Assessing cognition in ELDERLY drivers

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Overview

- The need to assess cognition in the older driver
- Predictors of driving ability in the older driver
- Predictors of driving ability in the older driver with cognitive impairment
- The older driver and self monitoring

The older driver: prevalence

- 13% of drivers are 65+ years of age (2008)
- A 23% rise from 1999 to 2009
- People 70+ years are retaining their driver's licenses longer, are driving more miles (km)
- Not known how many are at risk due to driving beyond their cognitive and physical abilities

U.S. Department of Transportation FHA 2008
U.S. Department of Transportation NHSA 2008
CDC

The older driver: risk

- The increase in older drivers makes it imperative to address issues of driving safety and mobility
- Aging and age-associated medical disorders impair driving ability, increase risk of driving errors and vehicle crashes
- Drivers over 65 years are at greater risk of crash due to age-associated disorders

Rizzo M. JAMA 2011

Duchek JM et al. J Am Geriatr Soc 2003

The older driver: accidents

The need to assess cognition in the older driver

Predictors of driving ability in the older driver

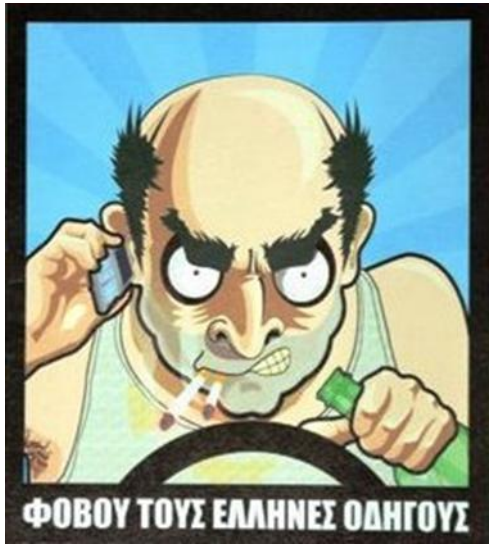
Predictors of driving ability in the older driver with cognitive impairment

The older driver and self monitoring

But

- young drivers, especially male drivers, are overrepresented in accident involvement in virtually every country

Be Afraid. Be Very Afraid.



Doherty ST et al. Accid Anal Prev 1998

The older driver: accidents

Population and Drivers Involved in Fatal Crashes by Age Group, 2008

	Age Group (Years)							
	15-20	21-24	25-34	35-44	45-54	55-64	65-69	70+
Population (Percent)	8.5	5.5	13.5	14.0	14.6	11.1	3.7	9.1
Drivers Involved in Fatal Crashes (Percent)								
- Single-Vehicle	14.0	13.1	20.9	16.9	15.5	10.3	2.8	6.2
- Multi-Vehicle	10.4	9.2	19.0	18.3	17.8	12.4	3.5	9.3
- All Fatal Crashes	11.9	10.8	19.8	17.8	16.8	11.5	3.2	8.1

NHTSA's National Center for Statistics and Analysis

The older driver: accidents

However, older drivers

- Are retaining their driver licenses longer (70+ years), drive more than in the past
- Have an elevated risk per capita/per mile traveled of being at fault for fatal crashes
- Have an increased susceptibility to injury and medical complications when involved in a crash

Important to identify drivers at risk w/o restricting those who are not

Important to balance accident risk with maintaining mobility and independence

Insurance Institute for Highway Safety 2010. Fatality Facts 2009.

CDC. Injury Prevention and Control: Motor Vehicle Safety. Older Adult Drivers: Fact Sheet.

Age-related cognitive decline

The need to assess cognition in the older driver

Predictors of driving ability in the older driver

Predictors of driving ability in the older driver with cognitive impairment

The older driver and self monitoring

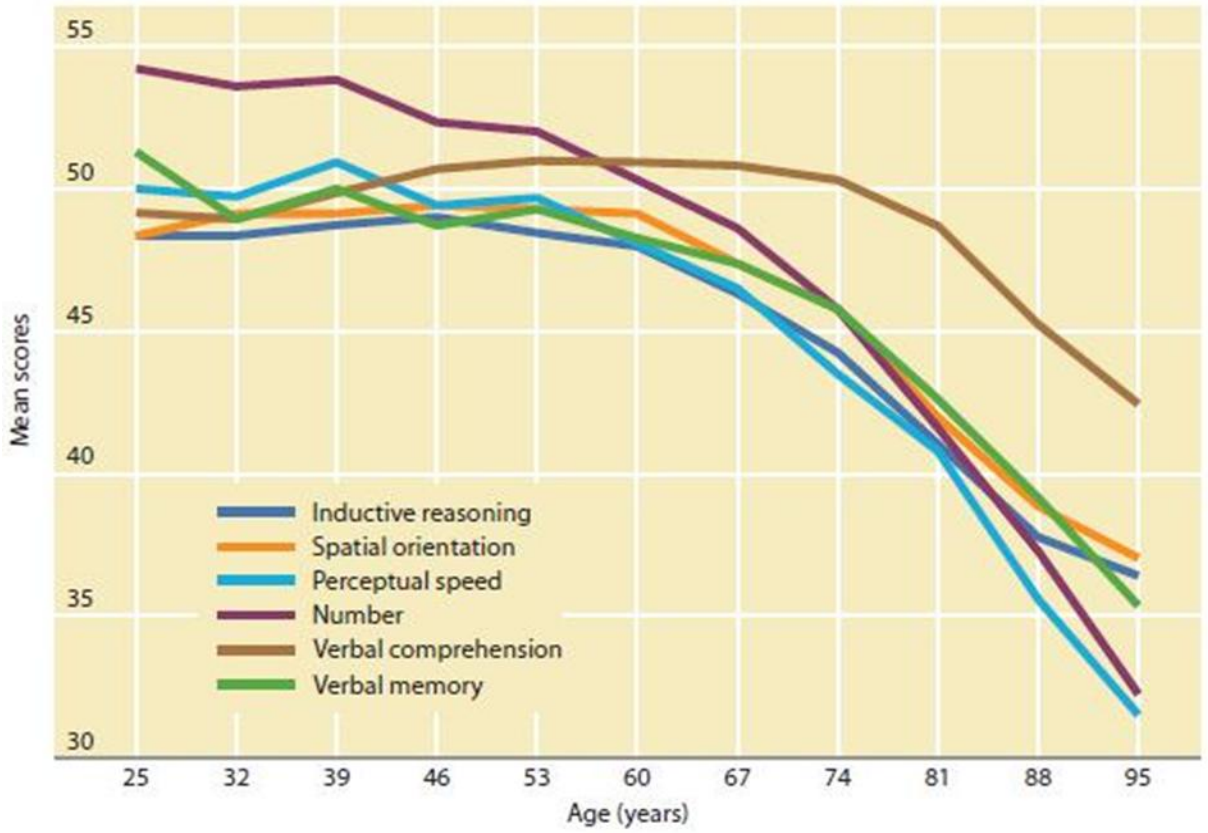


FIGURE **15.4**

LONGITUDINAL CHANGES IN SIX INTELLECTUAL ABILITIES FROM AGE 25 TO AGE 95

Source: Adapted from Schaie, K.W. (2012). Developmental Influences on Adult Intelligence: The Seattle Longitudinal Study (2nd ed.), Fig. 5.8. New York: Oxford University Press.

Predictors of driving ability

- Skills that show decline with cognitive aging (processing speed, visual attention, task-switching, etc.) will impact on older drivers
- These age-related declines in cognitive performance may place older adults at risk, esp. in cognitively demanding situations

Predictors of driving ability

- Driving test performance correlates with performance on tests that measure **attention shifting** and **updating**
  - **Attention shifting**: TMT B-A, Plus-minus task
  - **Updating**: Operation span task

Adrian J et al. Accid Anal & Prev 2011

- **A speeded selective attention & switching factor** was associated with the most error types in multivariate analyses (self-directed & instructor-navigated conditions)
  - Factor: Trails A & B, Visual Search Task, Digit Symbol Matching Task (computerized tasks)
  - UFOV was only associated with blindspot errors (but common errors)

Anstey KJ & Wood J. Neuropsychology 2011

Predictors of driving ability

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The older driver and self monitoring

But

- Best predictor: gender (women< men)
- Second best: age (in 60+ drivers) *Adrian J et al. Accid Anal & Prev 2011*

- The oldest old (90-97) made similar types/frequencies of driving errors than a younger old group (80-87)

Hollis AM et al. Traffic Inj Prev 2013

Most common driving errors

- All error types increase with age, from middle age, even in the absence of neurological diagnoses (self-directed & instructor-navigated conditions)
- **Lane positioning**: most common in both older unimpaired drivers and mild AD drivers
- Blind spot monitoring (merging & maneuvering)
- Linked with decline in attentional abilities (speeded selective attention), visuospatial skills and judgment

Grace J et al. J Int Neuropsych Soc 2005
Wood JM et al. J Am Geriatr Soc 2009
Anstey KJ & Wood J. Neuropsychology 2011
Dawson JD et al. J Am Geriatr Soc 2010

Most common driving errors

- Failure to stop at red traffic lights
- Related to a narrowing of the attentional visual field but not to vision

West SK et al. J Gerontol A Biol Sci Med Sci 2010

Types of driving errors

The need to assess cognition in the older driver

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The older driver and self monitoring

Crash statistics: rare events

Safety errors: more common; near-misses, driver disruptions in traffic flow (lane observance & change errors, speed control, ability to control vehicle, etc.)
Safety risk potential

Aksan N et al. J Amer Geriatr Soc 2012

Predictors: longitudinal data

- Changes in broad cognitive measures (visuospatial, memory, visuomotor speed, executive function) predicted on-road driving performance 1 & 2 years later in healthy older adults in multivariate analyses

Not a predictor:

- Visual, motor, UFOV measures

Aksan N et al. J Amer Geriatr Soc 2012

Driving ability & cognitive impairment

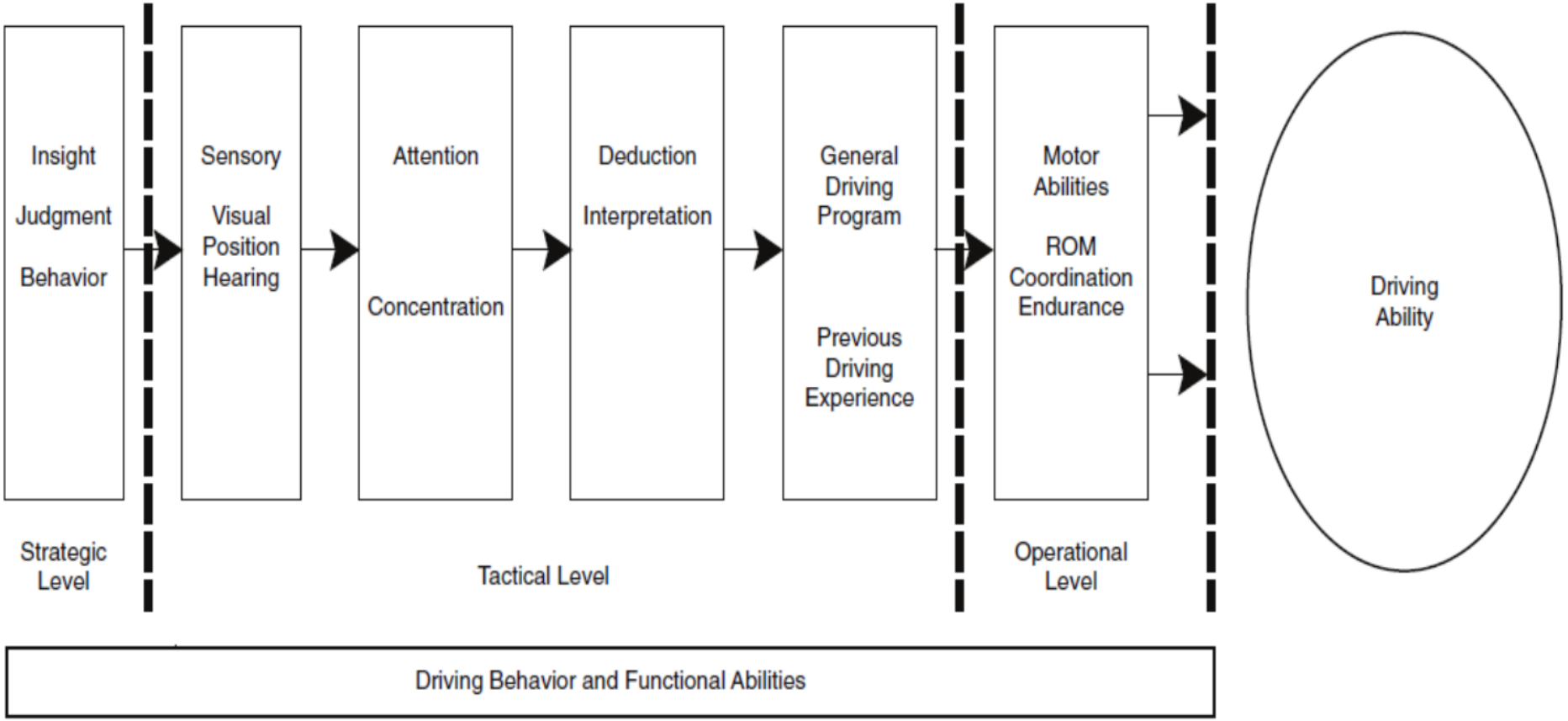
- While patients with mild dementia, as a group, are higher risk drivers (informant reports, on-road driving tests), 76% are still able to pass an on-road driving test
- Not *all* AD patients show poor driving performance
- Driving is highly automatized, may not show a decline in the early stages of the disease

Duchek JM et al. J Gerontol Psychol Sci 1998

Ott BR et al. Neurology 2008

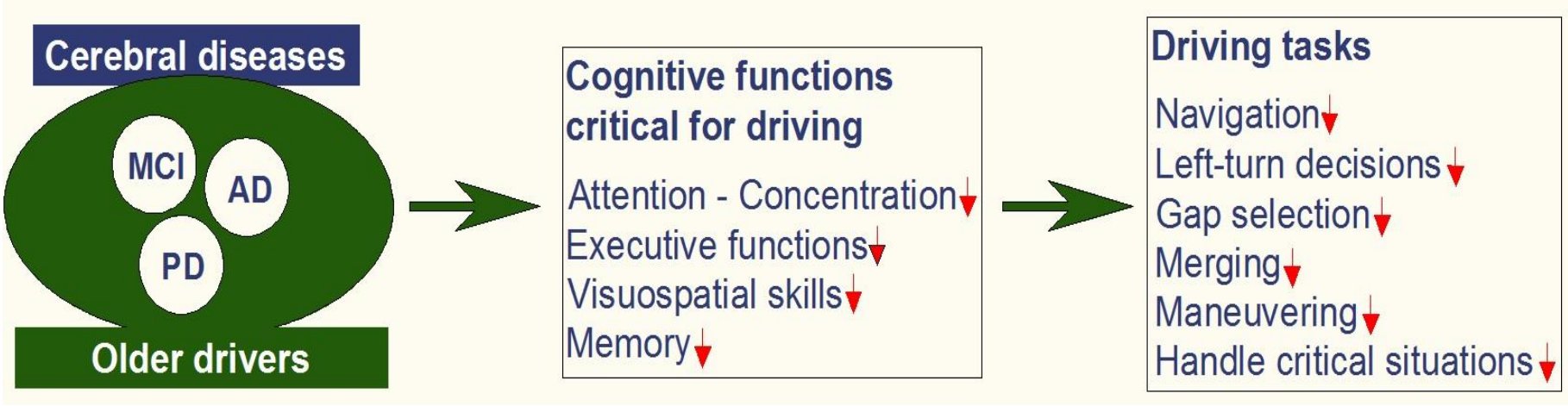
Iverson DJ et al. Neurology 2010 (update of the AAN 2000 practice parameter on driving and dementia)

A conceptual model of driving



Galski T et al. Am J Occup Ther 1992
Marshall S et al. Top Stroke Rehabil 2007

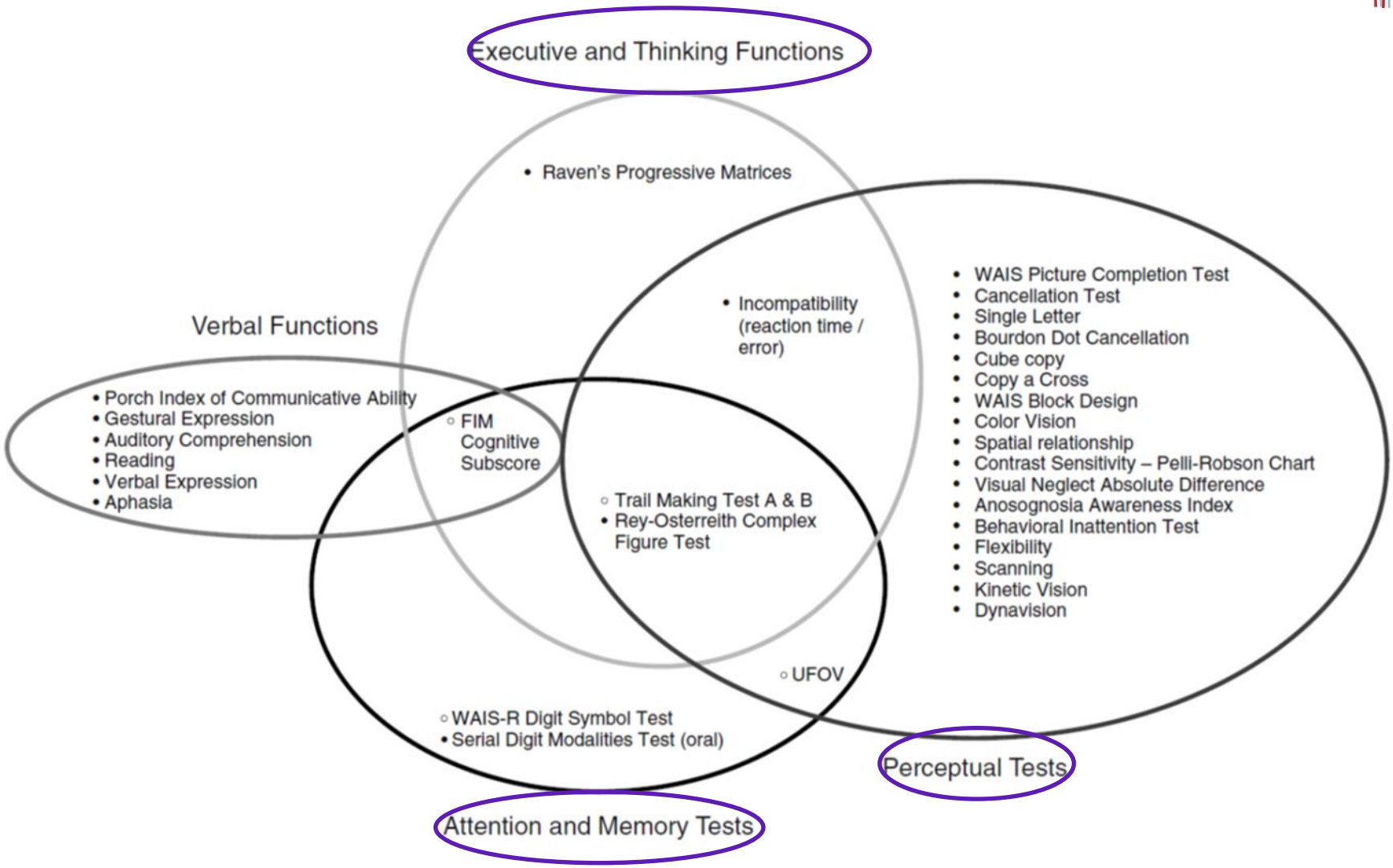
Cerebral Diseases affecting Driving Behaviour



- Older Drivers
- Cerebral diseases (MCI, AD, PD)

Downgrade the main cognitive functions critical for safe driving and affect driving tasks

Boolean diagram of tests by cognitive area



Marshall S et al. Top Stroke Rehabil 2007

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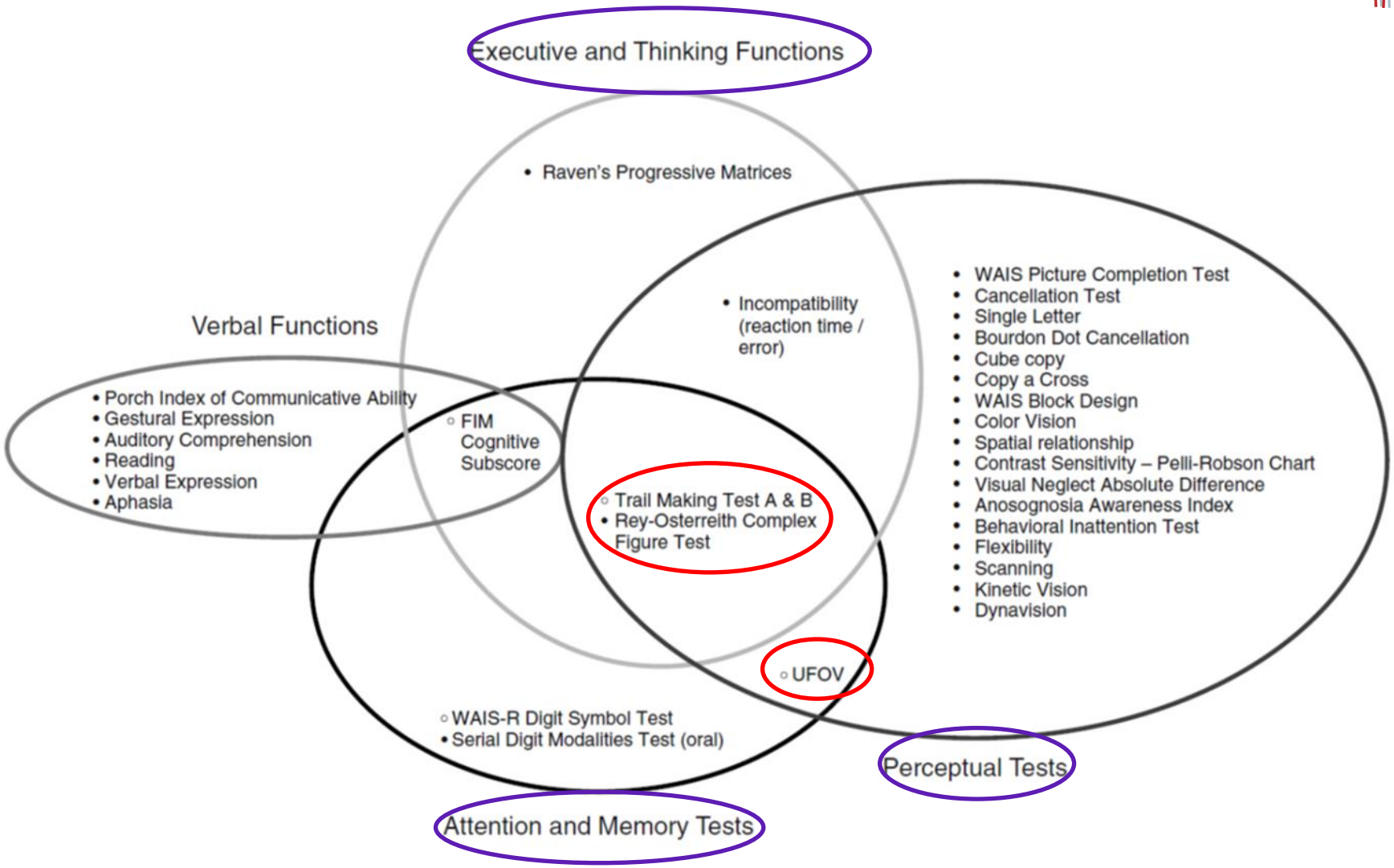

Marshall S et al. Top Stroke Rehabil 2007

Predictors of driving in MCI, early AD

- MMSE: not a useful measure for predicting driving performance & driving safety
- CDR: 40-85% of drivers with CDR= 0.5-1 are safe as per on-road driving test
- Neuropsychological tests: Trails A & B, UFOV, Line Orientation, WAIS-R BD, CFT Copy, etc.

But

do specific tests provide any **additional** information in identifying unsafe drivers beyond dementia diagnosis?

Iverson DJ et al. Neurology 2010

Predictors of driving in MCI, early AD

Memory impairment

- Does not impair most aspects of driving performance of the experienced driver
- May increase safety risk under conditions of distraction

Anderson SW et al. J Clin Exp Neuropsyc 2007

Predictors of driving in MCI, early AD

Road test in an instrumented vehicle

- COGSTAT: a composite cognitive score (COWA, CFT-Copy, CFT-Recall, AVLT, BVRT, WAIS-R BD, JLO, TMT-B): predicts safety errors in AD after adjusting for age, gender
- 1 sd decrease in cognitive function → a 4.1 increase in safety errors
- Individual tests: BVRT, TMT-A, CFT-Copy, Functional Reach, UFOV (almost)
- The tests have added value beyond the diagnosis of dementia

Dawson J et al. Neurology 2009

The older driver and self-regulation

- Older drivers' metacognitive abilities seem to reflect a realistic adjustment of their driving to their declining abilities, and may lead to safe driving

Mozák et al. Psychol Aging 2012

- But not all older drivers are aware of decline in their ability to drive
  - Those with the greatest mismatch between self-rated driving ability and road test performance showed higher rates of retrospectively reported crash rates

Wood JM et al. J Gerontol A Biol Sci Med Sci 2013

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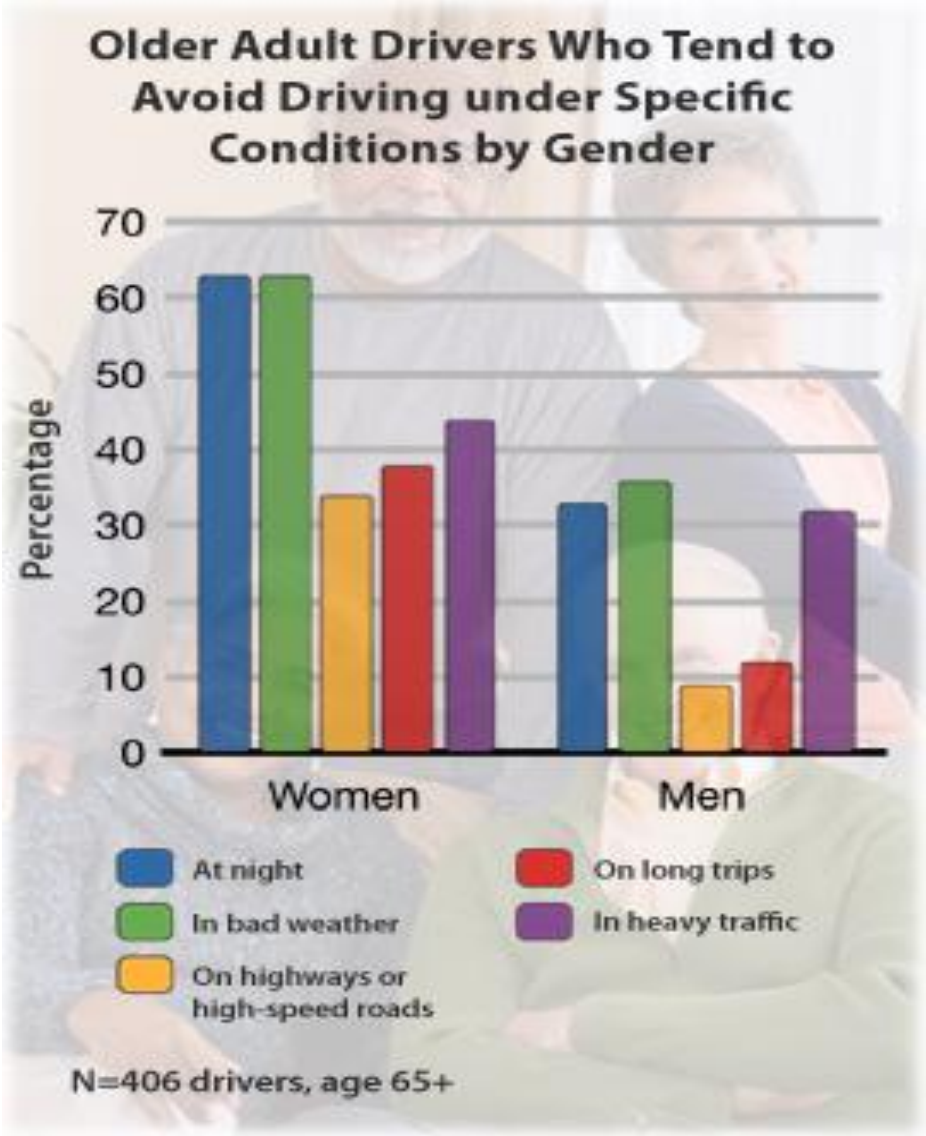
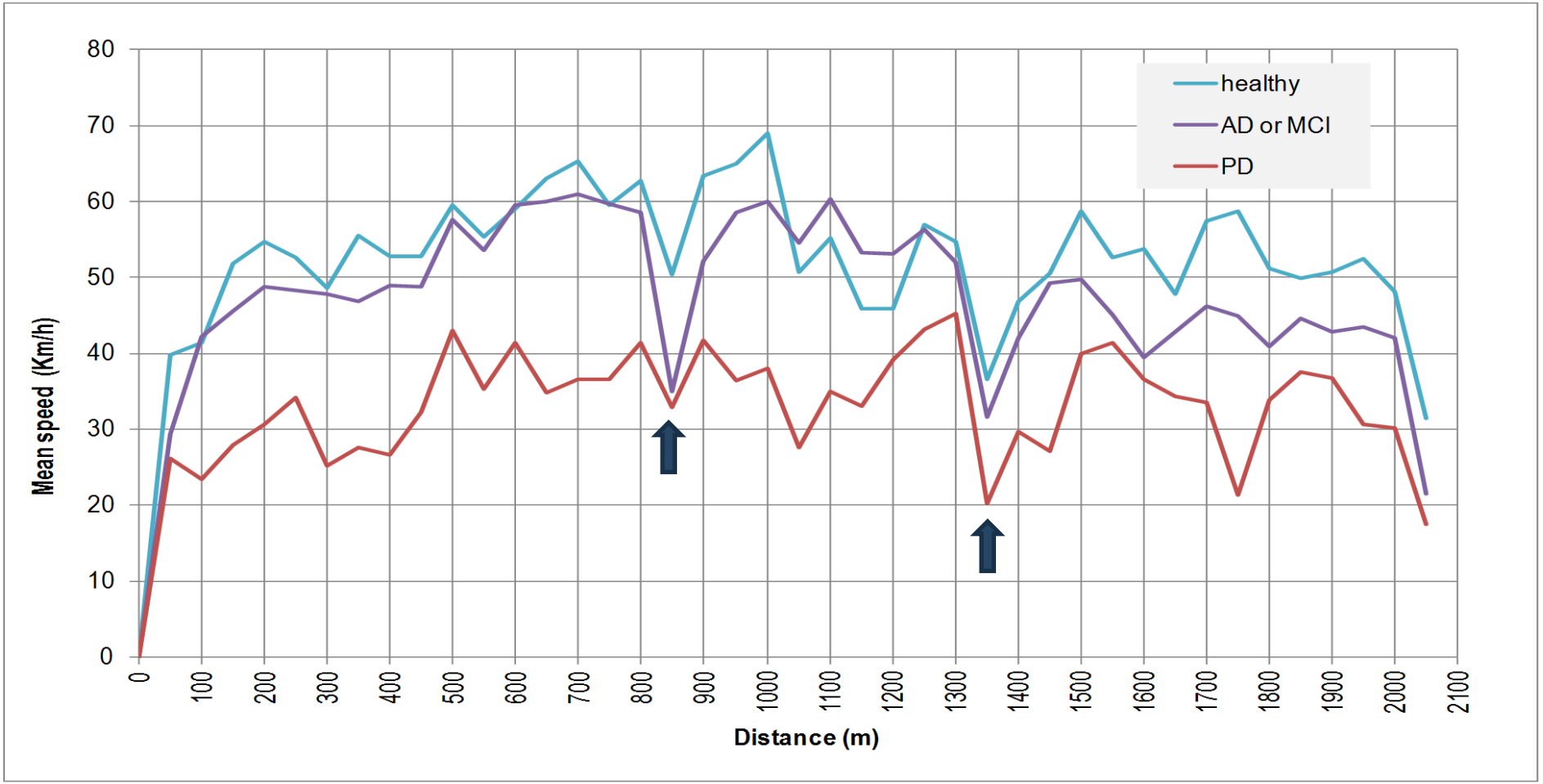


The neurological patient and self-regulation

Mean speed of healthy and impaired drivers in the rural area, moderate traffic volume, no distraction condition



Conclusions 1

Decline in measures of

- Attention (shifting, updating)
- Visuospatial skills, visuomotor speed
- Executive function

Predict driving performance in older adults with and without cognitive decline

Have added value beyond diagnosis of dementia

Conclusions 2

- No *single* test seems to be a good predictor of road test performance
- Composite scores are better predictors

Not clear which composite score is best

Moreover

- Different ways of assessing driving may draw on different sets of skills
- Different components of driving may draw on different sets of skills

Conclusions 3

- Changes in driving habits with age appear to reflect realistic adjustments to declining abilities
- Not all older drivers are aware of a decline in the ability to drive

distrACT

driverBRAIN