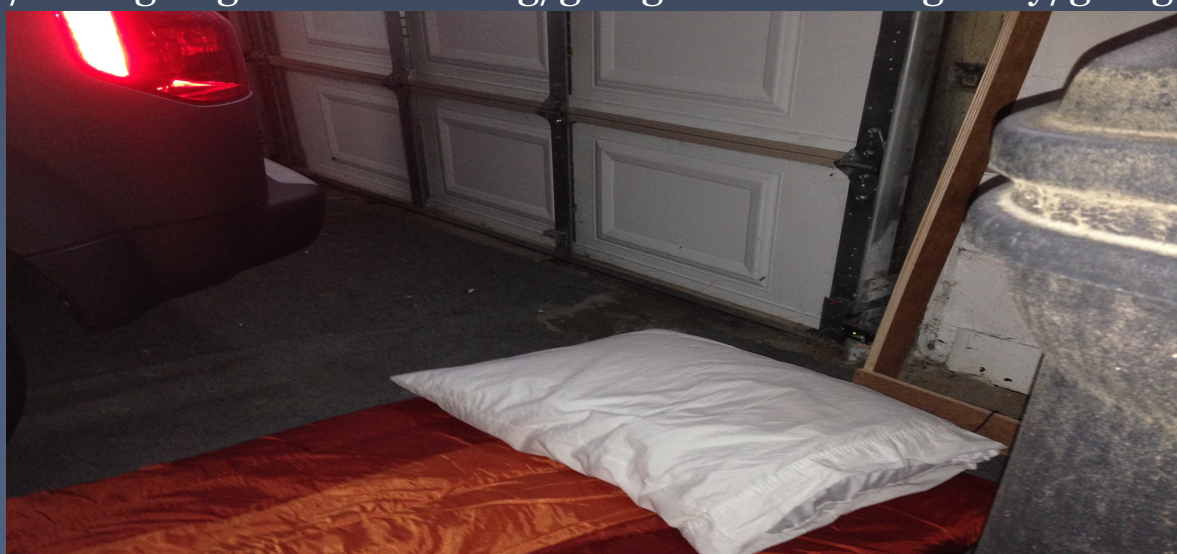
- 80% reduction in cost of transportation
- Reduced pollution
- Reduced stress and road rage
- Dramatic decrease in accidents and traffic deaths
- Gaining back lost time to commuting
- Increase productivity
- Freeing up lanes by eliminating park cars
- Reclaiming home space allocated to home garages
- 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

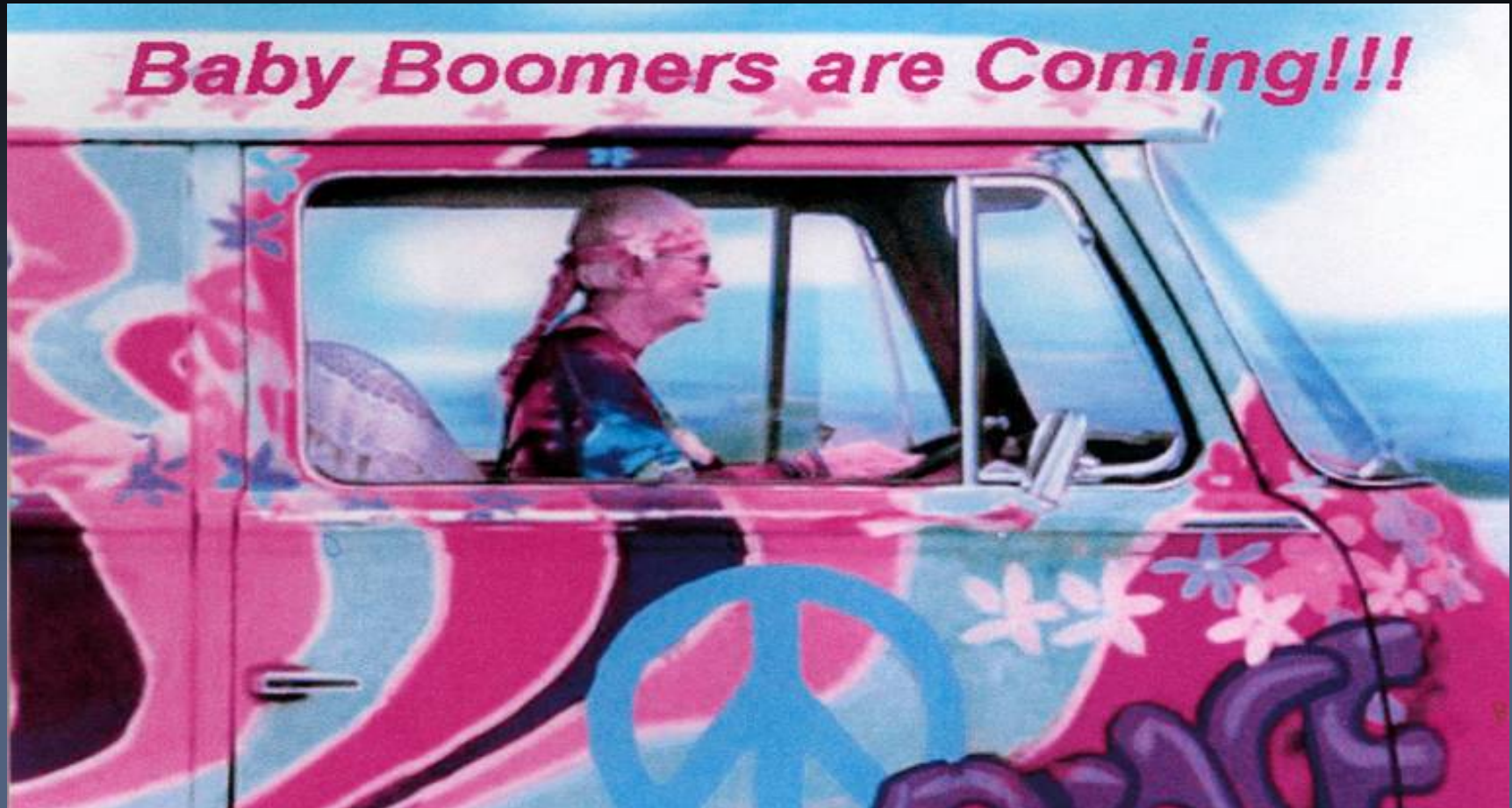


<http://www.garageconversion.org/garage-conversion-gallery/garage-to-room/>



<https://mysonisdreaming.com>

# Why is the need for research urgent?



# Fitness-to-Drive in Older Adults

Funded by the Division of Highway Safety/MoDOT 2007-2018

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Program of Occupational Therapy

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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 314-286-2683

DrivingConnections Clinic 314-658-3800